Physical activity assessment in Australian general practice: What is the acceptability and feasibility of existing instruments and how can they be integrated into routine patient care?

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Physical activity assessment in Australian general practice: What is the acceptability and feasibility of existing instruments and how can they be integrated into routine patient care?

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Background
There are a number of physical-activity (PA) instruments with potential applicability to primary care. However, less than 30% of patients are assessed during routine patient encounters. A range of contributory barriers have been identified including GP knowledge about PA, time constraints, limited skills or use of non-GP staff.

When identifying instruments for PA assessment, few studies have explored how general practice perceives assessment instruments or how they can be implemented in routine practice. Furthermore, there is little known about variables that influence uptake in routine practice or how this can be enhanced.

Methods
Study 1: A purposive sample of clinicians consented to participate. Participants took part in semi-structured interviews to determine acceptability of five assessment instruments.

Study 2: A convenience sample of PNs and patients consented to participate. The measurement properties of the two preferred instruments (study 1) were determined and compared against accelerometer-activity.

Study 3: A purposive sample of general practices consented to participate. Participants implemented a PA intervention using the GPPAQ, PA referral directory and patient education material. Formative methods were used to understand clinician attitudes, behaviour and understanding of PA assessment and practice processes relative to the intervention.

Results
Clinicians indicated preferences for the GPPAQ and 3Q instruments. These demonstrated distinct variations in content, theoretical orientation and outcome measures. Reasons for preference were linked to clinician PA status and knowledge/perceived competency in PA assessment and instrument features.

Validity showed low-moderate correlations between accelerometer and GPPAQ and 3Q. Agreement with PA recommendations was moderate for GPPAQ; fair for 3Q.

Several variables were identified as influencing implementation of PA assessment including resource availability; definition of roles/responsibilities; intra and inter team communication and leveraging relationships.

Discussion
Findings demonstrate the GPPAQ and 3Q as preferred. Reasons related to a range of intrinsic and extrinsic variables. The GPPAQ and 3Q instruments maintained reasonable rank order correlations for agreement against accelerometers. The GPPAQ showed higher agreement when compared against national PA guidelines.

This study demonstrated that increases in PA assessment, advice and referral can be achieved in Australian general practices using the GPPAQ questionnaire combined with resources to support patient education/referral.

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Contents

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Eastern Sydney Medicare Local, in particular Jamie Dallimore and Bridget Kirby who provided support during the recruitment and data collection phases of the implementation study.

ii. Dedication

This dissertation is dedicated to several people who have influenced me throughout my life.

My Grandmother

This dissertation has been completed in loving memory of my grandmother who demonstrated enduring strength, independence and dignity. She will continue to inspire me throughout my life's journey. I hope this dedication can represent my admiration of her.

My Father

My father has provided perpetual support to me. He taught me the value of hard work, persistence and belief in myself. Most importantly, he has remained a constant in my life despite times of adversity.

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To my husband Stuart and children, Ben and Ella I express my deepest gratitude for putting up with me over the past five years. I will be eternally grateful for their patience and unwavering love and support.

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"I can no other answer make but thanks, and thanks and ever thanks…"
William Shakespeare

iii. Abbreviations

2Q	Two-Question Physical Activity Questionnaire
3Q	Three-Question Physical Activity Questionnaire
5As	Five As - Ask, Assess, Advice, Agree and Arrange
AA	Active Australia
AHA	and the American Heart Association (AHA)
ACSM	American College of Sports Medicine (ACSM)
BDGF	Brain Derived Growth Factor
BEACH	Bettering the Evaluation and Care of Health
BMI	Body Mass Index
BP	Blood pressure
CAD	Coronary Artery Disease
CDC	Centre for Disease Control
COAG	Council of Australian Governments
COPD	Chronic Obstructive Pulmonary Disease
CV	Cardiovascular
CVD	Cardiovascular disease
EP	Exercise Physiologist
EPC	Enhanced Primary Health Care
ESSA	Exercise and Sports Science Australia
FBG	Fasting Blood Glucose
FTE	Full time equivalent
GP	General Practitioner
GPERS	GP Exercise Referral Scheme
GPMP	GP Management Plan
GPPAQ	GP Physical Activity Questionnaire
HDL-C	High Density Lipoprotein Cholesterol
HEPA	Health Enhancing Physical Activity
HT	Hypertension
ICC	Intra-class correlation co-efficient
LDL-C	Low Density Lipoprotein Cholesterol
LGA	Local Government Area

Abbreviations (continued)

MBS	Medicare Benefits Schedule
NHMRC	National Health and Medical Research Council
NICE	The National Institute for Health Care Excellence
OSPAQ	Occupational Sitting and Physical Activity Questionnaire
PA	Physical activity
PAAA	Physical Activity Assessment and Advice in primary health care survey
PAI	Physical activity index
PANA	Physical Activity Network of the Americas
PEN CAT	PEN Clinical Audit Tool
PEP	Prevention Evidence into Practice
PIP	Practice Incentive Program
PM	Practice manager
PN	Practice nurse
PNIP	Practice Nurse Incentive Scheme
RACGP	Royal Australian College of General Practitioners
SIGPAH	Strategic Inter-Governmental Forum on Physical Activity and Health
SNAP	Smoking Nutrition Alcohol and Physical Activity
T2DM	type 2 Diabetes Mellitus
TC	Total cholesterol
TCA	Team Care Arrangement
TDF	Theoretical Domains Framework
TG	Triglycerides
UNSW	University of NSW (Australia)
Usyd	University of Sydney (Australia)
WHO	World Health Organization

iv. List of Tables

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vi. List of appendices

1 Abstract

Background

There are a number of physical activity (PA) assessment instruments available with potential applicability to general practice patients. Despite the availability of instruments, less than 30% of patients are assessed during routine patient encounters in general practice. A range of contributory barriers have been identified including GP knowledge about PA, time constraints, limited skills with the interpretation of PA assessment and limited use of non-GP staff e.g. Practice nurses (PNs).

When identifying instruments for PA assessment that could be used in general practice, few studies have explored the views of GPs on the comparative acceptability and utility of available instruments. A better understanding of how GPs and their teams perceive assessment instruments and how they can be used in routine practice could help overcome barriers to PA assessment and inform future PA interventions. Furthermore, there is little known about the variables that influence uptake of routine PA assessment in general practice or how implementation can be enhanced. With little known about the acceptability, utility and feasibility of PA assessment instruments in general practice, this dissertation aimed to initially determine clinician preferences for PA assessment instruments. This included identifying reasons for preference, in addition to the feasibility of identified instruments for measuring PA in general practice patients. Secondly the measurement properties of preferred instruments were examined. Finally, this dissertation aimed to determine the impact of implementing the instrument(s) on PA behaviour change interventions in routine general practice. This included how the intervention impacted on data completeness for related clinical markers, if there were changes in clinician assessment and referral behaviour, and identified key features, processes, barriers, and drivers to the implementation of the intervention.

Aims

The preliminary aim (Study 1) of this dissertation was to determine the acceptability of a selection of PA assessment instruments amongst a sample of Australian general practice clinicians (Study 1). Subsequent aims included determining the measurement properties of the two preferred instruments (Study 2), and efficacy of implementing one of these instrument's in routine general practice (study 3).

Methods

Study 1: Acceptability

A purposive sample of GPs (N=9) and PNs (N=10) from eight general-practices in Sydney consented to participate. Stage-1 involved semi-structured interviews with participants to select preferred instruments for measuring PA. An analysis of the two preferred instruments was conducted as Stage-2, to identify differences in instrument purpose and content. Stage-3 involved participants using the two-instruments, selected from Stage-1, for 12-weeks. At the end of this period, semi-structured interviews were repeated to explore clinician experience. The two instruments identified as preferred by clinicians were implemented in Study 2 to determine their measurement properties.

Study 2: Feasibility

A purposive sample of PNs and patients from eight general-practices in Sydney consented to participate. The results of the PN or patient-administered GP-Physical-Activity-Questionnaire (GPPAQ) and Three-Question-Physical-Activity-Questionnaire (Q3), were compared against accelerometer-activity. The study examined agreement with classification of PA-levels, according to Australian PA-recommendations. The combined outcomes from Study 1 and Study 2 led to the development of a multicomponent practice change intervention, referred to as 'the intervention' in the proceeding sections of this thesis.

Study 3: Implementation

A purposive sample of four general practices located in southern Sydney, consented to participate. The results compared changes in data completeness for a selection of clinical markers, before and after the intervention (3 months) using the PEN CAT Clinical Audit Tool. Secondary outcomes included self-reported measures of PA management changes in clinician knowledge/confidence in PA assessment. Qualitative data was obtained from semi-structured interviews and observations.

Results

Study 1: Acceptability

Clinicians indicated preferences for the GP-Physical-Activity-Questionnaire (GPPAQ) and 3-Questionnaire Physical-Activity-Questionnaire (3Q) instruments. These instruments demonstrated distinct variations in content, theoretical orientation, and outcome measures. Reasons for preference were linked to; clinician PA status and knowledge/perceived competency in PA-assessment, and features within instruments.

Study 2: Feasibility

The validation study showed that the GPPAQ and 3Q instruments maintain reasonable rank order correlations for agreements against Actigraph accelerometers with low-moderate correlations between accelerometer and GPPAQ (rho=0.26), Q3 (rho=0.45). The GPPAQ showed higher agreement GPPAQ (kappa 0.73, 95%CI 0.56-0.85), and fair for Q3 (kappa 0.62, 95%CI 0.47-0.78) when compared against national PA guidelines in identifying participants as sufficiently active, compared with the 3Q. Reliability 7-day test-retest demonstrated excellent repeatability for both instruments using Intra-class Correlation Coefficients (ICCs) with 0.82-0.95 for GPPAQ, and 0.94-0.98 for Q3.

Study 3: Implementation

The results of this study indicate several principles that can influence implementation including:

- Access to versatile and acceptable PA behaviour change resources.
- Definition around roles and responsibilities for practice personnel in terms of PA behaviour change intervention.
- Acknowledge interpersonal relationships between patient and practice.
- Maintain structured internal practice systems to support implementation of PA behaviour change interventions

Discussion

Key findings from this dissertation include the need to ensure clinicians administering assessments have the opportunity to select PA instruments, according to their individual characteristics and preferences. Both the GPPAQ and 3Q have acceptable measurement qualities, in the context of assessing PA in general practice patients. The findings also indicate the need to consider the role of non-GP and non-clinical personnel have in implementing PA behaviour change interventions. This finding links with the final outcomes of this study, which suggest that ensuring structured internal practice systems are in place to support implementation of interventions.

The findings from this dissertation are an important step in improving the knowledge of barriers and enablers to PA behaviour change in the general practice setting, particularly the acceptability of PA assessment instruments amongst clinicians, and methods of implementing behaviour change without forgoing the need for additional capacity requirements.

Introduction

1.1 Overview

This chapter describes the conception of this dissertation including how the candidate's background has influenced its execution. This chapter is divided into the following sections:

- Influence of candidate's background.
- Formulating the research questions.
- Research questions.
- Contribution to research.

1.2 Influence of candidate's background

I have a background primary health care planning and program management with a focus on the role of PA focused responses to health care needs. I am academically trained as an exercise physiologist. However, over the last 16 years, I have had the opportunity to explore the interface between PA promotion and general practice, for the prevention and management of chronic disease.

In 2004 I commenced work at the Sutherland Division of General Practice as Manager for the Chronic Disease and Aboriginal and Torres Strait Island Health Programs. A significant part of my work involved the implementation of lifestyle risk factor management initiatives across local general practices including, but not limited to; Medicare Chronic Disease items (care planning) and health assessments, Lifescripts [1] and the type 2 Diabetes Risk Assessment [2]. Through this work, I saw firsthand the barriers faced by general practice in implementing preventive activities including a demand for acute care, with little time for much needed lifestyle risk factor management. These barriers were combined with resourcing issues such as (physical) practice space, rising administrative burden associated with changing Medicare items, need for additional clinical personnel, inadequate information technology assets, meagre use of information management systems and the introduction of electronic patient communication such as electronic health records and secure messaging.

Perhaps, my greatest achievement whilst working for Sutherland Division of General Practice (later South Eastern Sydney Medicare Local) was in the development and implementation of a local GP Exercise Referral Scheme. The program formed a link between local General Practitioners (GPs) and Exercise Physiologists where patients requiring exercise prescription to exercise physiologists at the local Council leisure centre. Exercise physiologists were responsible for preparing individually tailored exercise programs with pre and post PA assessments. Between 2004 and 2012, the program obtained more than 3,000 referrals, with 100% of GPs indicating high level of satisfaction with the program, in terms of meeting patient need for PA behaviour change.

Whilst this Scheme satisfied some limitations experienced by GPs such as supporting the need for resources required for PA behaviour change, it only addressed part of the problem. GPs, and a growing number of PNs were experiencing difficulties in determining whether a patient was sufficiently active. Some relied on their previous understanding of PA, while others used resources such as the Lifescripts assessments [1]. The remainder did not approach the topic at all because they did not feel confident.

I saw firsthand the barriers GPs faced in finding time to undertake PA behaviour change activities, such as assessment or understanding the principles associated with assessment and prescription. Many GPs did not understand the differences between vigorous and moderate intensity activity, nor did they understand the principles of physical fitness, or progressive overload. Even if they did have some understanding of these principles, time limitations and other priorities prevented them from addressing behaviour change.

In 2008, I was fortunate enough to be awarded a Research Development Scholarship through the University of NSW. This scholarship facilitated the completion of my Masters of Public Health (Research). My research focused on the effectiveness of the GP Exercise Referral Scheme and served to ignite my passion for research in PA, and general practice. While I benefited in many ways of completing my Master's degree, it did not completely address my pursuit in identifying ways to support general practice to implement patient focused, PA behaviour change interventions. Undertaking my PhD was a logical next step for two reasons:

1. Professional development opportunity, further develop my skills in research and;
2. Contribute to identifying solutions to the issues encountered by general practice with PA behaviour change.

As my experience working with general practice, I conceived this research on the basis that GPs had limited time to conduct PA assessment, and the need to identify an instrument that could address time constraints. This included consideration of the role PNs could have in PA assessment.

Prior to starting the study, my hypothesis was that preferences would sit with the shorter, brief instruments presented for selection. However, I was surprised by an overwhelming majority preference for the GPPAQ. This finding encouraged me to enquire more deeply into what clinicians told me and understand their unique position regarding PA assessment. It became evident that there were variations in clinician knowledge which appeared to impede the execution of PA behaviour change. Subsequently, I used a new method of analysing interview transcripts through the theoretical domains framework [3, 4].

1.3 Theoretical underpinnings

The theoretical and methodological foundations of my research were developed throughout the course of my research. The topic itself became iterative, developing with the findings of each study, and the subsequent theoretical perspectives and methods followed a similar path.

At the start of my PhD journey, my initial theoretical underpinnings were shaped from Crotty's hierarchical framework [5] . This hierarchy provided a path to navigate epistemology, theoretical perspective, methodology and methods to achieve relevance to the topic and consistency in approach. The components specified in Crotty's hierarchy are:

- Methods – techniques or procedures to collect and analyse data.
- Methodologies – the plan behind the choice of methods.
- Theoretical perspective – the philosophical stance providing the context for the research.
- Epistemology – the theory of knowledge which encompasses the theoretical perspectives and the methodology.

Originally, I adopted a constructivist epistemological position, as described by Charmaz [6-8]. Coinciding with these epistemological underpinnings was my experience with general practice, outlined in the previous section of this chapter. As an epistemological stance, constructivism asserts that reality is constructed by individuals as they assign meaning to the world around them [9]. From a constructivism perspective, meaning does not lie dormant within objects waiting to be discovered, but is rather created as individuals interact with and interpret these objects [5]. Constructivism challenges the belief that there is an objective truth that can be measured or captured through research enquiry and suggests that researchers seek to construct a 'picture that draws from, reassembles and renders subjects' lives' [6].

Further, Charmaz [7] suggests that research enquiry is created through an interactive process whereby the investigator and participants construct a shared reality.

Constructivism influenced my philosophical design including the translational direction I wanted the outcomes of this research to represent, being grass roots general practice. This theory therefore impacted on the methodological design of my research, particularly my efforts to reflect routine general practice. This included mixed methods such as semi-structured interviews and observations. Whilst these methods facilitated a deep enquiry into participant experience, their barriers and enablers to PA assessment, they offered a balance between analytical rigor and contextual data.

Following significant review of philosophical theories, reflection on my own theoretical foundations and purpose for my research, I was led to the theoretical domains framework (TDF) [3, 4]. This framework applied a methodological process to facilitate structure, whilst respecting the need for synthesis of a range of psychological theories, including my own theoretical perspective. Collectively, they were used to understand implementation and human behaviour. As a structural framework, TDF was used to design interview schedules, analyse qualitative data and match behaviour change interventions to known barriers. Combined with my personal theoretical foundations (constructivism), I developed and conducted semi-structured interviews allowing dialogue posed by participants to provide some direction [10].

1.4 Formulating the research questions

I reflected on my own experience in working with GPs to support their needs in conducting lifestyle risk factor management, to formulate the research questions for this study. Specifically this occurred through the aforementioned GP Exercise Referral Scheme, Medicare initiatives such as, GP Management Plans, Team Care Arrangements, Diabetes Risk Assessments and the Lifescripts initiative [1]. I saw firsthand the barriers GPs faced in attempting to meet the needs of patients at risk or, or living with, preventable chronic diseases.

My original research proposal was much less developed than the final product presented here. Conceptually, it proposed identifying an instrument to measure PA in general practice patients. This was to include determining the measurement properties of the newly identified instrument, then testing on a sample of participants from the NHMRC Partnership Project in which the University of NSW were leading through the Centre for Primary Health Care and Equity. This study, Prevention Evidence into Practice (PEP), aimed to investigate the uptake and effectiveness of current guidelines for the prevention of chronic disease in general practice and aimed to develop innovative implementation strategies for the future. My contribution to this study was to evaluate the uptake of PA guidelines.

Preliminary work in scoping this dissertation led to the implementation of a pilot study, which drew on a selection of existing PA assessment instruments. This deviation from the original proposal came about from collaborations with the University of Sydney School of Public Health, Physical Activity, and Exercise and Energy Expenditure unit. Their advice suggested an investigation around the acceptability of existing instruments for assessing PA, identified as an area of limited research. Subsequently, the pilot aimed to determine GP and nurse preferences for a selection of instruments, including previously established instruments designed for the purposes of general practice, workplace/occupational, population surveillance and from both Australian and United Kingdom settings *[Research questions 1 and 2].* Preferred instrument(s) were assessed for their measurement properties, including validity and reliability *[Research questions 3 and 4].* It was then proposed that the preferred instrument would form the PA intervention for the PEP study. However, a number of barriers were experienced with the implementation of the PA component of the PEP study using the proposed methods. The primary barrier for implementation was recruitment of practices to undertake the study. A number of practices consenting to take part in the PEP study indicated an initial interest in PA as a focus area, however during the implementation of the PEP protocol realised they needed to address internal functions first, before tackling specific risk factors such as PA. As a result, there were no practices formally expressing an interest in participating in the PA arm of the study. A number of alternative strategies were explored to boost recruitment to the PA arm of the study including revisiting practices that had previously expressed an interest in the study in the initial phase following the completion of the PEP intervention and offering the PA study to the late intervention participants. Both options proved fruitless.

I worked with my supervisors to explore opportunities outside of the scope of the PEP study. As a result, we agreed to develop an independent study, specifically focused on PA as an intervention. The premise was that recruitment may be less likely to be impeded by focusing on PA exclusively. The result was the implementation study outlined in Chapter 5.

Research questions 1 and 2 relate to the identification of acceptable instruments for assessing PA in general practice. Subsequent research questions were influenced by the outcomes of the acceptability study i.e. study 1 influenced development of research questions 3 and 4, and soon. The resulting research questions have been listed below:

1. What instruments are preferred by general practice clinicians, for assessing PA amongst patients, in routine practice?
2. What reasons do clinicians state for preferring one instrument above another, before and after using instrument(s)?
3. What is the validity of the GP Physical Activity Questionnaire (GPPAQ) and 3-Question Physical Activity Questionnaire (3Q) for assessing PA when, administered by PNs and compared against accelerometry, over the same period?
4. What is the reliability of GPPAQ and 3Q instruments when self-administered by patients
5. Are there changes in data completeness for PA related (patient) clinical markers before and after the intervention?
6. Are there changes in the uptake of PA assessment and referrals conducted by clinicians, before and after the intervention?
7. What are the key features, processes, barriers, enablers and influences of each intervention implemented by practices during the intervention?

The associated aims for each research question and the relevant study and chapter have been outlined in Table 1.

Table 1 Research questions, associated aims and relevant study and chapter.

Research questions	Aims	Relevant study and chapter
1. What instruments are preferred by general practice clinicians, for assessing PA amongst patients, in routine practice?	• Ascertain GP and PN preferences for PA assessment instruments from a pre-determined selection of instruments.	**Acceptability Study (Chapter 3)** Acceptability and utility of 5 instruments for assessing PA in general practice patients – GP and PN preferences.
2. What reasons do clinicians state for preferring one instrument above another, before and after using instrument(s)?		
3. What is the validity of the GPPAQ and 3Q for assessing PA when, administered by PNs and compared against accelerometry, over the same period?	• Determine the feasibility of the 2 instruments identified as preferred from Acceptability study, as robust measurement tools, as an alternative instrument for Australian general practice patients.	**Feasibility Study (Chapter 4)** Resourcing an evolution of roles in general practice – a study to determine the validity and reliability of tools to assist nurses and patients assess PA?
4. What is the reliability of GPPAQ and 3Q instruments when self-administered by patients?		
5. Are there changes in data completeness for PA related (patient) clinical markers before and after the intervention?	• Evaluate changes in clinical markers at baseline and again at three month follow-up resulting from the implementation of a PA assessment using the instruments analysed in Implementation study. • Evaluate methods used by general practices to implement PA assessment in patients.	**Implementation Study (Chapter 5)** Implementation of the PA intervention in Australian General Practice using the GPPAQ questionnaire.
6. Are there changes in the uptake of PA assessment and referrals conducted by clinicians, before & after the intervention?		
7. What are the key features, processes, barriers, enablers and influences of each intervention implemented by practices during the intervention?		

1.5 Contribution to research

Since the introduction of the Australian PA Guidelines in 1999, general practice has seen a number of instruments developed or introduced to support PA assessment with a large collection of instruments available for assessment [11-14]. Given the widespread promotion of these instruments, there has been a less than satisfactory uptake, with estimates indicating they are used in as few as one third of all general practice patient encounters [15]. This signifies an important gap between evidence and practice. Limited uptake has been linked to a number of barriers experienced by clinicians such as; knowledge about PA, time constraints, inadequate instruments available to measure PA, limited skills with the interpretation of PA assessments and limited use of non-GP staff such as PNs [7, 10-15].

The challenge in identifying instruments to support the uptake of PA assessment is only the first step. Of equal importance is determining the acceptability and methods to implement PA assessment instruments to enhance, fortify and expedite uptake.

To date, researchers have placed significant emphasis on PA assessment solutions to address limitations in GP time. With a focus on time constraints as the key barrier to PA assessment uptake, researchers have developed new instruments. These instruments have been briefer in length and content with the objective of being less burdensome to administer. Auxiliary approaches have looked to alleviate time taken to perform a PA assessment including; providing questionnaires in alternative formats such as electronic templates compatible with medical software or linking the assessment to (clinician) incentive funding such as Medicare Health Assessments and care plan. However, evidence on response to these efforts indicates no significant changes to the uptake if PA assessment in the general practice setting [11, 16-19].

Many studies have evaluated PA assessment in general practice however most have relied on third parties, such as researchers to measure activity levels, thus failing to develop a tool that is useful for routine practice [16, 17, 20-24].

Determining the specific needs of the general practice setting to ensure the systematic uptake of PA assessment in patients is important. Patients not meeting current PA guidelines and those assessed as sedentary have most to gain from behaviour change [25]. Ensuring these patients are systematically identified, assessed and provided with appropriate advice are integral responsibilities of general practice.

This dissertation will firstly outline the steps taken to identify instruments for assessing PA that are acceptable to members of the general practice team i.e. GPs, PNs, practice staff and patients. Secondly it will outline a process completed to evaluate the feasibility of those instruments identified as acceptable. Finally, it explores optimal ways of implementing PA assessment into routine practice, using the instrument(s) identified as a way of identifying barriers and enablers to the process to ensure those most in need of behaviour change are addressed.

1.6 Structure of this dissertation

The dissertation herein outlines three distinct studies which investigated methods for increasing PA assessment in Australian general practice. The first study identified two PA assessment instrument(s) from a selection of five, established PA assessment instruments.

For this dissertation, five instruments were selected by the candidate based on their potential for adaptation and/or use in Australian general practice. These were:

1. Active Australia [261].
2. Occupational Sitting and Physical Activity Questionnaire (OSPAQ) [259].
3. 2-Question Physical Activity Questionnaire (2Q) [262].
4. 3-Question Physical Activity Questionnaire (3Q) [262].
5. GP Physical Activity Questionnaire (GPPAQ) [26].

The process for identifying these instruments involved implementation of a decision matrix, developed by Strath et al. [27] outlined in their scientific statement for the American Heart Association [27]. The decision matrix offered a systematic process for selecting PA assessment instruments, across different settings. The matrix was used to identify instruments assessing PA in Australian general practices [32, 249].

The decision matrix identified questionnaires as the most suitable instrument for in the general practice setting. To select from the range of questionnaires available for assessment PA, an adapted decision matrix was developed to systematically deduce a smaller selection. The adapted matrix drew on responses from the original decision matrix, and compared against a selection of 18 established questionnaires, using the criteria to regulate appropriateness.

Accurate assessment of PA comprises the foundation for research aimed at promoting PA and eliminating health disparities [28]. However, improving the uptake of PA assessment in general practice requires clinicians to firstly initiate an intervention and secondly, to execute this assessment [29]. These aspects each have their own set of correlates that require closer attention to form appropriate responses. Additionally, little is known about the most appropriate methods of administering an instrument within routine consultations, what works and what does not work, or the view of general practice personnel regarding each instrument. Evidence suggests that clinicians are more likely to initiate a PA assessment when it is explicitly linked to the patient's presenting condition i.e. providing curative rather than preventative advice [30-34].

Determining the specific needs of the general practice setting to ensure the systematic uptake of PA assessment in patients is important. Patients not meeting current PA guidelines and those assessed as sedentary have most to gain from behaviour change [25]. Ensuring these patients are systematically identified, assessed and provided with appropriate advice is provided are all integral responsibilities of general practice.

There is a need to investigate each of the dimensions considered by Taylor et al [35], influencing, reinforcing and enabling factors around the uptake of PA interventions in the general practice setting. The literature review herein has highlighted the need to identify PA assessment instruments that are acceptable and meet the competency requirements of to those responsible for administration, reconsidering the role practice capacity has in addressing time constraints, and identify the role of alternative members of the general practice team.

Traditionally, the relative success of research has fallen with the inferences provided from the findings rather than the translational impact offered [36]. Implementation research is the scientific study of methods to promote systematic uptake of research findings, and hence improve the quality and effectiveness of an intervention or area of patient care. This relatively new field includes the study of influences on healthcare professional and organisational behaviour [37, 38]. The implementation study described in this dissertation provides both formative and summative data around influencing, reinforcing and enabling variables to support the translation in practice [35]

Implementation science was embedded within this dissertation through the application of the Theoretical Domains Framework (TDF) [3, 4, 37]. This framework aims to simplify and integrate the abundance of behaviour change theories through one integrated framework including behavioural determinants [3, 4, 18, 39, 40]. The framework was selected because of its alignment to the dimensions of PA behaviour change suggested by Taylor et al. [35] and for its ability to explain implementation barriers and enablers [3].

The proceeding dissertation has been divided into three studies. Chapter 2 explores literature in relation to the role that PA in reducing burden of disease, Australian population trends in PA, PA guidelines and the role that general practice can play in changing PA behaviour. Finally, the role of primary health care in PA behaviour change is discussed, including instruments designed to support uptake including acceptability of instruments, measurement rigor and implementation barriers to uptake in the general practice setting.

Chapter 3 describes the acceptability study, including the identification of two preferred instruments from a selection of five. Chapter 4 draws on the findings from the previous chapter to determine the feasibility of the two preferred instruments. Chapter 5 outlines the implementation study conducted to determine the efficacy of implementation of the GPPAQ evaluated in the previous two chapters. Finally, the dissertation is summed up in Chapter 6 discussing the collective findings from the three studies, reflecting on current literature, limitations and suggestions for further research. Table 1 provides a summary of the content of this dissertation by chapter number, chapter name, study aims and research questions.

2 Literature review

2.1 Introduction

This chapter explores the background literature in relation to the role that PA has in reducing the burden of disease and injury in Australia. The literature review will firstly outline the health benefits associated with PA and the burden of disease associated with sedentary behavior, followed by literature regarding current and projected trends in PA behaviour, within the Australian context. This discussion will be followed by a description of the development and role of the Australian National PA Guidelines PA and relative government policy. The role of primary health care in PA behaviour change will be discussed, including instruments designed to support PA assessment by clinicians. Finally, the review of literature will conclude with a discussion about the acceptability of instruments, measurement rigor and implementation barriers to uptake in the general practice setting.

2.1.1 Literature search

A literature search was conducted to identify recent reviews to objectively describe PA, physical inactivity and sedentary behaviour and its relationship to burden of disease and injury in Australia, and internationally.

A literature search was undertaken using a broad search strategy from the following electronic bibliographic databases to identify relevant studies: OVID: including CINAHL, EMBASE, PUBMED, MEDLINE and PsycINFO. In addition, search of EBM review databases including: Cochrane, Trials Register, DARE and ACP. Finally, Google Scholar was included to identify publications not already captured through the aforementioned process.

Additional searches for epidemiological evidence from Australia and overseas were conducted using the specific sources including:

- Australian Bureau of Statistics (ABS)
- Australian Institute of Health and Welfare (AIHW)
- Centres for Disease Control and Prevention (CDC)
- World Health Organisation (WHO)

The search included the following terms:

- PA and inactivity
- Moderate/vigorous PA
- Sedentary
- Planned PA
- Chronic disease
- Disease burden
- Incidental PA
- Active transport
- Trends in PA / inactivity and sedentary behaviour

2.2 What is physical activity?

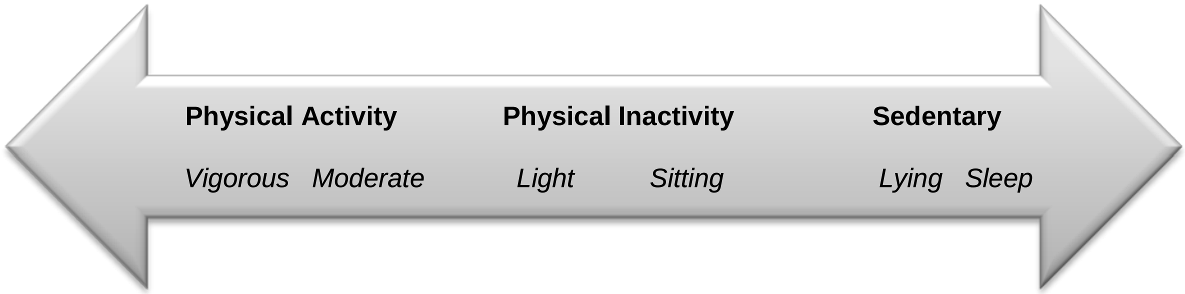
Physical activity is defined as any bodily movement produced by skeletal muscles, requiring the expenditure of energy. In contrast, physical inactivity refers to inadequate physical movement, which is essentially less activity than recommended with the PA guidelines [41]. In addition to physical inactivity there is sedentary behaviour. This refers to immobile or motionless periods, such as sitting or lying, when an individual is neither standing nor partaking in any bodily movement [42]. For the purposes of this review of the literature, To ensure consistency in the terminology and meaning presented in this literature review, a condensed version of the definition used in the Australian National Physical Activity Survey [43, 44] has been used to describe PA and inactivity. That is, sufficiently physically active will be used to represent PA where at least 150 minutes of PA over one week is undertaken. Insufficient PA will describe less than150 minutes of PA over the same period. Insufficiently physically active will be indicative of both physical inactivity and sedentary behaviour. A more detailed explanation of each variable is provided in Table 2.

Table 2 Physical activity variables explained.

Planned PA	Exercise, is a subcategory of PA that is structured, repetitive, and purposeful in the sense that the improvement or maintenance of physical fitness [45].
Incidental PA	Incidental PA is unstructured activity taken during the day, such as walking for transport, housework and the performance of activities of daily living [45].
Active transport	Active transport refers to any form of transport powered by an individual or group of individuals. Often it refers to PA undertaken to commute from one point to another. Examples include. Walking or running, cycling, skateboarding and skiing [45, 46].
Moderate level PA	PA at a level that causes the heart to beat faster and some shortness of breath, but during which a person can still talk comfortably.
Vigorous PA	PA at a level that causes the heart to beat a lot faster and shortness of breath that makes talking difficult between deep breaths [47].
Physical inactivity	Physical inactivity refers to inadequate physical movement, falling short of the recommended guidelines for PA [41].
Sedentary behaviour	Sedentary behaviour refers to immobile or motionless periods, such as sitting or lying, when an individual is neither standing nor partaking in any bodily movement [42].

Physical activity, physical inactivity and sedentary behaviour occur across a spectrum, demonstrated by Figure 1.

Figure 1 Physical activity, inactivity and sedentary behaviour spectrum [1].



2.3 Association between physical inactivity and disease

This section of the literature review will discuss the association between PA and the primary and secondary prevention of chronic disease. [48-53].

Several large systematic reviews have offered conclusive evidence to indicate a link between PA and the incidence and prevalence of chronic disease, illness and injury in Australia [54-57]. The leading causes of disease burden in Australia have each been linked to physical inactivity. The onset of each disease either has a direct or indirect association with physical inactivity. For example, cancer contributes to 19% of the burden of disease and illness in Australia. This is closely followed by CVD (18%), chronic respiratory disease and diabetes [58]. The prevalence and impact of these diseases has been shown in terms of burden of disease have been depicted in Figure 2.

Physical inactivity has also been associated with the development of other lifestyle risk factors such as; elevated blood pressure, insulin resistance and glucose intolerance, elevated triglyceride concentrations, low high-density lipoprotein cholesterol (HDL-C) concentrations, and overweight and obesity [57, 59-66]. The relationship between physical inactivity, lifestyle risk factors and chronic disease has been acknowledged by many epidemiologic studies [67]. Initial investigations examined the relationship between PA and the onset of chronic disease, demonstrating links between those who were insufficiently active and chronic disease [68, 69] [70]. Subsequent research led to acknowledgement of the link between all-cause mortality and higher PA levels in a longitudinal study by Paffenbarger et al. [71] and a prospective study by Blair et al. [72].

In 2013, Kyu et al. conducted a systematic review and dose-response meta-analysis of prospective cohort studies examining PA and chronic disease [57]. It found links between physical inactivity and the risk of breast cancer, colon cancer, diabetes, ischemic heart disease and ischemic stroke events [57].

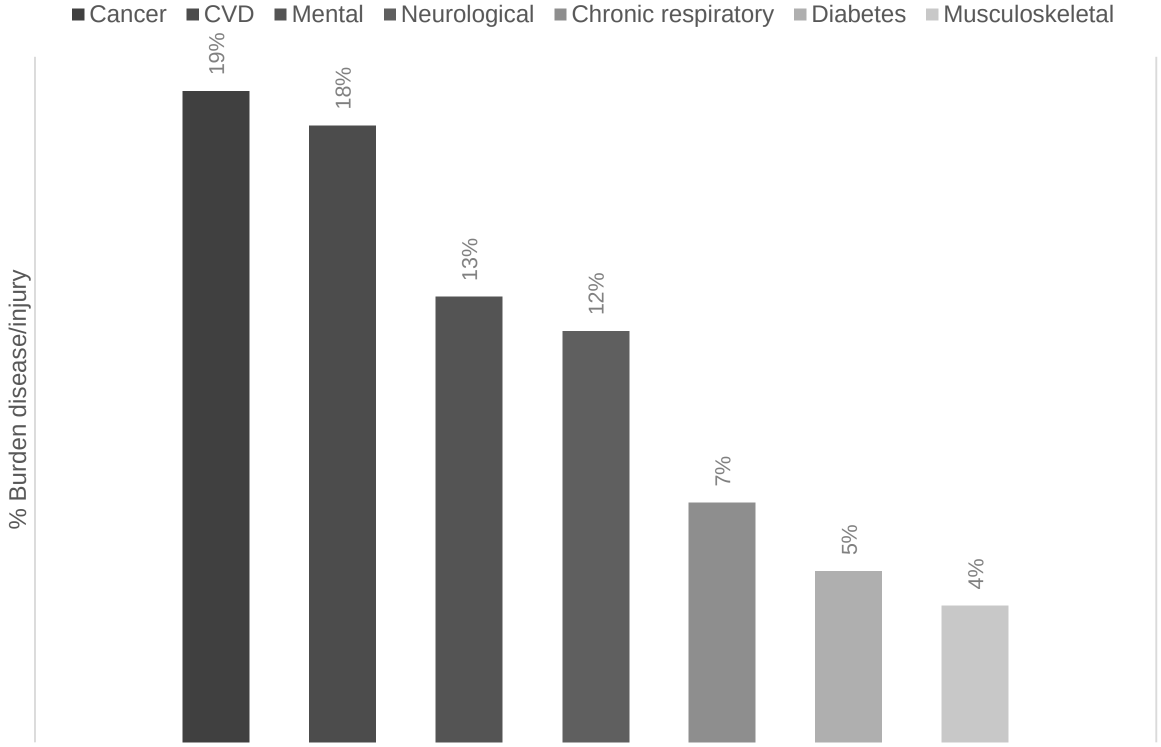
Compared with those who are sufficiently active, adults not meeting PA guidelines have been identified as having substantially higher risk of developing diabetes, heart disease, high blood pressure and a number of other prevalent and disabling chronic medical conditions [42, 58, 73-87]. PA performed to minimum requirements, has been associated with the following:

- Body weight control [48].
- Reduction in risks associated with development of cardiovascular disease (CVD) [48, 49].
- Reduction in risk associated development of type 2 diabetes and metabolic syndrome [88-91].
- Reduction in the risk associated with some cancers [92].
- Strengthens musculoskeletal structures [93].
- Improvements in mental health and mood [94-97].

Reiner [98] and Biswas et al. [99] in their systemic reviews validated the association between physical inactivity and its contribution to- morbidity and mortality [98, 99]. The Australian Bureau of Statistics published detailed results from the 2011-12 Australian Health Survey, outlining levels of PA and sedentary behaviour of the Australian population. This widely distributed self-report survey canvassed some 19,000 Australian adults across urban, rural and remote regions, with the exception of some discrete Aboriginal and Torres Strait Islander communities. The subsequent report estimated that physical inactivity contributed to 6.6% of the total burden of disease and injury in Australia. It was also able to demonstrate links as an independent risk factor in all-cause mortality. [48, 53, 100, 101].

Lee et al. [102] in their systematic review found that physical inactivity was attributable to 6% of the burden of coronary heart disease, 7% from type 2 diabetes, and 10% for both breast cancer and colon cancer worldwide. This level of evidence was not granular enough to represent the burden of physical inactivity on individual diseases, and injury in Australia. However, comparisons between this review and the National Health Survey [42, 58, 86] demonstrate similarities in the leading diseases [102] identified as attributable to insufficient activity; cancer, cardiovascular disease, mental health, neurological conditions, chronic respiratory, diabetes, and musculoskeletal conditions. The leading cause of disease and injury in Australia are shown in Figure 2.

Figure 2 Leading causes of disease and injury in Australia [58].



The following section will provide an outline of the mechanisms by which PA can aid in the prevention/management for each of the disease linked with the prevalence of disease burden.

2.3.1 Cancer

The World Cancer Report for 2014 provided Level A evidence of the association between physical inactivity and increased risk of developing some cancers including; colorectal, breast, endometrial, lung and prostate cancers [103]. This report indicates that adequate levels of PA is associated with reducing risk of cancer through mechanisms such as achieving and/or maintaining healthy body weight; reducing inflammation in response to injury and/or disease; strengthening immune systems and subsequent immune responses; maintaining hormone levels; and improving insulin resistance [103-108][99-104].

A systematic review by Wiseman [109] identified PA as a proximate cause of patterns of cancer incidence, it recommends the incorporation of PA as part of everyday life as a way of reducing risk associated with developing cancer, treatment and survival of selected cancers [109]. Increasingly, PA is being considered for its role in maintaining good health for a person diagnosed with any cancer, specifically associated with secondary prevention for breast, colon, and prostate cancer [104, 109, 110].

2.3.2 Cardiovascular disease (CVD)

Archer et al. in their systematic review identified a consistently positive relationship between PA and a reduced incidence of CVD, such as coronary heart disease [111-113]. The same relationship was described by Sattelmair et al. [112] in their meta-analysis which demonstrated a dose-response relationship between PA and the risk of developing coronary heart disease, with increases in PA exponentially linked to CVD risk reduction [111, 112]. In 2010, the European Association of Cardiovascular Prevention and Rehabilitation published a position paper regarding the relationship and the PA mechanisms that facilitate prevention and rehabilitation from acute cardiac events [114]. This paper indicated that consistent moderate-intensity PA prevents narrowing of blood vessels; prevents blood clotting; improves efficiency of blood transportation; and improves competency of heart muscle contractions [111, 114, 115].

Similarly, the results from a recent large meta-analysis of prospective cohort studies conducted by Li et al. [116] demonstrated a dose-response relationship between PA and the onset of stroke [116]. It found consistently positive outcomes between PA and the risk of CVD in the range of about 20-30%, compared to participants who were insufficiently active [116].

A systematic review and meta-analysis of randomised controlled trials identified a number of indirect associations between PA and CVD [117]. Associated benefits contribute as a peripheral mechanism in primary and secondary prevention of cardiovascular disease [117]. They include; improved, physical function and psychological wellbeing, and favourable changes in body weight and composition [117, 118].

2.3.3 Mental health

Over the last 10 to 15 years, evidence has emerged regarding the impact of PA on the mental and physical health for individuals with an existing mental illness [119]. Participants in several randomised clinical trials have demonstrated improved health outcomes for health-related quality of life, and functional capacity, in response to PA interventions. The same reviews identified improvements in mood states resulting from PA [120, 121]. A recent systematic review of prospective studies reinforced previous findings regarding the relationship between PA and mental health conditions, whilst offering new evidence to suggest the role PA has as a tool to reduce the risk of developing depression [122].

A recent systematic review of prospective epidemiological studies identified modest support for the effect of PA on maintaining or enhancing cognitive vitality and related neural circuitry in older adults. The same review identified that the majority of benefits related to the role PA had on improvements to the prefrontal cortex and the hippocampus [123].

Several meta-analyses have reported positive effects associated with PA for the treatment of depression compared with no PA [121, 124-126]. Rethorst et al. [127]. The same reviews showed similar results for participants who suffered more severe mental illness including moderate to severe depression and those with generalized anxiety disorder, phobias, panic attacks, and stress disorders [128](40)[125-127].

Whilst the association between depression and anxiety are noteworthy, a recent systematic review and meta-analysis suggested the role of PA in the management of a range of psychiatric conditions by improving the control of symptoms associated with schizophrenia, in addition to positive changes in anthropometric measures, aerobic capacity, and quality of life [129]. These findings support those from previous systematic reviews which identified improvements in mood and psychosocial wellbeing by reducing feelings of stress, anxiety and depression for patients with an existing mental health condition [130-132]. These findings highlight two key roles PA has in the management of mental health conditions. Firstly, the direct association PA has in reducing symptoms associated with the specific condition and secondly, peripheral associations such as improvements in psychological function cognitive functioning, lifestyle risk factors, cardiovascular responses to [120, 133-135] .

2.3.4 Neurological conditions

Physical activity has consistently shown to positively influence neurological cognition, motor control and function [136, 137]. Reiner et al. conducted a systematic review of fifteen longitudinal studies to examine the long term relationship between PA, and a selection of non-communicable diseases, including dementia and Alzheimer’s disease. Of the fifteen longitudinal studies reviewed, six provided evidence of the relationship between PA and the incidence of dementia and Alzhemier’s disease. The outcomes indicate that participation in PA can impact positively on cognitive decline and dementia in people aged 65years and older [138-143].

Experimental studies involving data from brain imaging and post mortems have identified significant changes in the brains of those who have undertaken regular PA, compared with insufficiently active individuals [136, 144]. The mechanisms thought responsible for neurological changes in response to PA include stimulation of brain monoamine and neurotrophins, crucial in the stimulus of mood, emotional control and cognition. In addition, PA is thought to stimulate the production of neurotransmitters responsible for efficiently communicating vital physiological functions through the body such as breathing, and the heart beating [136, 145].

Rasmussen et al. [146] used an experimental human study to identify a positive relationship, yet multifunctional relationship between PA and the production of brain derived growth factor. Brain derived growth factor (BDGF) is a key protein responsible for regulating maintenance, growth and survival of neurons [147]. It is noted for its role in influencing learning and memory with obvious consequences for the onset of dementia and Alzheimer's disease [148-150]. Additionally, the protein has also been attributed to supporting hypothalamic pathways which are responsible for controlling body weight and energy homeostasis [136, 144, 151].

People with neurological conditions are often affected by poor balance, mobility, strength, flexibility and coordination. Frequently, neural pathways impacted by the disease can interfere with gross and fine motor skills, impacting on tasks associated with daily living [136, 141, 152]. These effects lead to muscle atrophy, overweight or obesity, poorly controlled hypertension, dyslipidaemia, psychological and psychosocial wellbeing and can also contribute to the onset of cardiovascular related diseases, injury from falls or musculoskeletal conditions such as osteoporosis and arthritis [152, 153].

Physical activity provides unique benefits specific to neurological conditions such as improvements to nerve and physical functioning, improving muscle elasticity, coordination and balance and retraining or generating alternative neural pathways. As for the general population, people with neurological conditions can benefit from improvements in cardiorespiratory fitness provided by PA, which in turn offers the same protective effects described for CVD [145, 152, 154].

2.3.5 Chronic respiratory diseases

Substantial evidence exists to support the role of PA for enhancing cardiopulmonary fitness, in healthy individuals. However, until recently, there has been little evidence to comprehensively support the role of PA in patients with chronic respiratory diseases such as asthma and COPD [155].

In 2000, Ram et al. conducted a systematic meta-analysis a confirmed positive relationship between PA and cardiopulmonary fitness. Likewise, for Chronic Obstructive Pulmonary Disease (COPD), a recent expert review assessed the longitudinal effect of regular PA on lung function decline or incidence of COPD [26–30], indicating an inverse relationship between PA and the magnitude of lung function decline [156]. In addition, PA based pulmonary rehabilitation programs have demonstrated improvements in quality of life measures and reductions in hospital admissions [157]. Resistance training has also been shown to increase muscle mass and strength, augmenting patients' ability to perform tasks of daily living and improving health-related quality of life [158].

Collectively, evidence suggests the benefits of PA go beyond enhancements to cardiorespiratory fitness, imperative for those with a chronic respiratory condition, and extend to reductions in dynamic hyperinflation and exertional dyspnoea; improved exercise tolerance; and enhanced quality of life, with fewer disease exacerbations and reported sick days [159, 160] [161, 162]. Indirectly, it can support the reduction of complications associated with exacerbations in respiratory condictions caused by poor lifestyle risk factor management such as; reduction in body weight, cardiovascular fitness and structural control [159, 160] [161, 162].

2.3.6 Type-2 diabetes

Physical activity is considered a cornerstone in the prevention and management of type-2 diabetes mellitus (T2DM), along with diet and medication[163]. Consensus from several large systematic reviews indicates a reduction in risk of developing T2DM and impaired glucose tolerance (IGT), with adequate levels of PA[98]. Comparable findings were found by Hu et al. [164] and Berenzen et al. [165] and Demakakos et al. [166] in their longitudinal studies [75, 167, 168].Further, a longitudinal study by Katzmarzyk et al. [169]in 2007 found that PA was a determining factor in the level of obesity, cardiovascular fitness and the wellbeing of the patient.

An experimental clinical study determined the onset of T2DM could be delayed by up to 60% with appropriate PA intervention preventing the onset of related medical conditions by as much as 12% [170]. Additionally, evidence indicates that PA is a stimulus for increased glucose uptake by the skeletal muscles via the action caused by contraction and relaxation of muscles during exercise [171]. The mechanism by which glucose uptake is increased relates to the expediting the release of GLUT-4 transporters. Recent research indicates that greater benefits are achieved from participation in resistance training, which support muscle efficiency and subsequent transport of glucose and insulin sensitivity [172, 173].

Beyond the direct relationship between PA and T2DM, evidence from a systematic review in 2007 suggests reductions in insulin resistance and glucose intolerance, postprandial hyperglycaemia, and has been linked with a reduction in hepatic glucose output [90, 174-176]. In addition, PA has been demonstrated to improve control of blood glucose, decrease the proportion of body fat, decrease in the risk of heart disease, and increased heart and lung fitness [170].

2.3.7 Musculoskeletal disorders

The 2007, the American College of Sports Medicine (ACSM) and the American Heart Association (AHA) produced a report that explicitly acknowledged the important role in maintaining or improving bone density, muscular strength and mobility, structural and functional capacity [177]. These recommendations built on established guidelines regarding the types and amounts of PA required by adults, to maintain good health. Their report was based on a comprehensive review of relative physiologic, epidemiologic, and clinical scientific data, which included literature from primary research and systematic reviews published since the original recommendation was issued in 1995 [177].

The consolidation of evidence from the ACSM and AHA report concluded that PA positively influences most structural components of the musculoskeletal system that are related to functional capabilities and the risk of degenerative diseases such as arthritis and osteoporosis [178, 179]. The mechanisms by which primary prevention occurs is via enhancing muscle strength, muscle power (speed and strength), bone mineral density, range of movement, coordination and endurance [179, 180]. This is usually achieved via combinations of weight bearing, resistance, coordination and dynamic movements challenging balance. Traditional physiologic performance markers such as oxygen uptake and cardiac output hold minimal benefit in terms of musculoskeletal conditions [64, 180, 181].

Tailored PA supports functional capacity, supports normal pathological structures and processes, glucose homeostasis, bone health, psychological well-being, independence and quality of life. PA also has the potential to postpone or prevent prevalent musculoskeletal disorders, such as low back pain, neck and shoulder pain, and osteoporosis and related fractures [182, 183]. Exercise can contribute to the rehabilitation of musculoskeletal disorders and recovery from orthopaedic surgery [184].

2.4 Population trends in physical inactivity

Data from the 2011-12 National Health Survey showed that more than two-thirds of the adult Australian population were categorised as being insufficiently active; i.e. not taking part in any PA (sedentary), and those undertaking less than 150 minutes of PA per week [25, 41, 185, 186]. Worldwide, it is estimated that least 60% of the adult population are insufficiently active. It is estimated the as much as 67% of the Australian adult population are insufficiently active [41, 186, 187].

In Australia, insufficiently active people are made up of those who are either sedentary or inactive, that is those not meeting the minimum requirements for PA outlined in the National PA Guidelines [41, 186, 187]. Trends in physical inactivity increase with age with the highest levels of inactivity observed in the 75 years and older age category; with as few as one in four this age were classified as sufficiently active. In contrast the lowest levels of physical inactivity were observed in the 18-24 year old age category with 47% considered insufficiently active [41, 186, 187].

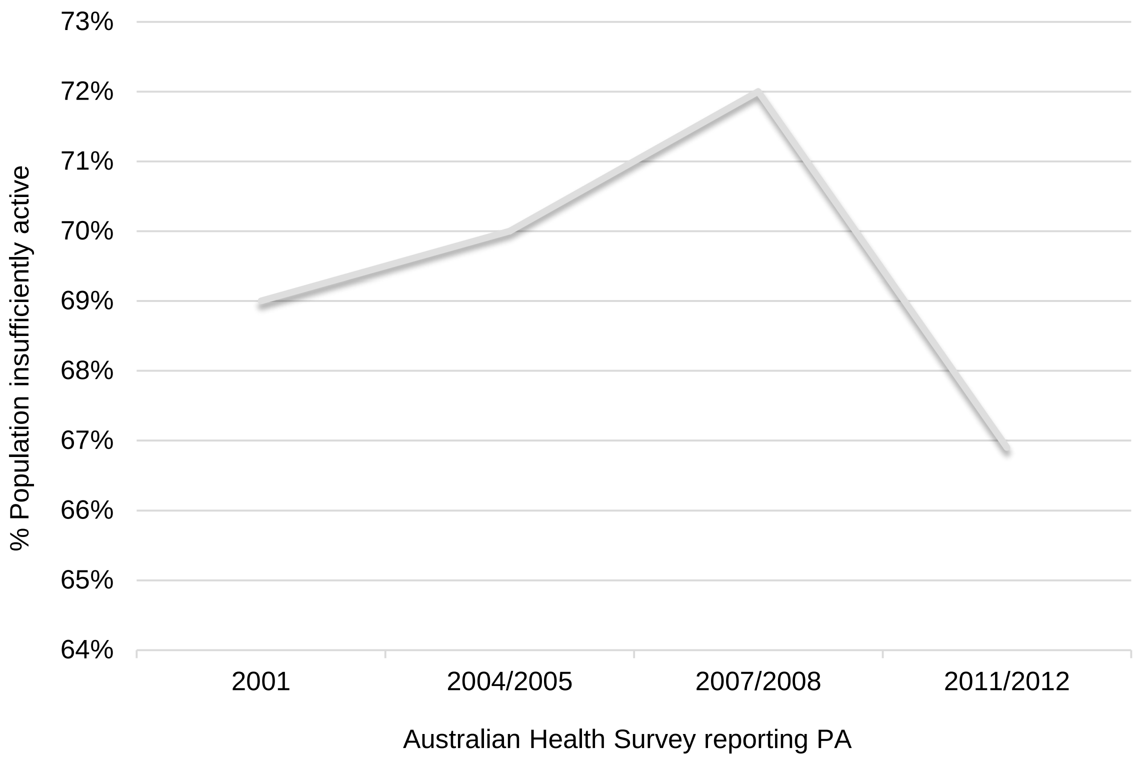
The following section will provide an outline of the trends in PA/inactivity with consideration of the rising rates of sedentary behaviour, which is an emerging contributor to the prevalence of physical inactivity.

2.4.1 Trends in physical inactivity and sedentary behaviour

Over the last 10 years, the proportion of the Australian population who are insufficiently active or sedentary remained low with only 33% of the adult population performing enough activity to obtain health benefits. Levels of sufficient PA were associated with a range of factors; including socioeconomic disadvantage, health status, body mass index (BMI) and smoking status [41, 186, 187]. Figure 3 demonstrates trends in sedentary and physical inactivity behaviours for Australian adults between 2001 and 2011/2012 [41, 188-190].

Identifying population trends in PA is a vital part of the development, implementation and monitoring of any public health responses to this lifestyle risk factor. Understanding fluctuations in behaviour supports the development and/or revision of policies and programs related to increasing activity levels [191]. Consistently low levels of PA have prompted formal surveillance to monitor PA and inactivity. Surveillance is an important and part of addressing the prevalence of chronic disease [192]. In Australia, surveillance has been implemented via the National Health Survey, first initiated in 1995 [193]. After an initial lag of five years, the second National Health Survey was produced in 2001 [188], with subsequent surveys occurring every four years after that; 2004/2005, 2007/2008 and 2011/2012 [41, 188-190, 193].

Figure 3 Trends in physical inactivity between 2001 and 2012 [41, 188-190].



2.4.2 Sedentary behaviour

There is an independent association between sedentary behaviour and burden of disease, regardless of whether an individual is sufficiently active or not [194-196]. These findings differ from previous research and infer that irrespective of the amount of PA (moderate or vigorous) undertaken by an individual, sedentary behaviour poses a separate, distinct risk in terms of disease burden [194, 196-199].

Specifically, researchers have identified, time spent sitting as important when calculating the PA quantity [200]. There is a dose-response relationship between sitting time and mortality, independent of leisure time activity [198]. In the context of chronic disease prevention, the impacts on health of too much sitting need to be considered, in addition to the well-established preventative-health concerns about too little exercise. Recent findings suggest that sedentary behaviour for more than four hours each day is associated with higher waist circumference, blood sugar levels, triglycerides levels and the onset of metabolic syndrome. These findings were independent of whether individuals who met National PA guidelines for moderate and/or vigorous activity [195, 200, 201].

Increasing trends in physical inactivity have been attributed to professional, technological, individual, social, cognitive, and environmental determinants [202]. Compared with earlier generations, populations from industrialised countries are now spending increasing amounts of time in sedentary states across most daily life environments such as work, commuting to and from work, home and leisure time. The addition of advances in technology has contributed to reduced movement for tasks otherwise requiring physical movement. Examples include; television remote-control devices, online shopping and mobile telephones. This recent shift from physically demanding lifestyles to one with few physical challenges is now evident in growing prevalence of overweight, obesity and related chronic diseases [25, 50, 203-205]. In Australia, it is estimated that sedentary behaviours occupy an average adult, 39 hours per week or 5.6 hours per day. Watching television, sitting at work and using a computer or similar electronic device, have been identified as most frequent reasons for this behaviour [42].

Researchers studying trends in PA behaviour have revealed a complex, multifaceted relationship between PA, energy expenditure and health. They have identified several factors such as; the geographical spread or urban areas, limiting active transport options, socioeconomic variables such as employment status, limited coordination across legislative tiers and barriers related to workplace culture such as issues around work/life balance [50, 203].

The modifiability of physical inactivity suggests that substantial health and economic gains could be achieved by modest changes to population levels of PA and sedentary behaviour [206]. The anticipated reduction in disease burden is estimated as much as 30% for those adults achieving recommended levels of PA, (National PA Guidelines) [25, 185, 207]. Based on current physical inactivity estimates (67%) for the Australian population, even a modest change of 10% in activity would lead to cost savings of $258 million, with 37% of these savings apportioned to the health sector alone [208]. Those most likely to reap benefits from changes include sedentary individuals and those from marginalised groups such as; older adults and those with disabilities, given their high risk associated with disease burden, mortality and morbidity rates [25, 85, 185, 186].

Incorporating PA into daily routines can often prove difficult. There are a number of common barriers to participation in active living. In particular, technological advances and increased conveniences, making life easier, have lessened the need to be active. It is important to understand the reasons why some people choose to be active and others do not, so that creating strategies to overcome them can be better targeted to support and encourage PA as part of a daily routine [25, 209, 210].

2.5 Physical activity recommendations

A literature search was conducted to identify the development, implementation challenges and successes related to policy initiatives to address physical inactivity both in Australia and overseas.

A review of literature regarding PA policy, guidelines and recommendations using the following electronic bibliographic databases to identify relevant studies: OVID: including CINAHL, EMBASE, PUBMED, MEDLINE and PsycINFO. In addition, search of EBM review databases including: Cochrane, Trials Register, DARE and ACP. Finally, Google Scholar was included to identify publications not already captured through the aforementioned process. Search terms used included: PA policy, guidelines, recommendations, chronic disease policy, general practice, and primary health care and Government initiatives.

2.5.1 Physical activity recommendations

The World Health Organisation has identified physical inactivity as the fourth largest global risk factor for mortality causing an estimated 3.2 million deaths annually, across the world [210]. In response, they urged members of their alliance to implement guidelines on PA for health, and dissemination of country specific policies and interventions addressing the following [211]:

- Develop and implement national guidelines on PA for health.
- Facilitate access to physical environments including supporting safe active commuting, and space for recreational activity.
- Strengthen public policy to lead interventions that promote PA including opportunities for planning, incidental and active transport.
- Increase public motivation and understanding.
- Promote partnerships.
- Increase relevant and meaningful translational research.

In Australia, guidelines have been established to specify the minimum standards required to achieve health improvements [25]. They focus on the importance of all forms of movement including planned and incidental PA and encourage Australians to integrate PA into their lifestyles [25, 185]. They have been designed to not only provide guidance for the general population but as a lifestyle education tool.

Exercise is described by a compilation of parameters, outlined earlier in this dissertation. These include; the frequency, intensity, type of exercise and/or duration of a PA undertaken. Dose-response, refers to the volume of which these parameters are manipulated (dose) and the magnitude of physiological response garnered (response) [25, 185, 186, 212, 213]. Parameters can be manipulated to produce desired responses. For example, the dose varies for the required response for cardiovascular fitness level, risk of coronary artery disease (CAD) and all-cause mortality, obesity, cholesterol profile, type 2 diabetes, colon cancer and so on [25, 185, 186, 213, 214].

The most recent Australian PA guidelines build on the earlier version and provide advice to support increments in exercise participation, including combinations of moderate and vigorous intensity PA and resistance training [25]. Whilst the earlier guidelines acknowledge the incidental nature of PA, the new guidelines provide more definition regarding what changes are required to increase incidental activity, they explicitly advise reducing sedentary time. The guidelines have been outlined in the Table 3.

Table 3 Australian Physical Activity Guidelines 1999 and 2014 compared.

1999 Guidelines [185]	2015 Guidelines [25]
Think of movement as an opportunity, not an inconvenience,	*Doing any PA is better than doing none. If you currently do no PA, start by doing some, and gradually build up to the recommended amount.
Be active every day in as many ways as you can,	*Accumulate 150-300 minutes of moderate intensity PA or 75-150 minutes of vigorous intensity PA, or an equivalent combination of moderate and vigorous activities, each week.
Put together at least 30 minutes of moderate intensity PA on most, preferably all, days, and	Be active most, preferable all days of the week.
Include vigorous exercise can provide additional health and fitness.	*Do muscle strengthening activities on at least 2 days each week.
	*Minimise the amount of time spent in prolonged sitting.
	*Break up long periods of sitting as often as possible.

*Denotes reviewed or new guidelines

2.6 Policy responses to physical inactivity

In addition to PA guidelines, a range of policy-based responses have been introduced to promote PA in the public space. In 1986, the Ottawa Health Charter provided an impetus for public policy to increase population levels of PA, from an international perspective [215]. The Charter described the role of health promotion in advocacy, stewardship and mediation in the coordination of legislative, financial and cultural changes for health gains. The application of the Charter is relevant to strategies to improve population levels of PA and places policy, and environmental interventions at the core of health promotion initiative. Subsequent to the Charter, WHO delivered a more definitive response to lifestyle risk factor management through the "Global Strategy on Diet, PA and Health" [45, 192]. This strategy highlighted PA as an independent consideration for prevention of non-communicable diseases, worldwide. Specifically, this strategy set out four key priorities:

1. Reduce prevalence of physical inactivity via the public health domain.
2. Enhance population awareness and competency around the positive and health enhancing impact of PA.

3. Develop and implement public policy and regionally tailored action plans to support behaviour change.
4. Maintain commitment to evidenced based approaches to PA via research and other relevant means.

2.6.1 International policy

International efforts to increase population levels of PA have emerged from the WHO strategies, with the establishment of a range of regional networks. These networks were established to interact around PA policies and programs. They have demonstrated success in integrating multicomponent, multi-sector policies and planning to promote PA [216] Successes have integrated environmental, structural, health, sport and recreation policy, across a range of levels including; individual, corporate, local, and regional levels motivate individual behaviour change, and increase and sustain the provision of institutional and environmental support to enduring changes in PA behaviour with time [46, 216-218].

The European Network for the Promotion of Health-Enhancing PA [219] and PA Network of the Americas [220] are two examples of regional networks established to inform PA policies and programs. The HEPA network was originally established in 1996 and designed to foster the development of health enhancing PA policy across Europe, through advocacy, consultation and information exchange. Outcomes from this network include the production of guidelines for the Development of National Policies and Strategies for Promoting Health through PA, Guidelines for Health-Enhancing PA Promotion Programs as well as the strategy document Promotion of Transport Walking and Cycling: Strategy directions [219].

The PA Network of the Americas (PANA) commenced in 2001, with the intent of sharing information, strategy coordination and strengthening efforts to improve population levels of PA [220]. Outcomes from this coalition include raising awareness of PA and its role in increasing incidence of non-communicable diseases, and trends in sedentary behaviours. In addition, the group have influenced the development of strategic partnerships for promoting PA. Lastly, the group have led the development of public policy-related programs and frameworks to codify evidence-based policy actions between the countries composing the Americas, national and local levels to promote PA [221].

Individual countries have made significant efforts to establish policy to address falling population levels of PA [222, 223]. Responding countries include; the United States, Canada, Finland, and the United Kingdom. They have accumulated a range of multi-sectoral actions to increase the visibility of PA behaviour change, generating synergies with other community and national issues. Examples include a number of collaborative activities led by United Nations agencies, with member states and partners from the public and private sectors such as the joint policy development between the World Health Organization (WHO) and the United States Centers for Disease Control and Prevention (CDC), in their collaborative efforts in developing policies related to PA [224]. This pre-empted the development of the WHO Global Strategy for Diet, PA, and Health [45]. Collaboration continues today with the most recent example being the International Society of Behavioural Nutrition and PA – Advancing Behaviour Change Science Conference in June 2015 [222, 225]. Collectively, these nations have recognised a range of enablers to PA promotion. These include the need for multi-sector approaches and policy directives in addition to a range of other considerations. These considerations have been summarised and collated in Table 4.

Table 4 Considerations for policy making when establishing physical activity policy.

Strategic partnerships	• Engage stakeholders from key inter-sectoral agencies ensuring broad scope for addressing whole-of-population, and support sustainability [45, 192, 210, 226].
PA policy	• Ensure policies are open to opportunities provided by related strategies to create synergies for efficiency and greater reach [45, 192, 210, 226].
	• All policy should be promoted as transparent actions ensuring accessible and equitable opportunities that are inclusive of whole-of-population [45, 192, 210, 226].
Environment/settings	• Establish environments or settings that are conducive to PA • Ensure settings are accessible and transparent to those referring/promoting PA e.g. referral pathways [45, 192, 210, 226].
Surveillance data	• Comprehensive and systematic data collection relevant to PA levels and sensitive to change to ensure evaluation of interventions [45, 192, 210, 226].
Economic incentives	• Consideration of incentives for promoting change and uptake of PA. Incentives may not be financial but in-kind [45, 192, 210, 226].
Active living	• Factored into education curriculum to ensure early, consistent teaching that is reinforced throughout an individual's lifespan [45, 192, 210, 226].
The health care system	• Ensure health professionals are adequately resourced to provide behaviour change interventions. • Explore feasibility of financial incentives to encourage uptake. • Empower health promotions to initiate behaviour change [45, 192, 210, 226].

2.6.2 Australian policy

In Australia, the inaugural National PA Guidelines were established in 1999 [25]. These guidelines served as a mechanism for raising public attention around minimum PA requirements to achieve health benefits. They formed part of a broader PA initiative, known as the Active Australia campaign [227]. This campaign brought together key stakeholders from government and non-government sectors to provide the structure for effective promotion of, and opportunities to participate in, PA in Australia. It provided a mechanism for shared information, resources and problem-solving for PA policy development and implementation.

Surveillance activities were introduced at the same time as the Active Australia initiative, with the aim of providing a coordinated approach to monitoring PA at the national and jurisdictional levels [43, 44]. In terms of monitoring PA interventions, national surveillance activities were able to demonstrate increases in public awareness resulting from the Active Australia initiative, in particular moderate level PA. Over time, surveillance activities have developed to include a range of measures not limited to planned PA, such as leisure and occupational PA and sedentary behaviour [228].

The Active Australia initiative provided an organisational structure and communication network to support inter-government and inter-sectoral relationships [227]. The trajectory promised by the Active Australian initiative was accepted internationally as a positive way forward for PA policy. During the period of the Active Australia initiative, the now obsolete Strategic Inter-Government forum on PA and Health (SIGPAH) was established, with the role of coordinating a national approach to physical inactivity [229]. The group successfully commissioned the preparation of the Getting Australia Active Report which responded to evidence highlighting the role of PA in the prevalence of chronic disease, and rising incidence of chronic disease and physical inactivity. The report described a range of strategies considered 'best practice' approaches to PA promotion. Of these strategies, the report highlighted seven settings considered optimal for initiating behaviour change. These were:

1. Linking research, practice and policy in the promotion of PA.
2. Promoting PA through general practice.
3. Schools as settings for interventions.
4. Promoting PA in worksites.
5. Media and community wide interventions to promote PA.
6. Environmental, policy and inter-sectorial approaches to PA.
7. Transport and PA.

Subsequent actions related to this report include the implementation of the Better Health for all Australians – Action Plan, with approaches that aimed to prevent or manage lifestyle risk factors such as overweight and obesity, excessive alcohol consumption, tobacco smoking and physical inactivity. The group was the first in Australia to recognise the role of general practice in PA change, amongst a range of other settings considered 'optimal' for behaviour change. The SIGPAH group explicitly recognised the role of primary health care in preventing and managing chronic disease and lifestyle risk factors including an acknowledgement of the limitations experienced by GPs in delivering routine preventive activities, including PA advice [230]. Resulting from the SIGPAH work, minimum standards were established to ensure preventive activities are carried out in the general practice setting. These include:

- Deliver appropriate interventions on-site or refer to external services.
- Establish referral processes for relevant service providers to support risk factor management.
- Establish baseline measures for patients regarding lifestyle risk factors, systematically monitor and record in medical notes.
- Access to a multidisciplinary workforce with relevant skills and expertise using mechanisms such as referral pathways.
- Relevant tools and resources such as guidance regarding assessment and prescription for lifestyle risk factors.
- Ability to stratify patients based on specific criteria using information systems.

2.6.3 General practice policy directives

The Royal Australian College of General Practitioners (RACGP) responded to the need for PA policy in the general practice setting by establishing guidelines for prevention of chronic disease [231]. They produced two publications to support general practice implement preventive activities, including PA behaviour change activities:

- **Putting prevention into practice: guidelines for the implementation of prevention in the general practice,** offering a framework for prevention strategies such as employing health assessments, using practice team members to delegate responsibilities and suggests ways of dealing with daily pressures of general practices such as time constraints [231].
- **Guidelines for preventive activities in general practice**, providing evidence based activities whilst ensuring effective and efficient use of time for clinicians working in the general practice setting [29].

Opportunities for GPs to intervene to promote lifestyle behaviour change have been supported by the development of the SNAP Framework [181, 232, 233]. This framework, provides an outline of the national PA guidelines for the prevention of chronic disease as well as highlighting the 5As approach for addressing preventive care in the general practice setting, i.e. Ask, Assess, Advise, Assist and Arrange [29, 91, 232, 234]. The RACGP have implemented the Guidelines for Preventative Activities in General Practice recommending that PA advice should be incorporated into routine visits in primary health care, for all patients [29, 235-238].

In 2004, the Australian Government Department of Health and Ageing commissioned a consortium to produce a range of lifestyle behaviour change resources for GPs. The resulting resource, known as 'Lifescripts' was designed to support GPs implement lifestyle risk factor management with a range of resources such as; assessment guidelines, assessment tools, prescription pads and patient targeted waiting room materials [1, 239]. Significant resources were provided for GPs, PNs and practices as a whole. Divisions of General Practice were used to disseminate the resources and provide education and training around the application and integration into routine practice [1, 239]. Despite widespread dissemination there were several limitations associated with the implementation. Firstly, the ability to quantify uptake of the instruments was indeterminate, with the inability to track use through medical software. Secondly, implementation was limited by poor coordination within general practice including:

- Administrative functions associated with scheduling patients for appointments associated with the use of the Lifescripts resources.
- Poorly defined roles and responsibilities with general practice including delineation of clinical and administrative functions.
- Vague and unstructured referral pathways with ancillary providers such as allied health professionals (AHPs) to facilitate expert advice regarding behaviour change advice.
- Limited financial incentives for GPs to link the initiative and drive their participation.

Lessons learnt from the Lifescripts initiative have been useful for informing the future direction of preventive activities in the general practice setting. Principally, the Lifescripts experience demonstrated that clinicians needed more than just a range of resources to support patient behaviour change. They need to have the necessary professional and corporate capacity to instigate patient behaviour change. This consists of relevant and coordinated support structures and functional ability such as competence in lifestyle risk factor management techniques, access to resources to support interventions e.g. incentives and instruments for assessment to facilitate lifestyle behaviour change. Despite these findings, the uptake of preventive activities in the general practice setting has remained low [15].

Subsequent efforts to support general practice to promote PA have included Medicare rebates for services by medical practitioners for treating patients with chronic and complex medical conditions via the Enhanced Primary Care Medicare program, Medicare health assessment items, the National Child Nutrition Program; the Diabetes Prevention Initiative; the Smoking, Nutrition, Alcohol and PA (SNAP) Framework for General Practice; Stronger Families and Communities Strategy, to address health issues, including obesity and related risk factors, in children and families and various programs targeting people identifying as Aboriginal and Torres Strait Islander consumers, and rural communities [232, 240-242].

The National Chronic Disease Strategy [206] which was introduced as an integrated approach to lifestyle risk factor management incorporated an expanded focus on chronic disease rather than individual lifestyle risk factors [206, 229, 243-246]. The expanded focus led to the establishment of several nationwide initiatives to address lifestyle risk factors collectively through approaches to chronic disease prevention and management. In response, the Australian Government has established the National Chronic Disease Strategy to guide policy development and service improvement for the prevention and management of chronic disease. In addition, the Strategy offers direction regarding the development and implementation of action plans tailored to meet local requirements within each jurisdiction.

In parallel to the National Chronic Disease Strategy, the Federal Government established the National Service Improvement Frameworks. These initiatives serve as a joint strategy between Commonwealth, state and territory governments and target specific chronic conditions. Initially, the framework is targeting asthma, diabetes, stroke and heart and vascular diseases, with a view to progressing frameworks with additional conditions over time. These frameworks aim to improve health services, prevent and limit the progression of the chronic conditions in question, slow the onset of complications, reduce preventable hospital admissions and reduce variations in the care provided.

Over time, political ideology and alternate priorities have caused policy deviations. A recent example is the disbandment of the National Preventive Health Taskforce [245]. Since the abolishment of the Taskforce, PA policy in Australia has moved from an independent focus to one that is associated with strategies for nutrition, overweight and obesity. Current initiatives leave lifestyle risk factor modification as a collective consideration, leaving PA as a subordinate to tobacco, nutrition and alcohol policy [221, 224]. Whilst Australia has implemented several policy initiatives, most have lacked integration with other national PA policies, resulting in fragmented policy that is episodic in nature. The result has produced little momentum for adequately reach population for meaningful and enduring behaviour change [221, 228].

The modifiability of physical inactivity and the unique opportunities to reverse the associated burden of disease has been acknowledged by researchers, government and policy makers [247]. Prompting behaviour change requires collaborative efforts from a range of stakeholders across sectors, and across national, state and regional/local governments [192, 210]. Governments have a responsibility to ensure that all community members have access to PA opportunities. This involves planning and building community knowledge and awareness of incidental and planned PA [186, 229, 248].

Achieving long-term sustainable change is likely to be difficult and resource-intensive, and will take time. It is not something that individuals or governments can do alone. To be effective, the approach needs to focus on engaging individuals, families and communities to make changes to their lives that will enable them to improve their nutrition and increase PA levels.

Preventative health care starts in the community, where people are born, grow up, raise their families, work and grow older. Primary health care is the gateway to a healthy life for Australian communities at each of these life stages, and is an important setting for the delivery of preventative health care [239, 249]. Despite this acknowledgement, there has been little policy directives since the introduction of Lifescripts initiative, which is now defunct [1]. The current MBS review may include consideration of PA, however it is unlikely [250].

The following section of this literature review will discuss the role of primary health care in PA promotion, including barriers to the uptake, initiatives to support uptake and the roles of the general practice team in PA promotion, including GPs, PNs, practice staff and patients.

2.7 Role of general practice in PA behaviour change

A literature search was conducted to identify the identification and development of responses to PA behaviour change in general practice. Literature was identified from both Australian and internationally, with a particular focus on countries with relative homogeneity to Australia. That is, industrialised countries such as the United Kingdom, New Zealand, United States of

America, and some European nations. This focus was based on the potential for genalisablity because of the following similarities:

- Demographic profile of males to females, and distribution of ages.
- Geographic profile such as access to and distribution of housing, transport and other essential resources.
- Comparable rates of PA, physical inactivity and sedentary lifestyles
- Comparable rates of chronic medical conditions
- Structure and function of general practice/primary care

The literature search used a broad strategy on the role of general practice in PA behaviour change. It used the following electronic bibliographic databases: OVID: including CINAHL, EMBASE, PUBMED, MEDLINE and PsycINFO. In addition, search of EBM review databases including: Cochrane, Trials Register, DARE and ACP. Finally, Google Scholar was included to identify publications not already captured through the aforementioned process. The search included the following terms:

- PA
- Chronic disease
- Behaviour change
- Primary care
- Planned care
- General Practice
- General practice team
- Practice nurse
- Practice staff

Additional searches for evidence from Australia and related industrialised countries were conducted using the specific sources including:

- National Health Service (NHS)
- Royal Australian College of General Practitioners (RACGP)
- Ministry of Health New Zealand
- Pan American Health Organization
- World Health Organization Health Organization
- European Observatory on Health Systems and Policies
- International Observatory on Health Systems and Policies

The previous section of this chapter, outlined the principal role of governments, and related health agencies in monitoring, preventing and promoting improved health across a given population [251]. These functions are intended to supplement the role of health service provision and related community sectors in effective primary and secondary prevention approaches to chronic disease [252]. This is substantiated through the Ottawa Charter for Health Promotion. Multi-faceted, population-wide initiatives have been identified as a key element of behaviour change via public policy, which include coordinated approaches across sectors and communities to ensure simple, clear, and consistent messaging [192, 253-255].

Primary health care includes services to the community that are accessed directly by the general public. It is often, but not always, the first point of contact with the health system when a person has questions about their own or their family's health. There is an expectation from the public that, when they visit a primary health care provider, they will receive information and assistance regarding preventative health issues [239, 256]. Primary health care provides essential services for all Australians, connecting care across the life course, and offers many opportunities for primary prevention. Primary health care also has a great capacity to care for Australians across a very wide range of disciplines, including medicine, nursing and allied health services such as physiotherapy, occupational therapy, dietetics, pharmacy and psychology [239, 249].

In 2006, the Council of Australian Governments (COAG) in its "Plan for Better Health for All Australians" identified the importance of promoting health lifestyles including addressing misuse of alcohol, improved nutrition, smoking cessation and achieving adequate levels of PA [257]. It proposed that this be achieved by:

- Supporting the early detection of lifestyle risks and chronic disease through a "well Person's Health Check" in general practice for middle aged people with one or more identifiable risks that lead to chronic disease.
- Supporting lifestyle and risk modification through referral to services that assist people wanting to make changes to their lifestyle.

Health professionals working in general practice are considered an important part of wider public health efforts to encourage people to become active [258]. A significant proportion (85.2%), of all presentations in general practice are related to chronic disease [259]. GPs have population wide access to a range of patients including the elderly and those identified with an existing chronic disease. Often, GPs have established and long standing relationships with these patients, which may be influential in instigating behaviour changes [260]. General practice is hence well placed to offer interventions for assessing and promoting PA [14, 49, 261].

Various attempts have been made both nationally [49] and internationally to utilise the influence of GPs upon their patients to increase levels of PA [50, 260]. Examples of initiatives include the Smoking Nutrition Alcohol and PA (SNAP) Trial conducted in 2001, which established and developed a strategic framework for lifestyle risk factor management in general practice.

Multiple guidelines have been developed to assist GPs in the prevention of chronic disease [29, 231]. The potential role of general practice includes the identification and provision of brief interventions to prevent chronic disease and also the referral to other services and programs [249]. Each guideline provides a framework for patient education and decision making about lifestyle changes. Research carried out in the United Kingdom has found that an estimated 10% of GPs are not aware of many of the guidelines available for primary and secondary prevention of chronic disease [262]. It is suggested that the growing number of guidelines available make it difficult for time poor GPs, to be aware of each and every one, in particular to ensure they have an adequate understanding in order to implement amongst patients [263, 264].

Improved methods of dissemination and implementation of the guidelines are required to assist with increasing population levels of PA. The following discussion will review the composition of stakeholders making up the general practice setting. This includes; GPs, PNs, administration staff and patients. The discussion will consider their role in the uptake of preventive guidelines, specifically reflecting on PA guidelines.

2.7.1 The general practice team

The general practice team has been defined as '… a small group of people with complementary skills who are committed to a common purpose, set of performance goals and approach, which is led by the general practitioner (GP)' [265].

The organisational structure of modern Australian general practice is different to that of 15 years ago [265-273]. The structure of the 'team' has changed significantly in terms of size, composition and function. The move away from the traditional general practice of GPs to a multidisciplinary approach that also involves PNs and non-clinical staff such as practice staff, to provide a systematic approach to care and complement, or supplement the role of GPs [274]. Their role, whilst varied from practice-to-practice, has become one that is diverse and multidimensional in purpose and execution, ranging from patient education, risk stratification, administrative duties, through to the provision of clinical services [265-273].

There is a growing interest in the development and enhancement of the general practice team, specifically how this can assist to improve the quality of patient care, address GP workforce shortages and improving functional efficiencies across patient care. This includes, primary and secondary prevention activities, often elusive due to demand for acute care [266, 268, 275, 276]. Globally, PNs have been have been acknowledged for their role in successful approaches to managing chronic disease that are systematised using members of the general practice team [277].

Modern Australian general practice has been described as a multidisciplinary unit of professionals who take responsibility for whole-of-patient care [278, 279]. Members are not limited to GPs, but integrate resources such as PNs, AHPs, medical specialists, community, social and welfare providers [280]. Administrators, practice managers and/or reception staff often contribute to intra and inter-team communication, expediting collaboration and enhancing communication which in turn, builds consensus. At the epicentre of the multidisciplinary team is the patient, this includes ensuring a patient is involved in, and has responsibility for health-care decisions [281-283].

2.7.2 Practice Nurses

Over recent years, the GP's role in chronic disease prevention and management has shifted based the clinical juggling act they are faced with; triaging patient's based on acute presentations with short consultation timeframes. In the United Kingdom, PNs have been shown to play an important role in facilitating and conducting part or all of the health checks in general practice [284]. These roles have included identifying patients for health checks, assessing their risk factors and combined risk score (such as using Framingham cardiovascular algorithm based tools), providing motivational interviewing, education and negotiating behavioural goals, and arranging follow-up [285].

In Australia, 60% of general practices employ at least one PN, with the most recent reports indicating as many as 8% of all patient encounters, involve a PN [15]. Whilst PN involvement has almost doubled in the period between 2005-06 and 2013-14, encounters have been limited to immunisation, general check-ups, wound care, atrial fibrilation, diabetes care, and skin ulcerations PN [286]. Despite the shift in PN involvement in patient encounters, the use of PN skills in the prevention and management of chronic disease remains underutilised [137]. Halcomb et al., reported that as few as one third of all PNs contributing to preventive activities and more than 80% eager to be more involved [249, 287, 288].

The emerging role of PNs has positioned them as a key player in chronic disease prevention and management, in general practice [289, 290]. Nurses now routinely assist in the preparation of health assessments and care plans, refer patients for allied health services and review progress. Research has highlighted the need to design delivery systems in general practice to work as a team with a clear division of labour, separating acute from planned care for patients with or at risk of chronic disease [271, 289]. The Australian Government has committed over $A230 million to support practices to employ PNs with the release of incentives such as the Practice Nurse Practice Incentive Payment (PNPIP) and PN Chronic Disease Items [291].

Evidence from the BEACH study offers a more descriptive picture of the nature of clinical work in general practice, profiling the clinical conditions presenting and how they are managed, using a large representative sample of GPs and administered annually since 1999 [292]. It uses the consultation or ‘encounter’ between the GP and the patient as the primary unit of analysis. In recent years the study has increased the amount of data collected about PN involvement in these encounters. The 2007–08 report indicated that 6.0% of encounters included some nurse activity [292]. For two-thirds (66%) of GP-patient encounters involving PNs, none of the PN Medicare items were claimable. This confirms that the Medicare data alone fails to capture much of PNs clinical patient care work such as via GP Management Plans or Team Care Arrangements. The ratio of PN to patient encounters without GP involvement are not counted in the BEACH data set, therefore limited a true picture of their work, particularly because these items are a large part of the nurse's work.

There is a need for trials to test the impact of PN interventions to ensure that the significant investment being made in expanding the PN workforce achieves maximum impact on improving quality of care and patient outcomes, specifically in the measurement and promotion of PA [291]. Researchers are now directing their efforts in this area [293-303].

Nurses now comprise a significant proportion of the general practice workforce in Australia [304]. Data suggests that the number of practices nurses has reached one nurse, for every two-point-three GPs [304]. This ratio has experienced exponential growth since formal acknowledgement of their role, in 2001. Between 2003 and 2011, the number of nurses employed in Australian general practices has more than tripled with a 230% increase during this period [305].

Given the introduction of these initiatives/incentives, little definitive evidence is available to quantify the contributory role PNs have on clinical load, patient outcomes and roles and responsibilities within Australian general practices. Researchers have identified a need for greater delineation of the scope and purpose of PN to understand the nature of PNs role, types of patients that service, conditions treated and servicers provided. Only after this information is gathered can enhancements to existing work be made [306].

2.7.3 Practice staff including reception/administrative personnel

Practice administration and management is defined as covering the relevant operational aspects of a general practice, that requires a broad scope of clinical and non-clinical areas such as an understanding of the general health needs of their patient population, availability of services, gaps in service provision, information management and technology, quality improvement activities, financial management and daily operations of the practice [307].

Reception and/or administrative personnel in the Australian general practice setting are considered integral to the delivery of effective, efficient and quality primary health care [308, 309]. Highly functioning reception/administrative staff can fulfil the requirements for an effective and efficient multidisciplinary team. This has potential to build capacity of clinical personnel, impact on team morale and improve access to clinical care, consequentially impacting on health outcomes [283, 310].

Over time, there has been a transition in the roles and responsibilities in Australian general practices where there is a shared workload between personnel. This includes clinicians and non-clinicians. This has been most evident in the scope of non-GP roles, where PNs and practice personnel have taken on responsibilities related to lifestyle risk factor management, coordination of care, including goal setting, sharing data and some common decision making [[283, 310]. These processes have expanded with added administrative functions involved with the introduction of initiatives such as Enhanced Primary Health Care [311]. For example, establishing patient disease registers, recall and reminder systems and billing associated with these incentives [270].

Recent work in this area has found that effective practice administration contributes to team functioning, which can lead to improved patient outcomes. This is accomplished through streamlined intra and inter-team work specifically for patients that are high-end users of a practice such as those with chronic and complex medical conditions [310, 312-314].

2.7.4 Patients

Recent research has highlighted the role patient's themselves play as an active participant in their health care, rather than a passive recipient [271, 315]. Self-management support is based on self-efficacy theory and when implemented in general practice, has best results when used to target specific behaviours such as diet or exercise behaviours [289, 316, 317]. Until recently, GP and PN based interventions have targeted lifestyle risk factors on stages of change theory rather than self-management support [317-319]. While this has been demonstrated to be useful for supporting behaviour change in relation to alcohol and smoking, it is less suited to other risk factors such as diet and exercise [239, 320-322]. There is a need to incorporate self-management education into existing strategies such as care plans, the annual cycle of care and health assessments.

There are a number of tools, which are designed to assist patients to assess their own risk and prompt them to discuss this with their GP. Tools such as the Diabetes Personal Health Decisions developed by the American Diabetes Association, offers comprehensive assessment of risk of heart disease, stroke, kidney disease and diabetes over 30 years [323]. Despite the availability of these instruments, their application in the Australia has been limited. This provides an impetus for research in this area to demonstrate validity in a local context.

There are limitations to the use of these instruments in Australia, given they have not yet been validated for use in the Australian setting.

2.7.5 Planned care in general practice

In the context of general practice, planned care refers to systematic approaches to implementing team based care [324, 325]. It involves multiple members of the general practice team (internal and external) delivering services that are predetermined and suitably dispersed across the approach [310, 312, 314]. Team members are allotted to tasks required to deliver the approach that is within their individual scope. For example, reception/administrative personnel can develop patient risk registers to target for preventive activities, recall patients for appointments, and provide support in terms of communication to patients and billing. PNs have the skills and capabilities to conduct activities such as disseminate patient education and assessments, monitor medication compliance, document care plans and maintain the patient register and recall system [310, 312, 314, 324, 325].

Over recent years, planned care has emerged in response to an increased demand for general practice services and has been acknowledged as an optimal method of caring for patients at risk, or living with chronic and complex medical conditions [239]. Despite recognition for the proliferation of planned care in general practice, it is estimated that only half of all patients receive care that is planned, pre-emptive and preventive, in Australia. This has been demonstrated in the care of children with asthma, and adults with T2DM or hypertension [326-328]. In terms of PA behaviour change, the evidence indicates that as few as one-third of all general practice encounters involve PA behaviour change interventions [15]. Reasons cited for failing to offer PA related interventions include:

- Lack of time [238, 329, 330].
- Lack of financial reimbursement.
- Relevance to patient condition [238].
- Perceptions of poor patient compliance and inertia from previous experience [331].
- Lack of confidence in providing advice on the part of the clinician and self-efficacy in the ability to motivate patients for change [332-334].
- Insufficient knowledge about the benefits of exercise [335].
- Lack of appropriate tools to assess and prescribe exercise [334, 336].
- Limited referral options to support learning and development [310, 312, 314].
- Limited systematisation of assessment activities and management of risk factors [337].

Time limitations have been acknowledged as a significant barrier to the implementation of preventive guidelines in general practice [256]. These limitations relate to the rising demand for general practice care [338]. Between 2009 to 2010, Australian GPs saw approximately 30-35 patients per day, for an average consultation time of 15 minutes [338]. For every 100 problems managed, there were 153 reasons of the consultation, nine referrals for to external providers made such as medical specialists and AHPs, 29 pathology tests and six imaging tests ordered [338]. Whilst more recent reports have been released regarding general practice activity in Australia, the 2009-10 report provides the most definitive picture of GP capacity.

It is estimated that seven point four (7.4) hours per day would be needed by the typical GP, in addition to their existing workload, to implement known best practice approaches to prevention [256]. Similar findings have been identified with interventions targeting alcohol consumption in general practice patients, with GPs citing lack of time as their most compelling limitation in conducting routine alcohol screening [339].

Previous efforts to investigate PA behaviour change and planned care have focused on the role of PNs, and their role in managing activities required for PA behaviour change, such as PA assessment and provision of patient education material. However, this has been conducted in conjunction with other lifestyle risk factors such as smoking, diet/nutrition and smoking. Little et al [340] and Collins et al [341] found benefits associated with the use of PNs in improving patient levels of PA, compared with other clinicians but fell short of considering the role of non-clinical personnel and their role in activities such as disease registers, recall systems, appointment management and reminder systems. Similarly, other preventive health interventions have demonstrated effectiveness when delivered by PNs and similar ancillary personnel such as AHPs, but failed to evaluate the role of non-clinical elements that make up planned care [342-346].

In addition to PNs, the role of non-clinical staff is a relatively untapped resource in terms of its contribution to planned care. The provision of administrative support for clinical activities is a key task in ensuring coordinated strategies, such as patient disease registers, recall systems, structured appointment systems and patient reminders [284, 347, 348]. Assigning responsibilities across the whole general practice team facilitates the execution of planned care in general practices. It does this by ensuring an equitable distribution of responsibilities for efficient management of all aspects of the patient's care, including clinical and non-clinical tasks [310, 314]. Despite growing evidence of the benefits associated with teamwork and planned care, there is little evidence to demonstrate that it has been comprehensively adopted in Australian general practices [349]. Limiting factors to the uptake of planned care strategies in Australian general practice include:

- National financial reimbursement program includes fees for service encourages reactive care, rather than systematic care.

- 40% of general practice do not have a PN and for those that do, only 8% of patient encounters involve the PNs, indicating limited multidisciplinary care [15].
- Limited intra-team communication to support multidisciplinary care [350].
- Underdeveloped information and decision support systems [249].
- A lack of physical infrastructure within many practices to allow workforce diversification [249].

Preliminary attempts to implement planned care approaches have limited their application to the use of PNs, often as a substitute for GP activities, and some consideration for the role off non-clinical staff [310]. Whilst planned care is a relatively new strategy for managing chronic and complex medical conditions in general practice, recent research indicates improvements can be achieved in patient outcomes for a range of conditions such as; type two diabetes, hypertension and chronic musculoskeletal disorders [351-354].

There is a large gap between evidence and practices regarding strategies to support general practice evolve from reactive care to planned, systematised approaches to care. Specifically, the role of planned care in addressing behavioural risk factors such as PA has received even less attention [324, 355]. Investigation requires consideration of the resources (infrastructure and human) required, in addition to the organisation of these resources across each element of the Five As (5As) for PA behaviour change [356] (Figure 4). This includes the delineation of the roles and responsibilities of clinical and non-clinical staff, and use of external health care providers such as AHPs, to ensure effective interventions to address physical inactivity [324, 355, 357, 358]. In addition, there is a need to improve the use of technology available to general practice, such as medical software and aggregating clinical records. However, advancements in medical software are required to facilitate recording and extraction of relevant data. Currently, Australian medical software excludes PA status from being recorded in a functional field [359].

Figure 4 Five As model of behaviour change [356]

2.8 Measurement of physical activity in general practice

The Five A's approach formulates a basis and provides direction for health professionals in terms of the future care requirements of the patient. In terms of PA guidelines, this stage is where health professionals compare a patient's PA status against that of the recommended guidelines [24, 91, 360].

2.8.1 Physical activity domains

The key correlates of PA provide the foundation for understanding how PA is measured [27]. Using the definition for PA, outlined in section 2.2 of this literature review it is understood PA involves any bodily movement produced by the contraction of skeletal muscle(s). Bodily movements require the expenditure of energy to produce muscle contraction with variations in energy expended depending on four domains. These have been outlined below and presented in Figure 5:

1. **<u>Frequency</u>** of the activity i.e. how often is the activity done per day or per week?[27, 361]
2. **<u>Intensity</u>** of the activity e.g. moderate or vigorous intensity [27, 361]

3. **Time** taken to complete the activity or how long is the individual active?[27, 361]
4. **Type** of activity such as swimming, cycle, walking or rowing [27, 361].

2.8.1.1 Measures of physical activity

In order to quantify PA, the amount of energy expended is required [27]. Determining energy expenditure during PA is represented by Kilocalories and/or metabolic equivalent (MET). Alternatively, an estimate of the amount of energy expended can be undertaken by considering the dimensions of PA occurring across a given period of time [27].

2.8.1.1.1 Kilocalories

Kilocalories is used to measure the consumption of oxygen during PA [27]. Evidence indicates that one litre of oxygen consumption is approximately equivalent to five kilocalories of energy [27].

2.8.1.1.2 Metabolic Equivalent

Metabolic equivalent is a unit of measure used to represent the intensity of PA [27]. The measure uses an algorithm (3.5 mL O_2 x kg^{-1} x min^{-1}) to represent resting energy expenditure during quiet sitting [27]. Calculations can then be made as increases in oxygen consumption occur, which is in turn associated with variation of each or all of the PA domains i.e. frequency, intensity, time and type of activity [27].

Despite the scientific orientation of each of these measures, they are subject to limitations because of factors such as physiological and anthropometric variables. As a result, they are considered approximations of individual resting energy expenditure [362].

2.8.1.1.3 Intensity

The intensity of PA in defined by two board categories:

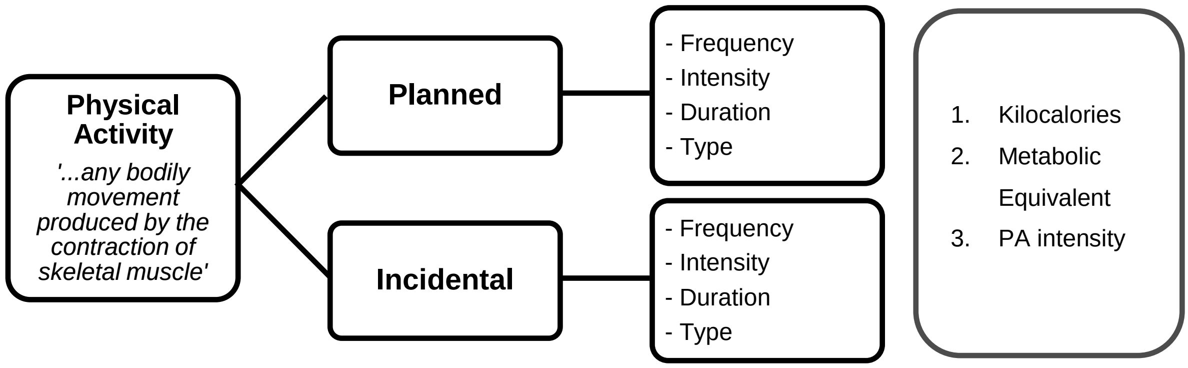
1. **Relative Intensity**

   This is the amount of effort is required for an individual to execute and activity. Changes in heart and breathing rate are used to measure relative intensity [27]

2. **Absolute Intensity**

   The amount of energy used during PA for each minute of activity [27].

Figure 5 Domains of physical activity



2.8.1.2 Methods of quantifying PA

Several systematic literature reviews have analysed methods for quantifying PA, acknowledging the complexity and multi-variant considerations required to accurately and reliably determine PA status [363, 364]. The result has identified a significant number of PA instruments available that consider measurement from alternate perspectives [19, 365-370]. Selection and implementation of the most suitable instrument requires an understanding of variations between instruments. Instruments for measuring PA are generally grouped into objective and subjective measures [371-374].

Both objective and subjective assessment instruments differ across a range of characteristics including their reason for the assessment or purpose, the population or sub-group they target and the domain(s) of PA they measure e.g. intensity, frequency, time or type of activity. Additionally, there are variations in the feasibility of assessment instruments including: resources, cost, expertise, and time required; capacity for analysis; the burden administering the instrument for both participant and the person administering the assessment [13, 375].

Historically, research examining PA assessment with large sample sizes have relied on subjective instruments to determine PA levels [376]. These instruments generally include questionnaires or recall logs and rely on data from self-reported assessment of some, or all PA domains to provide an estimate of PA status [376, 377]. The accuracy and reliability of outcome measures largely depends on the integrity of information provided by participants [376, 378]. Benefits associated with subjective instruments include their relatively low cost, limited burden on users and potential for application across large population groups [376-

378]. Despite widespread use of subjective instruments, evidence indicates they are limited in the production of valid and reliable outcomes [376-378]. These limitations relate to recall bias and, social desirability bias in addition to random error and, potential to miss capturing non-structured PA such as housework, active transport or occupational related activity [376, 378, 379]. Table 5 provides a summary of the strengths and weaknesses of both subjective and objective instruments for assessing PA.

In contrast to subjective instruments, objective instruments such as Global Positioning Systems (GPS) devices, heart rate monitors and motion sensors provide a range of quantitative outcome measures such as energy expenditure and intensity and address many of the limitations faced by subjective instruments [363, 364, 380-384]. For example, accelerometers can summarise raw data into proprietary ‘counts’ known as epochs [10]. They provide continuous numerical data, enabling measures of PA to be derived using algorithms across a range of PA dimensions such as planned, incidental and active transport [12, 13]. The data and analytical methods associated with accelerometers increases methodological transparency which in turn facilitates the comparison of data across studies. Whilst objective measures address several of the limitations posed by subjective ones, such as self-report bias, they are generally more expensive, require technical skills to operate or analyse data with increased time required for data reduction, transformation and processing [14, 15]. Table 5 provides a summary of the strengths and weaknesses of both subjective and objective instruments for assessing PA.

Table 5 Summary of subjective and objective physical activity assessment instrument strengths and weaknesses

	Subjective		Objective			
	Questionnaire	**Recall/Logs**	**HR**	**Pedometer**	**Motion sensor**	***DLW**
Strengths	• Low cost & patient burden • Suitable for measuring large samples • Ranks against benchmark • Assesses PA dimensions & domains	• Low cost • Detailed data on dimension & domains • Provides subjective measure of energy expenditure	• Low cost & patient burden • PA intensity	• Low cost • Low burden • Provide quantitative • Suitable for measuring large samples	• Low burden • Detailed data regarding PA domains e.g. intensity, frequency, & duration	• Valid & reliable measure for total daily energy expenditure
Weaknesses	• Recall & social desirability bias can occur • Population specific • Limited validity for assessing incidental PA	• High burden on patients • Population specific • Increased time for data analysis	• Affected by non-activity stimuli (emotion, medication, caffeine) • Limited in estimates of intensity	• Quantifies steps but no other domains e.g. intensity, duration • Limited in measurement of energy expenditure	• May miss capturing non-structured PA or upper body activities • Increased time for data analysis • Higher cost • Technical expertise for analysis	• High cost • Invasive test • Technical skills required for implementation and analysis • Unable to discern dimensions or domains

**DLW refers to Doubly Labelled Water*

Despite a growing choice of measurement options, few studies have determined the appropriateness and usefulness of subjective and objective measures from the perspective of general practice. Such data are needed to inform the uptake of PA assessment in this setting for the purposes of primary and secondary prevention in patients [377].

Within the scope of objective and subjective measures, instruments have been produced with a range of purposes, domains, population groups and measurement rigour [13, 375]. For the purposes of this literature review, an overview of seven types of measurement instruments has been described. There are two from the subjective category, and five from the objective category (Tables 6 and 7). Examples of instruments for each category have been included (Tables 6, 7 and 8)

Table 6 Summary of objective instruments to assess physical activity

	Type	Description	Instrument	Purpose	Domain
Subjective (subjective) measures	*Recall records or logs*	• Records or logs, which require individuals to record every activity done over a predetermined period of observation • Designed with multiple purposes e.g. surveillance or detecting behaviour change • Vary in complexity across domains e.g. occupation, planned or incidental activity and population characteristics • Low cost • Administration & analysis requires skills/training in interpretation to ensure accurately benchmarked against PA guidelines • Burdensome on participants in terms of completing logs which require multiple daily entries • Recalls can be subject to misclassification due to poor recall or over/under reporting • Can measure a range of domains including occupation, incidental and planned activity • Intensity may be over or under estimated and variable between population sub-groups	1. Seven-day PA Recall [385]	▪ Adults ▪ Adolescents ▪ Children ▪ Epidemiological purposes ▪ Clinical interventions ▪ Behaviour change interventions	▪ Planned activity ▪ Incidental activity ▪ Moderate intensity activity ▪ Vigorous intensity activity
			2. Bouchard three day PA record	▪ Children ▪ Adults ▪ Epidemiological purposes	▪ Planned activity ▪ Incidental activity

Table 7 Summary of subjective instruments (Questionnaires) to assess physical activity.

	Type	Description	Instrument	Items	Admin	Score	Dimensions	Domains	Setting	Population
Subjective measure	Self-report questionnaires	• Designed with multiple purposes e.g. surveillance or detecting behaviour change • Risk of misclassification due to over/under reporting • Vary in complexity across domains e.g. occupation, planned or incidental activity and population characteristics • Varying psychometric properties • Validity can be enhanced with use of objective measures • More accurate for measuring moderate and vigorous level activity • Less accurate for measuring light intensity activities such as incidental and activities of daily	Global exercise vital sign [386]	2	Self	Min/wk	5	2	International	Adults
			EPIC PAQ [387, 388]	4	Self	Min/wk MET.h-1.wk-1	1, 3, 4	2, 3, 4	European	Adults
			Godin Leisure Time Exercise [389-391]	4	Self	Total leisure activity score	1, 2, 3	3	Canada	Adults, men, women, specific subgroups
			Lipid Research Clinics [367, 368, 392, 393]	4	Self, Interviewer	Activity Score	5	3, 4	USA	Adults, older adults, men, women, Select sub-groups
			Minnesota Heart Health [392]	4	Self	5 point score	4	3	USA	Adults, men, women and select sub-groups
			Global PAQ [394]	16	Interviewer	Continuous of categorical score; MET.h-1.wk-1	2, 3, 4, 5	1, 2, 3, 4, 5	International	Adults (males and females)
			International PAQ short [395, 396]	4	Telephone interviewer, self	Continuous of categorical score; MET.h-1.wk-1	1, 2, 3, 6	3, 4, 5, 6	International (12 countries)	Adults, men, women, older adults, specific subgroups
			International PAQ long [395]	27	Telephone interviewer, self	Continuous of categorical score; MET.h-1.wk-1	1, 2, 3, 6	3, 4, 5, 6	International (12 countries)	Adults, men, women, older adults, sel subgroups
			Cardia [397, 398]	60	Self	Weight frequency	2, 3	3, 4	USA Australia	Adults, men, women, older adults
			Rapid Assessment of PA [399, 400]	7 (9)	Self, telephone	Active score	5	2	USA	Older adults
			Kaiser PAQ [401]	75	Interviewer, self	Activity index (1-5), total activity index	2, 3, 4	2, 3, 4, 6	USA	Adults, women, pregnant women and select subgroups
			Yale PAQ [367, 402, 403]	25	Interviewer	Activity index (kcal/wk), total time index (h/wk), summary index	1,2,3,6	1,3,6	USA	Older adults, men, women and select population subgroups

		living • Incidental activity difficult to measure using questionnaires due to population variances. • Low cost and relative ease of administration • Usually requires training	Modifiable Activity Questionnaire [404-407]	Varies	Interviewer, self	h/wk, MET.h-1.wk-1	234	34	USA France	Adults, men, women and select population subgroups
			GPPAQ [26]	3	Self, Interviewer	4 level PA index	1,2,3,4,5	1,2,3,4,6	United Kingdom, General practice	Adults, males and females
			2Q [18]	2	Self, Interviewer	h/wk	1,2,3,4,5	2,3,6	Australia, General practice	Adults, males and females
			3Q [18]	3	Self, Interviewer	h/wk	1,2,3,4,5	1,2,3,6	Australia General practice	Adults, males and females
			OSPAQ [408]	3	Self, Interviewer	% work time/PA labour/5 days	1,2,3	4	Australia Community	Adults, males and females
			AA [44]	3	Self, telephone interviewer	h/wk	1,2,3	1,2,3	Australia Community	Adults, males and females

Table 8 Summary of objective measures to assess physical activity.

	Type	Description	Instrument	Purpose
Objective (objective measures)	*Accelerometer*	• Movement monitors measuring intensity of PA • Administered by clinician of technician • Usually attached to an individual's waist, wrist, ankle, or shoe. • Best for use in measuring intensity of activity consisting of flat-ground ambulation and rest • Do not capture activity undertaken involving upper body extremities e.g. arm crank, rowing, of household duties such as dusting or washing dishes • For robust data, device should be worn for at least 7-days in adults	▪ Adults ▪ Older adults ▪ Epidemiological purposes ▪ Behaviour change interventions	▪ Measures activity across vertical plane ▪ Determines Intensity of activity
	Electronic Activity Monitors [370]	• Portable, wearable devices [369, 370] • Objectively measure PA undertaken[369, 370] • Delivers visual feedback to wearer [369, 370]	▪ Adults ▪ Individual use ▪ Behaviour change interventions	▪ Measures activity using Global Positioning System (GPS) to track geographical distance ▪ Intensity of activity ▪ Comparative measures, kilojoules expended and heart rate
	Doubly Labelled Water [409]	• Provides estimate of total energy expenditure linked with PA • Administration involves ingestion of water labelled with two stable isotopes of a single hydrogen (2H2O) and oxygen (H218O) and based on principle that after a loading dose of 2H218O, 18O is eliminated as CO2 and water, while deuterium is eliminated from the body as water. The rate of CO2 production (i.e. energy expenditure) is calculated from the difference of the 2 elimination rates. • Requires use of radioactive medical substances • Administrator must be formally trained in nuclear medicine to perform test	▪ Adults ▪ Behaviour change interventions	▪ Planned activity ▪ Incidental activity ▪ Occupational activity ▪ Sedentary behaviour ▪ Transport
Objective (objective measures	*Heart Rate Monitoring* [410, 411] [412]	• Heart rate is one of the fundamental vital signs and is related to level of physical exertion • Based on linear relationship between heart rate and oxygen consumption during exercise • Administration requires training regarding analysis and interpretation	▪ Children ▪ Adolescents ▪ Adults ▪ Behaviour change interventions	▪ Measures variations in heart rate indicative of PA ▪ Determines Intensity of activity ▪ Does not definitively define exercise domains
	Pedometers [413-416]	• Measures movement of the lower extremities i.e. footsteps or footfalls • Low cost • Does not measure intensity & some types of activity	▪ Children ▪ Adolescents ▪ Adults ▪ Behaviour change	▪ Planned activity ▪ Incidental activity ▪ Weight bearing activity only

2.8.2 Instruments suitable for general practice setting

Currently, there is little evidence available to guide the selection of PA assessment instruments for the wide variety of potential applications. Traditionally, general practice has used self-report questionnaires based their relative cost effectiveness; customary use; and do not require burdensome storage in practices, which are often short on space [232, 238, 318].

Australian clinical practice guidelines suggest GPs assess patients considered at increased risk of developing chronic disease, and have their PA status assessed at every opportunity [231]. To successfully execute this recommendation, general practice clinicians require suitable measurement instruments to identify patients who are insufficiently physically active [29, 232]. However, with a large range of assessment methods and instruments available, selection of an appropriate instrument for the general practice setting can be a difficult prospect [27, 376-378].

Strath et al. [27] in their scientific statement for the American Heart Association developed a decision matrix to guide identification of instruments for across different settings and purposes [27]. The matrix considers a range of variables to assist in determining the suitability of subjective or objective methods of PA assessment, with a range of example instruments for both measurement categories. Examples include questionnaires, accelerometers and pedometers [27].

To progress the granularity of this literature review, the decision matrix was employed as a method of identifying instruments suitable for implementation in routine general practice. The matrix served as a systemic and independent method of identifying instruments for use in this setting, and work to support clinicians implement the RACGP Red and Green Book guidelines [29, 232]. The RACGP Redbook is designed to provide guidance to GPs and practices regarding preventive care, including PA management. Similarly, the Green Book suggests activities to support the implementation of prevention in this setting including the role and use of the general practice team [29, 232]. A specific focus was made on identifying instruments for integration in urbanised Australian general practices. Consideration was made for instruments that offered potential generalisability with similar homogeneity in terms of population demography, incidence of physical inactivity and chronic disease and similar primary care systems or processes such as the United Kingdom, New Zealand and

USA or other industrialised countries [41, 210, 417-419]. Initially, the decision matrix was used to identify the most appropriate PA measurement category i.e. subjective or objective measure, with the outcome demonstrating self-report questionnaires as the most suited to the requirements of general practice. Appendix 1 shows the completed decision matrix indicating self-report questionnaires as the most suitable instrument.

Questionnaires from the subjective category were identified as the most suitable instrument to conducting PA assessments for the general practice setting. To further isolate instruments suitable for this setting and purpose, an adapted decision matrix was developed to systematically deduce a smaller selection of instruments. The adapted matrix (Table 9) draws on the responses from the original decision matrix (Appendix 1), and compares against the 18 questionnaires outlined in Table 8, using the criteria to regulate appropriateness. The ease of administration, concision, and outcome produced from questionnaires offer information to guide the designed outputs for the general practice setting i.e. classification as active. Collectively, the elements of the decision matrix indicate PA questionnaires a desirable method of assessment for use during brief office visits with general practice clinicians.

Table 9 Physical activity assessment instruments for general practice – decision matrix

Criteria	PA assessment requirements for GP	Eligible questionnaires		
Number of items	≤4 questions	☑ **Global exercise vital sign** ☑ **EPIC PAQ** ☑ **Godin Leisure Time Exercise** ☑ **Lipid Research Clinics** ☑ **Minnesota Heart Health** ☑ **Modifiable Activity Questionnaire**	❑ ~~Global PAQ~~ ☑ **International PAQ short** ❑ ~~International PAQ long~~ ❑ ~~Cardia~~ ❑ ~~Rapid Assessment of PA~~ ❑ ~~Kaiser PAQ (KPAS)~~	☑ **Yale PAQ (YPAS)** ☑ **GPPAQ** ☑ **2Q** ☑ **3Q** ☑ **OSPAQ** ☑ **Active Australia**
Administration method	Flexible – Self and clinician administration	❑ ~~Global exercise vital sign~~ ❑ ~~EPIC PAQ~~ ❑ ~~Godin Leisure Time Exercise~~ ☑ **Lipid Research Clinics** ❑ ~~Minnesota Heart Health~~ ❑ ~~Modifiable Activity Questionnaire~~	❑ ~~Global PAQ~~ ☑ **International PAQ short** ❑ ~~International PAQ long~~ ❑ ~~Cardia~~ ❑ ~~Rapid Assessment of PA~~ ❑ ~~Kaiser PAQ (KPAS)~~	☑ **Yale PAQ (YPAS)** ☑ **GPPAQ** ☑ **2Q** ☑ **3Q** ☑ **OSPAQ** ☑ **Active Australia**
Summary score unit	PA Guidelines (not technical)	❑ ~~Global exercise vital sign~~ ❑ ~~EPIC PAQ~~ ❑ ~~Godin Leisure Time Exercise~~ ❑ ~~Lipid Research Clinics~~ ❑ ~~Minnesota Heart Health~~ ❑ ~~Modifiable Activity Questionnaire~~	❑ ~~Global PAQ~~ ❑ ~~International PAQ short~~ ❑ ~~International PAQ long~~ ❑ ~~Cardia~~ ❑ ~~Rapid Assessment of PA~~ ❑ ~~Kaiser PAQ (KPAS)~~	❑ ~~Yale PAQ (YPAS)~~ ☑ **GPPAQ** ☑ **2Q** ☑ **3Q** ☑ **OSPAQ** ☑ **Active Australia**
Dimensions assessed	Meeting PA guidelines	❑ ~~Global exercise vital sign~~ ❑ ~~EPIC PAQ~~ ❑ ~~Godin Leisure Time Exercise~~ ❑ ~~Lipid Research Clinics~~ ❑ ~~Minnesota Heart Health~~ ❑ ~~Modifiable Activity Questionnaire~~	❑ ~~Global PAQ~~ ❑ ~~International PAQ short~~ ❑ ~~International PAQ long~~ ❑ ~~Cardia~~ ❑ ~~Rapid Assessment of PA~~ ❑ ~~Kaiser PAQ (KPAS)~~	❑ ~~Yale PAQ (YPAS)~~ ☑ **GPPAQ** ☑ **2Q** ☑ **3Q** ☑ **OSPAQ** ☑ **Active Australia**
Domains assessed	Lifestyle, Leisure time, Occupational, Transportation, and Household activity	❑ ~~Global exercise vital sign~~ ❑ ~~EPIC PAQ~~ ❑ ~~Godin Leisure Time Exercise~~ ❑ ~~Lipid Research Clinics~~ ❑ ~~Minnesota Heart Health~~ ❑ ~~Modifiable Activity Questionnaire~~	❑ ~~Global PAQ~~ ❑ ~~International PAQ short~~ ❑ ~~International PAQ long~~ ❑ ~~Cardia~~ ❑ ~~Rapid Assessment of PA~~ ❑ ~~Kaiser PAQ (KPAS)~~	❑ ~~Yale PAQ (YPAS)~~ ☑ **GPPAQ** ☑ **2Q** ☑ **3Q** ☑ **OSPAQ** ☑ **Active Australia**
Population	Adults (males and females)	❑ ~~Global exercise vital sign~~ ❑ ~~EPIC PAQ~~ ❑ ~~Godin Leisure Time Exercise~~ ❑ ~~Lipid Research Clinics~~ ❑ ~~Minnesota Heart Health~~ ❑ ~~Modifiable Activity Questionnaire~~	❑ ~~Global PAQ~~ ❑ ~~International PAQ short~~ ❑ ~~International PAQ long~~ ❑ ~~Cardia~~ ❑ ~~Rapid Assessment of PA~~ ❑ ~~Kaiser PAQ (KPAS)~~	❑ ~~Yale PAQ (YPAS)~~ ☑ **GPPAQ** ☑ **2Q** ☑ **3Q** ☑ **OSPAQ** ☑ **Active Australia**

Adapted from Strath et al. [27]

2.8.3 Identified instruments

The outcomes from the decision matrix (Table 9) identified five questionnaires as having potential for adaptation and/or enhancement in Australian general practice. This selection of instruments provides a cross section of features that address identified needs for assessing PA status within the general practice setting. The five instruments include:

1. Active Australia [261].
2. Occupational Sitting and Physical Activity Questionnaire (OSPAQ) [259].
3. 2-Question Physical Activity Questionnaire (2Q) [262].
4. 3-Question Physical Activity Questionnaire (3Q) [262].
5. GP Physical Activity Questionnaire (GPPAQ) [26].

Three of the instruments (2Q, 3Q and GPPAQ) have been designed specifically for application in general practice. Two of these have been validated for use in Australia (2Q and 3Q). The third (GPPAQ) has been validated for use in the United Kingdom, a comparative setting to Australia [26]. The remaining two instruments (Active Australia and OSPAQ), have both been validated for use in Australia however; have been designed for use as a population wide or occupational surveillance tool, respectively. The selection of instruments provides a cross section of features that address identified needs for assessing PA status in the general practice setting. More detailed information regarding the theoretical orientation and application of these instruments has been outlined in the proceeding section.

2.8.3.1 Active Australia survey [44]

The Active Australia Survey was first implemented in 1997 to assess the effectiveness of the *Active Australia* campaign conducted in New South Wales. In 2004, Brown et al. [420] examined the measurement properties of the AA, demonstrating variations in agreement between moderate and vigorous PA. Reliability coefficients for frequency/time in each domain of PA ranged from 0.56–0.64 and per cent agreement scores ranged from 40% to 65% for the PA activity categories; agreement was 76% for sufficiently active [420].

Since then, the survey has been implemented nationally through the National PA Surveys in 1999 and 2000 [227] and the Australian Diabetes, Obesity and Lifestyle

Study in 1999–2000 [421]. It has also been used in several state-based surveys, such as in Queensland, South Australia, and New South Wales [44].

The Active Australia Survey is designed to measure participation in leisure-time PA and to assess knowledge of current public health measures about the health benefits of PA. It offers a short and reliable set of questions that can be easily implemented via computer-assisted telephone interviewing techniques or in face-to-face interviews [44]. The questionnaire derives the following outcomes measures for each patient:

- Number of sessions of PA per week.
- Total time spent in each activity per week.
- Average time spent in each activity per week.
- Total PA time.

2.8.3.2 Occupational Sitting and Physical Activity Questionnaire (OSPAQ) [408]

The prevalence of adults working in sedentary occupations has increased over the past thirty years [422-424]. Recent research indicates that "office work, typing" is the second largest contributor, behind "driving a car" to insufficient energy expenditure during waking time of US adults [425]. The Occupational Sitting and PA Questionnaire (OSPAQ) [408] has shown excellent test-retest reliability and moderate to high validity in measuring occupational PA behaviour and has been recommended for inclusion in epidemiological studies to quantify PA (planned and incidental) for eligible patients [297, 426]. Chau et al. [408] evaluated the measurement properties of the OSPAQ, demonstrating excellent test-retest reliability (ICC 0.73 to 0.90). Comparison of sitting measures with accelerometers showed strong correlation ($r = 0.65$). Criterion validity correlations for occupational standing and walking measures with accelerometers were: moderate for standing ($r = 0.49$); and weak for walking ($r = 0.27$-0.29).

2.8.3.3 Two-Question Physical Activity Questionnaire (2Q) Instrument [14, 18]

The Q Two-Question Physical Activity Questionnaire (2Q) [18] has been developed for use during routine medical consultations and is a preferred instrument of GPs because of its simplicity. The instrument measures the number of bouts of vigorous intensity activity that were ≥ 20 minutes in duration and bouts of walking or moderate-intensity activity that were ≥30 minutes in a usual week. The 2Q version assesses participation in walking and moderate-intensity activity in the same question [18]. This instrument is reported as a reliable and moderately valid baseline measure of PA in general practice.

Smith et.al [18] determined the validity and reliability of the 2Q instrument in an empirical design. The instrument demonstrated moderate test–retest reliability with kappa 58.0% and 95% CI=47.2–68.8%. Criterion validity showed poor results for identifying patents as sufficiently active (kappa=18.2%, at 95% CI=3.9–32.6%). The 2Q and related 3Q have previously been integrated into Australian general practices through medical software programs such as Medical Director [427] and Best Practice [428] and in 2005 the instruments were included within the Lifescripts resource package, now no longer in use [1].

2.8.3.4 Three-Question Physical Activity Questionnaire (3Q) Instrument [18]

The three question (3Q) PA assessment tool [18] is a derivative of the 2Q instrument and has been developed for use during routine medical consultations. The instrument measures the number of bouts of vigorous intensity activity that were greater than or equal to 20 minutes in duration and bouts of walking or moderate-intensity activity that were greater than or equal to 30 minutes in a usual week. The 3Q version assesses participation in walking and moderate-intensity activity separately, whereas the 2Q instrument measures these together. As with the 2Q instrument, the 3Q instrument has also been reported as a reliable and moderately valid baseline measure of PA in general practice [18]. As with the 2Q instrument, Smith et.al [18] determined the validity and reliability of 3Q using the same empirical design; demonstrating moderate test–retest reliability (kappa 55.6%, and 95% CI=43.8–67.4%) and poor criterion validity for identifying patents as sufficiently active (kappa 24.3%, at 95% CI=11.6–36.9%).

2.8.3.5 General Practice Physical Activity Questionnaire (GPPAQ) [429]

The General Practice PA Questionnaire (GPPAQ) is a validated short measure of PA for adult general practice patients (aged 16 – 74 years) developed by London School of Hygiene & Tropical Medicine for the United Kingdom, Department of Health [430, 431]. The instrument provides a four-level PA Index (PAI) categorising patients as; Active, Moderately Active, Moderately Inactive and Inactive. This is then correlated to cardiovascular risk [22, 23]. The GPPAQ instrument is intended for use in general practice patients who are free from longstanding illness or disability potentially preventing them engaging in a PA and designed so that they can be conducted during routine consultations with a doctor or nurse, new patient registrations or health checks [431].

The measurement properties of the GPPAQ have been evaluated in a number of studies since its inception. Wareham et al. [432] determined the measurement properties of the PAI scores derived from the GPPAQ against objectively measured energy expenditure assessed using heart-rate monitoring (with individual calibration.) Outcomes demonstrated high repeatability with kappa = 0.6, (CI 95%, $P < 0.0001$) [432]. There were positive associations between the PAI from the questionnaire and the objective measures of the ratio of daytime energy expenditure to resting metabolic rate ($P = 0.003$) and cardio-respiratory fitness ($P = 0.001$). As an indirect test of validity, there was a positive association with energy intake, assessed by 7-day food diaries, to predicted basal metabolic rate [432].

More recently Fitzgerald et al. [433] evaluated the measurement properties of the GPPAQ against accelerometry. This study determined relative sensitivity in identifying patients as meeting (50%) or not meeting (46%) PA guidelines [433].

2.9 Implementation of PA assessment in general practice

There is a unique opportunity to support increases in PA using interventions in general practice. Patients not meeting current PA guidelines and those assessed as sedentary have most to gain from behaviour change [25]. In the general practice setting, patients need to be systematically identified, assessed and provided relevant advice for behaviour change. For this to occur, there is need for greater understanding of the range of barriers, enablers and influencers of lifestyle behaviour change interventions [35]. Previous research conducted by Taylor et al suggests consideration of three dimensions [35, 302]:

1. Influencing factors such as attributes and characteristics of patients.
2. Reinforcing factors related to personnel from a general practice such as; attitudes, knowledge, beliefs and behaviours e.g.PA level of individual clinicians.
3. Enabling factors which represent the availability of resources, structures, guidelines and procedures.

Reinforcing factors in the context of Australian general practice relate to the attitudes, knowledge, beliefs and behaviours of those professionals regarded as instrumental in motivating and supporting patients to become more sufficiently active, Taylor argued that there has been a lack of research in this area [35]. Steptoe *et al*.[434] suggested that it is crucial to gain an understanding of the philosophies, culture and principles of a general practice and the personnel within it to be able to fully appreciate what influencers, reinforcing factors and enablers are required for integrating PA behaviour change into their routine practice.

The social ecology model is an alternate framework used to understand the variables that influence health behaviour interventions, in particular the implementation of preventive activities in the general practice setting [435]. The same model can be applied to understanding the influencers on the acceptability of PA assessment in this setting, considering the practitioner and patient environments against macro, meso and micro level influencers that occur in both environments. Table 10 provides an outline of practitioner and patient influencers, applied to PA behaviour change across macro, meso and micro level environmental factors of the social ecology model for health promotion [435].

Table 10 Social ecology model applied to physical activity behaviour change interventions in general practice [435].

	Practitioner	Patient
Macro	**System** *Workforce, financial reimbursement opportunities, initiative in place (policy).*	**National** *PA related policy, regulation and media supporting PA behaviour.*
Meso	**Local** *Resources available to practice (human and infrastructure), systems in place, provider networks, patient demography, financial implications.*	**Community** *Environment, workplace, education and transport.*
Micro	**Practice** *Prior knowledge of PA, personal PA level and previous experience in PA and attitude towards PA.*	**Family/Individual** *Financial implications, culture, language, literacy, beliefs.*

A considerable number of questionnaires have been developed and disseminated [11-14, 18, 207, 408, 436-439]. Within the range of questionnaires available, there is a spectrum of purposes. For example, some questionnaires have been designed for epidemiological surveillance purposes, interventional studies and others measuring PA behaviour change, amongst others [371-373].

Traditionally, PA assessment instruments have been administered by GPs during a face-to-face consultation. There are a number of reasons associated with this method of implementation; firstly, GPs have historically completed all clinical related activities such as lifestyle modification interventions. Secondly, GPs have been viewed as maintaining the relationship with a patient. To this point, even medical software is designed so that PA assessment is limited to clinicians [440].

The challenge in identifying instruments to support the uptake of PA assessment is only the first step in addressing the need to improve the uptake to PA assessment in general practice. Of equal importance is determining the acceptability and methods to implement PA assessment instruments to enhance, fortify and expedite uptake.

2.9.1 Acceptability of physical activity assessment in general practice

Australian clinical practice guidelines suggest GPs assess patient considered at increased risk of developing chronic disease (or with an existing chronic disease), have their PA status assessed at every opportunity [231]. The guidelines for the management of PA have been outlined within the RACGP Guidelines for Preventive Activities in General Practice (Red Book) [231]. Despite the production of this comprehensive resource, and its sister document, the 'Green Book' which aims to support the implementation of these guidelines, rates for routine PA behaviour change interventions remain unsatisfactorily low [15]. Whilst there is evidence available to identify barriers to the uptake of the PA interventions, there is limited research available to understand GP attitudes and perceptions influencing or limiting uptake of interventions [238, 329, 330]..

Several studies have identified that GPs and patients see preventive care as an important part of their role, suggesting some level of acceptability, at least conceptually [441, 442]. However, whilst GPs acknowledge the need for preventive care, they are uncertain about the effectiveness of the interventions they deliver, citing discomfort providing advice about PA [443]. Additionally, evidence suggests that the level at which this discomfort occurs varies across individual GPs, such as whether the providers are themselves physically active [443].

Although general practice plays a vital role in screening and management of PA, time and resourcing issues, in addition to the need to deal with primary reasons for the patient encounter, means that interventions do not always occur [31, 181, 231, 444-446]. While recall and reminder systems for monitoring patients with an existing chronic disease are becoming more widespread, they are limited in their use for preventive activities such as PA behaviour change [447]. Therefore, finding ways to increase the capacity and efficiency in which PA behaviour change interventions can occur is necessary. However, the acceptability of these responses needs to be considered in terms of the stakeholders involved with the intervention e.g. GPs, PNs and patients.

Research highlights the need for improved clinician knowledge to execute PA behaviour change. Little is known about the role PA questionnaires can have in supporting clinicians to execute PA behaviour change or, at least which may in turn improve efficiency of PA assessment and behaviour change through improved competency [448]. In addition, the role that questionnaires can have in supporting clinicians to execute PA assessment is an area that requires greater attention. There is growing evidence that suggests providing clinicians with resources that encourage them to administer PA assessment and that boost knowledge and confidence in PA behaviour change, can be effective in improving their competency of PA interventions [30, 32, 33]. Greater knowledge and confidence is linked with an increased likelihood of delivering PA behaviour change interventions [30, 32, 33]. However, further research is required to ensure resources are compatible to the needs of clinicians.

Recent research in the management of patients with type 2 Diabetes indicates a lack of appropriate resources, creating a barrier to treatment and management [449]. It suggests a need for new and innovative approaches to prevention and management of diabetes, involving identification of barriers and enablers to prevention and management. Whilst this research relates specifically to diabetes management, previous research indicates this issue is not exclusive to diabetes management, and evident across lifestyle risk factors presenting in general practice [31].

Little is known about the feasibility and acceptability of these instruments for meeting the needs of the general practice setting. To date, measures of acceptability have focused on the time taken to complete a questionnaire [450]. Smith et.al [18] determined the validity and reliability of the 2Q and 3Q instruments in an empirical design; however it did not determine uptake in routine practice. The three remaining instruments have not been tested in this capacity in the Australian general practice setting. Methods of identifying feasibility and acceptability of these instruments in routine general practice are required. The following section of this chapter will discuss the aims of the dissertation herein including selection of preferred instruments for assessing PA in this setting and the need for exploration of optimal ways of implementing guidelines for preventive activities such as PA assessment.

Accurate assessment of PA comprises the foundation for research aimed at promoting PA and eliminating health disparities [28]. However, improving the uptake of PA assessment in general practice requires clinicians to firstly initiate an intervention and secondly, to execute this assessment [29]. These aspects each have their own set of correlates that require closer attention to form appropriate responses.

Additionally, little is known about the most appropriate methods of administering PA assessment within routine consultations, what works and what does not work, or the view of general practice personnel regarding each instrument. Evidence suggests that clinicians are more likely to initiate a PA assessment when it is explicitly linked to the patient's presenting condition i.e. providing curative rather than preventative advice [30-34]. Lessons learned from the adoption of alcohol screening in general practice patients demonstrates alcohol-use assessment is perceived to be more acceptable when it is conducted within a related consultation such as those with relevance to lifestyle risk factors, rather than acute conditions such as influenza [320, 451, 452]. Whilst these outcomes relate more to the acceptability from the patient perspective, they consider the appropriateness in terms of how GPs can broach the process of alcohol assessment, within their existing processes.

2.10 Summary

This literature review details evidence regarding the role of PA in primary prevention and management of chronic disease. It highlights the disproportionate representation that physical inactivity has in Australia, with 67% of adults not undertaking adequate PA to support good health, and public policy responses implemented to reverse physical inactivity. [239, 249]. It highlights the need to consider the collective role members of the general practice team has in systematically, and comprehensively executive PA assessment and advice, for patients requiring behaviour change.

To date policy initiatives have not impacted positively on the uptake of PA behaviour change initiatives in general practice. The review discussed the role of primary health care in PA behaviour change including how tasks can be dispersed across the general practice team, to execute an intervention. Finally, the literature review outlines an array of instruments developed for general practices to assess PA status in patients, and highlights gaps in evidence regarding their acceptability and feasibility for the Australian setting, particularly in terms of the role of non-GP members of the general practice team e.g. PNs and practice/reception staff.

This dissertation will firstly aim to identify instruments for assessing PA in general practice, that are preferred by those with responsibility for administering them (Chapter 3), secondly it will determine the feasibility of identified instruments (Chapter 4) for accurately and reliably measuring PA. Finally, it will explore optimal ways of implementing assessment into routine practice (Chapter 5) to ensure those most in need of behaviour change are captured.

3 Qualitative Study

3.1 Introduction

This chapter describes a qualitative study conducted to determine the acceptability of five instruments amongst clinicians, for use in assessing PA in general practice patients. The study used semi-structured interviews to explore acceptability, including clinician (GP and PN) preferences and reasons for preferences. The study analysed and compared the features of two preferred instruments and explored clinician experience, following their use in routine practice.

A poster presentation based on the outcomes of this study was published by the Journal of Science and Medicine in Sport (Appendix 2). A paper based on the outcomes of this study has been published by BMC Family Practice (Appendix 3).

3.2 Background

Evidence-based guidelines have been developed to support Australian primary care clinicians to address physical activity (PA) behaviour change in their patients [453, 454]. Despite evidence demonstrating the importance of implementing brief interventions, uptake is less than satisfactory with as few as 30% of primary care encounters involving PA assessment. [338, 455] These data highlight the need for routine and consistent assessment of PA within clinical settings to improve identification of insufficient PA, and instigate behavior change. Understandably, there are many challenges to routine PA assessment within clinical settings and subsequently, a range of tools have been developed. Physical activity questionnaires are used to determine PA status, by providing self-report responses to questions regarding a selection of PA domains.[297, 366]

Despite some evidence indicating limitations of self-report, questionnaires remain the most cost effective and pragmatic option for assessing patient PA behaviour, within primary care settings.[232, 238, 318] Research indicates a degree of analytical rigour when using self-report PA assessment instruments. [297, 366, 432, 456] Evidence has demonstrated strong correlations and agreement with other construct criteria measures for vigorous-intensity PA, and discriminant validation studies have shown that questionnaires have usefully classified patients in rank order according to activity level.[297, 366, 432, 456] This reiterates the value of PA assessment instruments in primary care settings, specifically for risk factor identification and behaviour change interventions.

In Australia, a range of policy initiatives have led public health approaches to reduce the prevalence of physical inactivity. These include the introduction of inaugural PA guidelines (1995), which were updated in 2015, introduction of national surveillance activities.[228] Inter-government and inter-sectoral approaches through the Active Australia and Strategic Inter-Government forum on PA and Health (SIGPAH).[229] More recently, the Australian Government committed $932 million between 2009 and 2018, for strategies to prevent disease through the National Partnership Agreement for Preventive Health (NPAPH). [457-459]This work aims to focus on encouraging the adoption of healthy behaviours, including PA.[457-459] The Royal Australian College of General Practitioners (RACGP) responded to the need for PA policy in the primary care setting by establishing guidelines for prevention of chronic disease.[231] They produced the *Putting Prevention into Practice: Guidelines for the Implementation of Prevention in General Practice* and, *Guidelines for Preventive Activities in General Practice* [29, 232]. Both resources have been designed to support primary care clinicians to implement preventive activities. [29, 231]

There are several barriers identified as limiting the uptake of preventive activities, including PA assessment, in primary care settings. In response, researchers have focused on ways to support clinicians to apply the National PA Guidelines through interventions assessing patient PA. [12, 13, 232] Since the introduction of the Australian PA Guidelines in 1999[185], a number of PA assessment questionnaires have been developed for use in primary care.[13, 18, 408, 436, 437] However uptake has been suboptimal with evidence indicating a number of barriers experienced by clinicians including; time constraints; knowledge about PA; inadequate skills with interpretation of PA assessment; and capacity limitations of the practice.[17, 18, 460, 461]

Identifying interventions that help primary care clinicians to conduct PA assessment, whilst taking into consideration limitations on their capacity, has been identified as a key success factor in the uptake of guidelines.[462] To date, researchers have placed emphasis on overcoming limitations in general practice time such as providing new instruments that are briefer in length and content.[18] Auxiliary approaches have included providing questionnaires in alternative formats such as electronic templates which are compatible with medical software and linking the assessment to (clinician) incentive funding such as Medicare Health Assessments and care plans.[463] However, there has been little noteworthy change in the uptake of PA assessment in general practice.[17, 18]

This study sought a better understanding of how clinicians perceive assessment instruments and how these were influenced by clinician factors and their experience using the instruments in practice in order to inform future PA interventions.

This chapter will describe the study to explore the acceptability and utility of five PA assessment instruments amongst a sample of general practice clinicians, including GPs and PNs. Measures of acceptability and ease of use included; instrument preference and reasons for preferences. The study also explored clinician experience with using two preferred assessment measures in practice over a short period.

3.3 Aims

The primary aim of this study was to determine the acceptability of a predetermined selection of five instruments, for assessing PA in routine general practice. Specifically, this study answered the following two questions around the acceptability of these instruments:

1. What instruments are preferred by general practice clinicians, for assessing PA amongst patients, in routine practice?
2. What reasons do clinicians state for preferring one instrument above another, before and after using instrument(s)?
3. Identify intrinsic and extrinsic variables that influence clinician uptake of physical assessment amongst patients.

3.4 Methods

This study was a qualitative design, using semi-structured interviews, with a convenience sample of general practice clinicians (GPs and PNs). Participating clinicians were asked to indicate preferences from a selection of five instruments. The previous chapter identified five commonly used instruments for PA assessment based on their previous application in general practice or potential for use in this setting (Section 2.8.3). In addition to instrument preferences, semi-structured interviews were used to explore reasons for preferences, barriers and enablers to the use of the instruments in routine care.

This study aimed to determine clinician preferences for a range of PA assessment instruments. It called for clinicians to draw on insight into their patient population, and practice systems to determine which instrument would be the best fit for their individual situation. Clinicians were considered as having experience in assessing patient PA behaviour, determined by previous referrals to the General Practice Exercise Referral Scheme (GPERS)program. Former methods used to assess PA, or the frequency at which this occurred was not determined because of potential recall bias. Clinician knowledge of PA assessed was determined by their PA status. The process for determining PA status is outlined in the methods for Stage-1 of this study.

3.5 Recruitment

3.5.1 Process

A database managed by the Sutherland Division of General Practice, who were responsible for administering the GP Exercise Referral Scheme, was used to identify GPs and PNs that had referred patients to the program in the previous six months. Identified clinicians were sent an invitation to participate including an information sheet and consent form. Similarly, patients that had participated in the program in the previous six months were identified and sent (by mail) an invitation to participate.

The study recruited three categories of participants including GPs, PNs and patients. The eligibility criteria for each participant category have been outlined in Table 11.

Table 11 Participant inclusion criteria for the study.

Participant category	Inclusion criteria
GPs	▪ Aged 21 years and above. ▪ Previously referred patients to the Sutherland Division of General. Practice GP Exercise Referral Scheme.
PNs	▪ Aged 21 years and above. ▪ Previously referred patients to the Sutherland Division of General. Practice GP Exercise Referral Scheme.
Patients	▪ Aged 18 years and above. ▪ Previously participated in the Sutherland Division of General. Practice GP Exercise Referral Scheme.

3.5.2 GP and PN recruitment

Prior to the initial recruitment phase of this study, information about the investigation was included in the Sutherland Division of General Practice newsletter. Only GPs o that had referred a patient to the GP Exercise Referral Scheme (GPERS) in the previous six months were eligible to participate in the study. Practice nurses from practices with a GP, who had previously referred to the GPERS program (in the six months prior to the study), were also eligible to participate. Although PNs were not eligible to directly refer to the GPERS Scheme, they were included with the scope of this study because of their potential role in lifestyle risk factor management within the primary care setting. Of the 214 GPs and 46 PNs practicing in the region, 123 GPs and 32 nurses were eligible to participate.

Eligible GPs and PNs were invited to participate in the study via a GP and PN Information Statement. A follow-up mail-out was conducted, two-weeks after initial invitation, followed by a telephone call to provide clarity around areas of uncertainty and collate informed consent/revocation of consent. Figure 6 provides an outline of the recruitment process for clinicians and patients.

3.5.3 Patient recruitment

Patients that had been referred to the GP Exercise Referral Scheme in the previous six month were eligible to participate. Remaining patients were ineligible to participate and removed from the list.

An Information Statement (Appendix 4) was mailed to eligible patients. Patients were informed to contact the student (SND) if they required clarification regarding the study. A follow-up mail-out was conducted, two-weeks after initial invitation, followed by a telephone call to provide clarity around areas of uncertainty and collate informed consent/revocation of consent.

3.6 Instruments

The following five instruments were identified as having potential for adaptation and/or enhanced use in Australian general practice. The selection of instruments provide a cross section of features that address identified needs for assessing PA status within the general practice setting. The five instruments and a description have been outlined Table 12.

For the purposes of this study, each questionnaire was modified to indicate the ‘‘usual’’ week measurement period instead of the preceding seven days, to reduce the possible effect that recent illness may have on reported PA. Adjusting the referent point from previous week to usual week addressed two possible limitations:

- Consistency across in the referent point for all instruments desirable when comparing instruments [464].
- Capture a representation of regular PA undertaken rather than the possibility of outliers that may have occurred if the patient were sick, travelling or unavailable to exercise during that period [464].

Table 12 Summary of instruments selected for the study

Instrument Name	Description
1. Occupational Sitting and Physical Activity Questionnaire (OSPAQ)[408]	▪ Brief instrument; 3-questions with allocation of proportions for time spent sitting, standing, walking or in heavy labour whilst at work. ▪ Valid instrument for measuring time spent in static postures (sitting and standing) during work hours. ▪ Designed for use in surveillance and behaviour change interventions. ▪ Possible application in general practice as an instrument for patients fitting working-age range.
2. 2-Question Physical Activity Questionnaire (2Q)[18]	▪ Brief instrument; 2-questions measuring vigorous activity, moderate activity and walking time. ▪ Designed for use in assessing PA status of Australian general practice patients. ▪ Valid for measuring the number of bouts of vigorous intensity activity (≥ 20 minutes in duration) and bouts of walking or moderate-intensity activity (≥30 minutes) in a usual week.
3. 3-Question Physical Activity Questionnaire (3Q) [18]	▪ Brief instrument; 3-questions measuring vigorous activity, moderate activity and walking time. ▪ Designed for use in assessing PA status of Australian general practice patients. ▪ Valid for measuring the number of bouts of vigorous intensity activity (≥ 20 minutes in duration), bouts of moderate-intensity activity (≥30 minutes) and walking undertaken in a usual week.
4. General Practice Physical Activity Questionnaire (GPPAQ) [26]	▪ Brief instrument; 3-questions measuring incidental, planned, occupational and activity undertaken for transport. ▪ Designed for use in assessing PA status of general practice patients, validated for use in United Kingdom. ▪ Provides a four-level PA Index (PAI) outcome measure categorising patients as; Active, Moderately Active, Moderately Inactive and Inactive.
5. Active Australia Survey [44]	▪ Brief instrument; 3-questions measuring planned activity and five statements to assess awareness of current public health messages about PA. ▪ Valid for use in population surveillance activities within the Australian context. ▪ Possible application in general practice as an instrument for patients based on the Australian context.

3.7 Interview Schedule

The study was conducted in two phases. Phase one involved semi-structured interviews with general practice clinicians to identify two preferred instruments to measure PA. Following identification of the two preferred instruments, a detailed analysis of the features of each instrument was conducted.

Phase two involved implementing the two preferred instruments, identified in Phase 1, over a period of 12 weeks. At the end of the implementation period, follow-up semi-structured interviews were conducted to explore the clinician experience implementing the instruments in practice.

3.8 Phase 1

The GPs (n=9) and PNs (n=10) took part in semi-structured interviews with the investigator (SND). Demographic data were collected for each participant including; age, gender, profession, practice location and whether their own PA behaviour met the Australian PA Guidelines [185]. Clinician PA behaviour was assessed by the student (SND); a tertiary trained Exercise Physiologist who determined the frequency and intensity of PA undertaken, over the previous or usual week. The responses provided by clinicians were used to determine whether they were sufficiently physically active, against the Australian National PA Guidelines.[185]

Following collection of demographic data, participants were provided with copies of five commonly used PA questionnaires to review for a period of 5 to 10 minutes. The review process was loosely structured, with instruments presented in the following order:

- Active Australia (AA) [44] (Appendix 5).
- Occupational Sitting and PA Questionnaire (OSPAQ) [408] (Appendix 6).
- 2-Question PA Questionnaire (2Q) [18] (Appendix 7).
- 3-Question PA Questionnaire (3Q) [18] (Appendix 8).
- General-practice PA Questionnaire (GPPAQ) [26] (Appendix 9).

Instruments were selected for the review process based on their potential for use in Australian general practice. Participants reviewed each instrument for as long as required within the designated time-frame, and were asked a series of questions about their preferences. The interviews were guided by a schedule (Appendix 10) of open-ended questions to explore the participants':

- Preferences for instruments.
- Understanding and confidence in PA assessment.
- Perceptions of barriers to assessing PA.

3.8.1 Preferred instrument review

Following identification of the two preferred instruments a detailed review of literature was conducted to understand the variations between each instrument. The review was conducted as part of the study, following the completion of Phase 1 and continued throughout the course of Phase 2. Variables considered in this review included:

- Theoretical orientation
- Length of the instrument including the number of questions and estimated time taken to complete
- Scoring or outcome measures
- Terminology and/or language used within the content of the instrument
- Range of PA domains considered (e.g. planned, incidental, work and leisure)
- The use of explanatory text such as examples and scenarios [465]

The search used the following electronic bibliographic databases to identify relevant studies: OVID: including CINAHL, EMBASE, PUBMED, MEDLINE and PsycINFO. In addition, search of EBM review databases including: Cochrane, Trials Register, DARE and ACP. Finally, Google Scholar was included to identify publications not already captured through the aforementioned process. Search terms included:

- General Practice Physical Activity Questionnaire
- GPPAQ
- 3-Question Physical Activity Questionnaire
- 3Q
- 3-Question

3.9 Phase 2

The two instruments ranked highest from phase-1 were implemented by clinicians in routine practice, over a 12-week period. At the end of the 12-week period, there was a second round of semi-structured interviews to determine participants' satisfaction and experiences of using the selected instruments. There was one GP and one PN that were unavailable to participate in the follow-up interviews leaving eight GPs and nine PNs who took part. The interviews were guided by a schedule (Appendix 10) and the questions covered:

- Preferences between the two (selected) instruments.
- Understanding and confidence in PA assessment using the two (selected) instruments.
- Exploration of their perceptions of barriers to assessing PA using the selected instruments.

All interviews were conducted in 2011 and were audio recorded and field notes made. The interviews were transcribed verbatim.

3.10 Ethical approval

Ethical approval was granted by the University of New South Wales Human Research Ethics Committee (HREC 11068).

3.11 Data handling and analysis

The QSR NVivo9 software research software was used to support the analysis of interview content obtained through the qualitative phases of the study. Thematic analysis was conducted following the framework analysis approach [466, 467]. Thematic analysis was used to identify emergent themes from interview transcripts and for its ability to explore the implementation of the PA assessment, identifying variations in clinician experience and perspective rather than quantifying the frequency of themes/categories, as is the case with content analysis which was an alternative method of analysis [468]. GP and PN were analysed together so that themes could be considered in the context of patient flow through the practice and collective clinical efforts. The student (SND) read and re-read all transcripts and coded emergent themes and subthemes.

The transcripts were coded using the 18 theoretical domains and 112 constructs from the Theoretical Domains Framework (TDF) [3, 4, 18, 39, 40]. The TDF was selected because of its capacity to integrate 33 constructs across 18 domains of behavioural determinants, covering the full range of current scientific explanations for human behaviour i.e., ‘Knowledge’, ‘Skills’, ‘Social/professional role and identity’, ‘Beliefs about capabilities’, ‘Beliefs about consequences’, ‘Memory, attention and decision processes’, ‘Environmental context and resources’, ‘Social influences’, ‘Emotion’, ‘Behavioural regulation’, and ‘Nature of the behaviours’ [3, 4, 18, 39, 40]. As a consequence, researchers can use this integrative framework instead of having to choose between different theories [3, 4, 18, 39, 40]. The TDF describes a comprehensive range of potential mediators of behaviour change relating to clinical actions. It offers a useful conceptual basis for exploring implementation problems, designing implementation interventions to enhance health care practice, and understanding behaviour-change processes in the implementation of evidence-based care.

To ensure analytical rigour, a second iteration of this process was performed, with re-review of transcripts to identify any important quotes or subthemes missed or misallocated. It was noted whether subthemes arose solely from GPs or from PNs or from both. The final synthesis and interpretation involved considering each theme/domain and subtheme in the context of the whole set of interviews. The strongest domains were those mentioned by most clinicians; where the most sub-themes were developed; which were discussed at greatest length; and/or which were judged by the investigators to be invested with considerable intensity, passion, or sentiment by clinicians. The coding was discussed with members of the research team and modified following discussions.

3.12 Results

A total of nine GPs and ten PNs took part in the interviews in Phase-1, and eight GPs and nine PNs in Phase 2. There was one GP and one PN unavailable to participate in Phase 2 interviews, due to being on leave during the study period. Participants were from eight group practices representing an equal proportion of small (four or less GPs) and large (five or more GPs) group practices. The characteristics of the participants are outlined in Table 13.

Health professionals were classified as either meeting or not meeting the Australian PA Guidelines of 30 minutes or more moderate intensity PA on most days of the week. A total of 68.4% (13/19) of health professionals indicated that they were currently physical active, 100% of males and 57.1% (8/14) of females.

Table 13 Characteristics of participating clinicians

Characteristic	GP (n = 9)	PN (n = 10)
Female (n)	4	100
Clinicians working in small (≤ 4 GPs) practice (n)	4	6
Clinicians in Large practice (≥ 5GPs) (n)	5	4
Physically active *(i.e. meets PA guidelines)* (n)	9	4

3.12.1 Instrument preferences

The majority of health professionals (88% GPs, 100% PNs) interviewed in Phase-1 preferred the GPPAQ [1]. A ranking process determined the GPPAQ and 3Q as most preferred, from the original selection of five instruments and they were used in the second phase (Table 14).

After implementing the instruments in Phase-2, preferences changed amongst some clinicians (Table 14). This was evident amongst those clinicians (GP and PNs) who were more sufficiently active. In Phase-1, 89% (n=9) GPs preferred the GPPAQ instrument. In Phase-2 this proportion changed (for GPs) to an even preference for GPPAQ and 3Q.

Table 14 Questionnaire preferences for clinicians at Phase 1 and Phase 2 of semi-structured interviews.

	GP			PN		
	Phase 1		**Phase 2**	**Phase 1**		**Phase 2**
	1st Preference (n=9)	2nd Preference (n=2)	Aggregate preference (n=8)	1st Preference (n=10)	2nd Preference (n=4)	Aggregate preference (n=9)
AA	0	1		0	0	
OSPAQ	0	0		0	0	
2Q	1	0		0	0	
3Q	0	1	4	0	4	1
GPPAQ	8	0	4	10	0	8

3.12.2 Preferred instrument review

The instruments selected in Stage-1 were (1) GPPAQ [429] and (2) 3Q [18] and were different across a range of variables. The GPPAQ was longer in length than the 3Q, and used explicit examples of incidental and planned PA. This included specific reference to PA undertaken in an occupational setting. In addition, it offered versatility in terms of who could administer the instrument as opposed to the 3Q e.g. patient self-completion opposed to GPs or PNs. The 3Q was briefer in length; and contained technical terminology, typically used by exercise professionals. A comparison of selected variables for the two preferred instruments is provided in Table 15.

Table 15 Preferred instrument review, across selected variables.

	Preference 1: GPPAQ	Preference 2: 3Q
Theoretical orientation	▪ Validated instrument designed to produce a short measure of PA in general practice patients aged 16-74 years. ▪ Administration of the instrument: o GP o PN o Patient o Other health care professionals [429]	▪ Designed for epidemiological surveillance purposes and adapted for use in general practice. ▪ Administration of the instrument: o GP o PN o Other health care professionals [18]
Length (number of questions)	▪ 7 questions. ▪ Additional sub-questions. ▪ Estimated completion time between ≤1 minute [429].	▪ 3 questions. ▪ Estimated completion time between ≤1 minute.
Outcome measures	▪ Provides a simple, 4 level PA index (PAI); Inactive, Moderately Inactive, Moderately Active or Active.	▪ Assigns patients based on outcome score to one of four categories; Minimal, Low, Adequate or High.
Terminology and/or language	▪ Simple language. ▪ Terminology typically used amongst lay-people.	▪ Technical used by exercise professionals. ▪ Terms used obtain unique definitions specific to PA assessment e.g. Vigorous and Moderate Intensity.
Range of PA settings considered	▪ 5 Occupational settings. ▪ 3 Planned exercise settings. ▪ 2 Home-based incidental settings.	▪ Discrete suggestions of incidental and planned exercise. ▪ No reference to specific environments or situations.
Use of explanatory text such as examples and scenarios	▪ 28 explicit examples, within scenarios.	• 9 single-term examples of types of exercise e.g. jogging, walking or digging. • Discrete definition for vigorous and moderate activity.

3.12.3 Key themes

Coding was conducted by the chief investigator (SND) and identified six-themes that were linked to domains and constructs from the TDF. Not all domains were found to be relevant to the context of the interviews. Themes have been grouped into (1) intrinsic or (2) extrinsic variables. Intrinsic variables are those inherent to the clinician. Extrinsic are fundamentally, external influencers. Data has been presented according to the themes identified from the TDF below.

3.12.3.1 Intrinsic variables

Knowledge

In the context of this study, the domain “knowledge’ refers to self-reported and/or perceived clinician knowledge and competency, about PA assessment/advice [3]. Clinician feedback demonstrated a link between the following four variables:

- *Clinician knowledge.*
- *Clinician individual characteristics.*
- *Instrument design/content.*
- *Clinician knowledge/ competency.*

Clinician knowledge and understanding of PA was determined based on their current PA status, and their awareness of Australian PA guidelines, including their understanding of terminology associated with PA assessment e.g. differentiating between vigorous and moderate PA. A participating PN who was considered as having less knowledge and/or understanding of PA domains indicated that the 2Q and 3Q instruments were limited in the information they provided, whereas the GPPAQ provided more detail to conduct the assessment *“…there’s just not enough information in there and these are a bit more detailed …”* (PN6). An GP, also considered to be less knowledgeable of PA suggested that the same instruments [2Q and 3Q] *“…took more concentration to work out; I had to go back over the questions…”* (GP5)

The analysis of the two preferred instruments carried out during Stage-2 of the study found the GPPAQ to offer rudimentary support for clinicians less knowledgeable of PA, whereas the 3Q instrument suited those more familiar with the mechanisms of PA assessment.

Clinician knowledge/competency regarding PA appeared to influence their preference for instruments. Clinicians with less knowledge about PA preferences were more likely associated with the, GPPAQ, the reverse was the case for 3Q. For example, several clinicians highlighted that the GPPAQ instrument provided terminology or wording that was "… *more specific with asking exactly what exercise" and comments that the GPPAQ instrument "… was more specific*." (PN5).

Clinician individual characteristics

Clinicians meeting national PA guidelines showed greater understanding of PA, and had a preference for the 3Q rather than the GPPAQ, in phase-3, whereas those less physically active preferred the GPPAQ, linked to its ability to guide the assessment process.

Instrument design/content

Participant responses provided insight into the knowledge and confidence of clinicians, regarding PA assessment. This was closely linked with the design, and content of instruments. The GPPAQ did not feature technical terminology such as 'vigorous' and 'moderate' intensity and contained more text than the 3Q. The GPPAQ used explicit examples for incidental and planned PA including reference to occupational activity (see Table 15).

Participants' referred to how their preferred instrument supported inadequacies, or limitations faced in conducting PA assessments. Specifically, PNs referred to the absence of technical terminology such as "vigorous" and "moderate" intensity in the GPPAQ. Several clinicians highlighted that the GPPAQ provided descriptive terminology that supported their completion of the assessment. For example, a PN outlined that the GPPAQ was "… *more specific with asking exactly what exercise*" and comments that the GPPAQ *"… was more specific*" (PN5).

Just over half of all clinicians reported using their preferred instrument as a prompt/guide during the assessment. Some clinicians referred to using examples provided in the GPPAQ as a valuable source of guidance in executing the assessment. For example, a GP indicated that the GPPAQ "… *helped explain what was meant*… was *clearly written… [provided] good examples of what they would expect each types of activity to include*" (GP5).

The GPPAQ content used limited technical (PA) terminology, yet offered clinicians a comprehensive understanding of the patient's PA status. Specifically, the GPPAQ used examples for the clinician to consider when completing the assessment, such as work, leisure and planned PA. For example, one clinician said that the GPPAQ '…*gets people to give a bit of a depiction of how their work is and exactly how intense their work is … it also breaks down the PA outside of work fairly accurately too…. somewhat easier for the patient to interpret than some of the other ones… [gives]…more of an idea of what they're actually doing rather than them just saying I do regular exercise*" (GP4).

Comments regarding the content and design of each instrument included "…*examples helped explain what was meant*" (GP5) and were "… *clearly written [with]… good examples of what they would expect each types of activity to include*." (PN4). In addition, the scope of the instruments and types of patients that were considered also influenced preferences. An important distinction made in relation the GPPAQ included the assertion that the "… *GPPAQ was broader based, so it covers the employment side of things as well as the things that you do for leisure as opposed to the other one seems to be more just what you do for leisure, really*." (PN4).

Clinician beliefs about their own capabilities

The intrinsic beliefs and capabilities of clinicians about their ability to execute PA assessment was linked to instrument preferences. There were two themes associated with this domain:

- *Ability to motivate patients.*
- *Confidence and familiarity.*

Ability to motivate patients

There was reference regarding clinician's ability to motivate the patient for successful behaviour change and the role the instrument played in prompting patients to think about their activity. For example one of the PNs suggested the GPPAQ "…*helped motivate these patients to exercise if they weren't already…* One of the patients was saying*, you know, I think I should be doing more, I should be doing more*" that kind of think came up "(PN5).

Confidence and familiarity

Clinicians discussed how they would link the use of the instrument to existing procedures or activities within their practice. They reflected on current processes/systems in place, and how the questionnaire would fit within this framework so that it could conform to existing processes.

One of the GPs referred to the similarities between the 3Q instrument and current practice. This GP described how the similarities contributed to their preference, through familiar terms, limited change to process and possibly confidence in conducting the assessment. This GP highlighted that "*This is similar to the way I'm already approaching patients... I suppose I'm biased because it's something that I'm familiar with and that's the way I do it, um and it can lead on to some advice I guess*…" (GP6).

3.12.3.2 Extrinsic variables

Social/professional and role and identity

The analysis indicated that clinicians maintained a professional responsibility to facilitate PA assessment. Professional training, knowledge and competencies provided clinical knowledge of the benefits associated with PA. There were two themes that emerged from clinician feedback that related to this domain:

- *Patient selection.*
- *Leveraging external factors.*

Patient selection

Extrinsic variables included the professional responsibilities of the clinicians and how the instrument supported this role. Clinicians referred to patients within a strata or a demographic classification e.g. patients with established chronic conditions, gender, age or social mediums, such as unemployed, mothers and elderly.

There were differences between clinician roles and responsibilities and how they referred to implementing their preferred instrument. Both GPs and PNs indicated that PA assessment was undertaken with select patients, however for GPs, selection was undertaken on an incidental basis rather than pre-emptive planning. That is, as patients presented for consultations, the clinicians elected to conduct an assessment if they felt there was a specific clinical need. In essence, this stratified patients, albeit incidentally, for assessment rather than assessing the practice population in an all-encompassing approach. One GP mentioned that “…*whenever I go through blood test results and there’s something that’s a little bit abnormal… high cholesterol, borderline sugar, it usually does prompt a discussion on exercise….middle aged patients who are slightly overweight*...” (GP4).

In contrast to GPs, PNs used the preferred instrument(s) within formal practice-based initiatives such as health assessments. This was evident when discussing the type of consultations or patients they would likely initiate PA assessment. A nurse whose primary role was to conduct 75 year old health assessments for her practice selected the GPPAQ instrument because of how it aligned with existing structures, patient population, processes or initiatives of the practice. This PN suggested that the instrument (GPPAQ) “… *would incorporate the retired people*” (PN3). Another PN mentioned that her role focused on women’s health. This nurse preferred the GPPAQ instrument for similar reasons such as its ability to suit the practice patient population. For example, this PN suggested that the GPPAQ “*…covers traditional women’s activities like housework better than Questionnaire 3* [3Q]…” (PN2).

Leveraging external factors during consultations

The use of specific situations where the clinician could introduce or initiate PA assessment, were highlighted during interviews. Clinicians referred to the use of the preferred questionnaire(s) during consultations where they could initiate a discussion about PA under the guise of something else such as health assessments, poor pathology results, diabetes cycle of care activities and care planning. One GP referred to the instances they used to leverage a PA assessment: “… *whenever you go through blood test results there’s often something that’s a little bit abnormal, you know high cholesterol, boarder line sugar, it usually does prompt a discussion on exercise. … it would be very useful for that situation*” (GP4).

Innovation

Innovation refers to the use of the PA assessment instruments as a tool to discourage/encourage the development of PA assessment skills or behaviour. There were two themes that emerged from the data that related to this domain:

- *Support tool for conducting/initiating PA assessment*
- *Adaptive behaviour to support improved competency*

Support tool for conducting/initiating PA assessment

Clinicians referred to using the instrument as a mechanism for starting a conversation with the patient about PA, rather than raising with topic independently. In one case, the GPPAQ was used as "… *a springboard …It kind of led on to other things*." (PN10). In addition, there was reference to the questionnaires acting as a prompt during their consultation with patients, initiating thought about activity. A participating PN referred to a consultation with a patient where PA behaviour was discussed. The PN recalled that the conducting the PA assessment using the GPPAQ enabled patients to independently realise they were insufficiently physically active. This PN recalled patient responses "…y*ou know I think I should be doing more, I should be doing more*" that kind of think came up." (PN10)

Adaptive behaviour to support improved competency

After using the instruments in phase-3, preferences changed amongst some clinicians from the GPPAQ to the 3Q. This was particularly evident amongst clinicians with higher knowledge/perceived confidence of PA assessment. This indicated a period of adaptation and heightened understanding of the concepts of PA assessment. Supporting the premise that a degree of adaptation occurred between the two study points (Stage-1 and 3), amplifying clinician competency. For example, a participating GP described initial difficulties experienced in administering the 3Q, however after several times, found administering the instrument much easier: "… *[I] found the 3Q one a little harder to understand at first, but we just read it through a few times and then it was no problem*" (GP5).

Innovation strategy

Innovation strategy refers to how the PA instruments encouraged or discouraged the execution of PA assessment for each clinician. Clinicians indicated that the brevity of the instrument was not indicative of the time taken to complete the questionnaire, and inconsequential in deciding their preferences. Whilst time was raised as a consideration, it was associated with how quickly or efficiently they could complete it the assessment. This was linked to clinician knowledge and confidence and how this would impact the time taken to complete an assessment. This was linked to their ability to their understanding of the content of each instrument. Almost half (47.4%, 9/19) of all clinicians referred to the support the instrument(s) provided them using phases such as *"…it took a little bit longer but I'd still prefer this one [GPPAQ]." (PN6) and "… I'd rather do [GPPAQ] and get that much more info"*(GP2).

Social influences

In the context of this study, social influences referred to interpersonal variables that influenced clinician knowledge/competency of PA assessment.

Analysis identified associations between clinicians who were physically-active and their preference for the 3Q instrument. This was particularly evident in Phase 2, when clinicians had used both instruments for the period of the intervention (12-weeks). These differences indicated a variation in the competency of clinicians administering the instruments. Administration of the 3Q necessitated a proficiency in PA assessment variables. The link between preference and PA status possibly relates to prior knowledge, perceived confidence, and/or personal experience with PA.

The study did not determine the number of PA assessments undertaken by clinicians during the intervention period. The primary purpose of the study was to determine clinician preferences following a period of 'testing' the preferred instruments (between Stages 1 and 3). This process was to validate initial preferences stated in Stage-1 interviews. Initially, the frequency of PA assessments undertaken during the testing phase was not considered when designing the study. Some clinicians changed their preferences between Stage 1 and Stage 3. This is indicative that a period of adaption or learning occurred after using the instruments, following their initial impressions of each instruments. This study did not focus on variations in exposure to each instrument. Further research is required to investigate the educational requirements or variations that occur to increase clinician knowledge on this topic. This has been added to the further research section in the conclusion section.

3.13 Discussion

This study examined GP and PN preferences amongst a selection of five PA assessment instruments. Preference for two-instruments were identified; (1) GPPAQ and (2) 3Q. Reasons for preference were linked to a range of variables including; individual clinician PA status, knowledge/perceived competency in PA assessment, and features contained within each instrument.

Triangulation of data identified links between; (1) clinician PA status, (2) knowledge and perceived competency in PA assessment and (3) preference for PA instruments. Practice nurses maintained consistent preference for the GPPAQ instrument, had a lower proportion of personal PA (40%) than GPs, and demonstrated limited knowledge/perceived competency and confidence in PA assessment. The reverse was the case for GPs and PNs who were recorded as physically active.

3.13.1 Intrinsic variables

The relationship between the individual characteristics of clinicians and how this impacts on the interchange that occurs during patient encounters has been documented by Taylor et al [35, 302] highlighting that differences between clinicians can influence the uptake of a PA intervention such as individual attitudes, knowledge, beliefs and behaviours e.g.PA level of individual clinicians. Yet, little is known about the relationship between individual clinician characteristics and their impact on delivering PA assessment. This study identified a number of intrinsic demographic characteristics of clinicians that showed associations with instrument preferences including clinician PA status and their level of competency regarding PA assessment.

The findings indicate that the self-reported and perceived clinician knowledge/competence fit on a spectrum from high through to limited knowledge/competency, in terms of their ability to perform PA assessment. Clinicians categorised as physically inactive were associated with lower knowledge/competency of PA behaviour change, the reverse was the case for physically active clinicians. The GPPAQ demonstrated rudimentary support for clinicians, whereas the 3Q instrument suited those more familiar with the mechanisms of PA assessment. This study suggests that consideration of clinician knowledge and perceived competency or confidence of PA behaviour change could be addressed by simplifying terminology, and including relevant examples to guide the assessment process.

For less knowledgeable clinicians, the time taken to complete an assessment is likely to be longer, particularly if the instrument does not support limited knowledge/competency. This finding is contrary to previous research. [33, 273, 461, 469] Whilst time is a limiting factor, this study suggests that it might be addressed if clinician knowledge and competency in PA assessment is augmented by the assessment instrument.[33, 273, 461, 469]

3.13.2 Extrinsic variables

There were differences observed between the GPPAQ and 3Q instrument variables (Table 15) determined in the preferred instrument review. These included theoretical orientation, terminology, number of questions, outcome measures, types of PA such as planned and/or incidental exercise, and inclusion of examples/scenarios to aid interpretation.[18, 429] Given the theoretical orientation of the GPPAQ lies within the context of general practice, it is not surprising there was a high preference for this instrument.[429] Interpretation of technical terminology, such as ‘vigorous’ and ‘moderate’ in the context of PA assessment proved difficult for some clinicians, specifically those linked with lower levels of individual PA

The patient population within each practice influenced clinician preferences, with clinicians ensuring the questions met the needs of current patients and/or encounters e.g. women with children, men and retired patients. Complex adaptive theory can be used to describe how clinicians considered the dynamic network of interacting agents presented to GPs in routine care such as balancing the need for acute care with than of preventive care [470, 471]. This is compounded by variations in routine encounters according to patient demography e.g. patient gender, reason for visit or the complexity of conditions [280, 472].

The notion of a blanket approach to PA assessment, incorporating the entire patient population was not evident in this study. Consistent with complex adaptive practice, clinicians were selective, or decentralised in their approach, leveraging or drawing on a range of methods or situations to incorporate PA assessment into routine practice.[473] Examples of methods include clinicians initiating PA assessment following the delivery of poor pathology results or, during health assessments. Clinicians indicated that by using their preferred instrument, they would be able to integrate PA assessment into a given situation such as those outlined above. Theories of behaviour change and complexity for health promotion provide the best explanation for these findings, with clinicians using selective approaches to adapt to change by shifting one variable, such as the PA assessment instrument discussed here [280, 338, 472, 474].

3.13.3 Strengths and limitations

Limitations of this study include the small sample size and potential generalizability beyond that of the geographical region in which the study was conducted. Despite this, there was equal representation of GPs and PNs. All clinicians had prior experience in referring patients for PA behaviour change via the local GPERS. As a result, it is recognised that this sample describes clinicians who may be more interested in PA assessment and preventative care, than the general population [460, 475, 476]. However, these health professionals are more likely to offer meaningful input regarding their application of PA assessment instruments, than those without prior involvement as they have an established commitment to preventative care. The geographical region where the study was conducted offers relative homogeneity with respect to other large, industrialised cities both in Australia and internationally. This extends beyond population profiles to rates of physical inactivity, rates of chronic disease and primary care systems.[41, 210, 417-419]

Use of the TDF offers both strengths, and limitations. The strengths of this framework include the ability to draw on a range of relevant behaviour change and implementation research theories in one synthesised and accessible framework [4]. It is acknowledged that potential limitations may have impacted on the findings of this study; however the following efforts have been made to reduce any outliers [4]. The TDF was used as a structural framework for analysis only. Secondly, the investigators aimed to reduce associated limitations with data analysis by co-opting investigators skilled in behaviour change and implementation research skills.

3.14 Conclusion

This study demonstrated preferences for two instruments, preferred for use in routine general practice encounters. The GPPAQ was most preferred, followed by the 3Q for both GPs, and PNs. However, as experience in PA assessment increased both GPs and PNs reported increased satisfaction with the 3Q.

The GPPAQ has not previously been implemented in Australia, despite widespread application in the United Kingdom, whilst the 3Q has had an established position in Australian general practice through use in existing resources [18, 26].

Instrument preferences were influenced by a range of intrinsic and extrinsic variables. Intrinsic variables related to clinician knowledge/perceived competency of PA and/or individual PA levels. Extrinsic variables related to the content of instruments facilitating support for clinicians throughout the assessment process and limiting time taken to complete the assessment.

The outcomes of this study suggest that limited uptake of PA assessment in general practice may not be directly linked to clinician time restrictions, but associated with a range of intrinsic and extrinsic variables. It suggests that PA assessment may be related to variations in personal PA levels of clinicians, and that identification and integration of assessment instruments should be matched to their individual needs, acknowledging differences in physician knowledge/competency levels, and patient population.

Further research is required to quantify clinician knowledge of PA assessment to ensure instruments are appropriately graded to meet the needs for assessment.

4 Quantitative Study

4.1 Introduction

The previous chapter investigated the acceptability of five instruments for assessing PA in general practice. Specifically, this study identified two instruments that were preferred by GPs and PNs because of a range of intrinsic and extrinsic variables. These included the knowledge of clinicians regarding PA, the individual characteristics of clinicians and the design and content of these instruments.

This chapter described a measurement study to examine the validity and reliability of the GPPAQ and 3Q questionnaires, identified in Chapter 3 as the preferred instruments for assessing PA in general practice patients. A poster presentation based on the outcomes of the previous study (Chapter 3) and this study was published by the Journal of Science and Medicine in Sport (Appendix 2). A paper based on the outcomes of this study has been published by the Australian Journal of Primary Health (Appendix 11).

4.2 Study description

This study investigated the measurement properties of two instruments for assessing PA in general patients, in a sample of n=10 PNs and n=84 patients. The study was conducted between May and October 2011 with participating clinicians and patients within the boundaries of the Sutherland Division of General Practice.

The study determined the validity of both questionnaires for assessing PA in patients, when administered by PNs. In addition, it examined the reliability of the same two instruments.

4.3 Aims

The primary aim of this study was to determine the performance of the GP Physical Activity Questionnaire (GPPAQ) and 3-Question Physical Activity Questionnaire (3Q) questionnaires, as measurement tools, when administered by PNs and self-completed by patients, in the context of for Australian general practice. Specifically, this study answered the following two questions:

1. What is the validity of the GP Physical Activity Questionnaire (GPPAQ) (6) and 3-Question Physical Activity Questionnaire (3Q) (7) instruments' for assessing PA

when administered by PNs, and compared against accelerometry over the same period?
2. What is the test re-test reliability of the GPPAQ and 3Q instruments when administered twice, seven days apart and self-completed by patients?

4.4 Methods

The study design was quantitative. It aimed to determine the validity and reliability of two instruments designed for assessing PA amongst Australian general practice patients. The study compared two nurse-administered PA questionnaires against accelerometer activity using Actigraph GT1M-accelerometer. The study used quantitative measures to determine the degree of correlation between questionnaire responses and accelerometer counts, and agreement in classification of PA levels against the Australian PA recommendations [185]. Test re-test reliability of both the GPPAQ and 3Q instruments was determined by administering both instruments amongst participating patients, on two occasions, seven days apart.

4.5 Recruitment

There were two components to the recruitment process for this study. The first involved recruitment of PNs. The second stage involved recruitment of patients. The following outlines in more detail the recruitment process.

4.5.1.1 Recruitment process

All PNs who had referred patients to the Sutherland Division of General Practice GP Exercise Referral Scheme, in the previous six months, were invited to participate in the study. Patients that had previously participated in the Sutherland Division of General Practice GP Exercise Referral Scheme, in the previous 12 weeks, were invited to participate in the study.

A database managed by the Sutherland Division of General Practice, responsible for administering the GP Exercise Referral Scheme was used to identify PNs that had referred patients to the program in the previous six months. Similarly, patients that had participated in the program in the previous six months were identified and sent an invitation to participate.

An Information Statement (Appendix 12) was mailed to eligible PNs and patients. Those PNs expressing an interest in the study were visited by the student to explain the project, and obtain informed consent. Patients were informed to contact the student (SND) if they required clarification regarding the study.

Follow-up mail-outs were conducted, two-weeks after initial invitation, followed by a telephone call to provide clarity around areas of uncertainty and collate informed consent/revocation of consent. Figure 6 provides an outline of the recruitment process undertaken for PNs and patients

Figure 6 Study recruitment process (clinicians and patients).

- **PN recruitment**
- Identify PNs with referral to GP Exercise Referral Scheme in previous 6 month period
- Information statement and consent mailed

- **Patient recruitment**
- Identified patients that had participated in GP Exercise Referral Scheme in previous 6 month period
- Information statement and consent mailed

- **Follow-up mail out**
- Follow-up mail-out inviting identified PNs and patients inviting them to participate 2 weeks after initial invitation
- Obtained informed consent/revocation of consent

- **Follow-up telephone call**
- Follow-up telephone call 2 weeks after second invitation
- Obtained informed consent/revocation of consent

4.5.2 Methods to boost recruitment

Strategies employed to increase PN and patient recruitment included interventions targeting eligible nurses and patients.

4.5.2.1 Newly eligible participants

Weekly communication was established with staff from the GP Exercise Referral Scheme. This enabled identification of new referrals from PNs and identification of patients finishing the program. This method provided an effective way of identifying eligible participants for the study. This method proved fruitful, specifically in terms of increasing patient recruitment. It is thought that the currency from recently completing the GP Exercise Referral Scheme provided some relevance to the patients and influenced their likelihood of consent to participate.

4.5.2.2 Newsletters

The local Division of General Practice newsletter was used to publish several advertisements and updates regarding the study. Contact details for the student (SND) were included in the advertisements to provide a point of contact for queries about the study.

4.5.2.3 Follow-up letter

To assist with recruitment, a follow-up procedure for eligible PNs and patients was implemented. The procedure included a second mail-out and a telephone call, two weeks later. The second mail-out included the same information as the initial mail-out. The follow-up telephone call was made by the research student to answer questions the proposed participant had and encourage participation in the study.

4.5.2.4 Prize draw

To assist with uptake of patient recruitment and compliance for the period of the study, ethical approval was sought enabling the provision of a prize draw for participating patients. Patients consenting to participate in the study were entered into the draw to win a $100 Coles Myer Voucher. The prize draw was conducted at the end of the intervention period of the study.

4.6 Sample

A purposive sample of PNs (N=10) from eight general practices located within the Sutherland Division of General Practice region consented to participate in the study. A total of n=84 patients consented to take part in the study, having participated in the Sutherland Division of General Practice, GP Exercise Referral Scheme in the previous six months. A detailed description of the GP Exercise Referral Scheme has been provided in Appendix 12.

4.6.1 Participant eligibility

Recruitment for this study involved a two-tiered approach, firstly recruiting PNs from the region that had referred patient(s) to the local GP Exercise Referral Scheme. Only nurses with a referral to this program, in the previous six months were eligible to participate. The second phase of recruitment involved patient recruitment. Patients were eligible if they had participated in the local GP Exercise Referral Scheme, in the previous six months. Additional criteria such as proficiency in English language and age were also applied. These criteria have been outlined in Table 16. A more detailed description of the recruitment process for this study has been described in the following section of this chapter.

Table 16 Participant eligibility criteria for feasibility study.

Participant category	**Eligibility criteria**
PNs	o Aged 18 years and above. o Proficient in English language. o Previously referred patients to the Sutherland Division of General Practice GP Exercise Referral Scheme.
Patients	o Aged 18 years and above. o Proficient in English language. o Previously participated in the Sutherland Division of General Practice GP Exercise Referral Scheme.

4.6.2 Instruments

The following instruments were identified from the qualitative study described in the previous chapter (Chapter 3) of this dissertation. The two instruments selected were identified based on clinician preferences and include:

- 3-Question Physical Activity Questionnaire (3Q) (Appendix 8).
- General Practice Physical Activity Questionnaire (GPPAQ) (Appendix 9).

4.6.2.1 General Practice Physical-Activity Questionnaire (GPPAQ) (6)

This is a short measure of PA for adult patients (aged 16 – 74 years), developed and validated in the United Kingdom. Physical activity is categorised into one of four categories known as the PA Index (PAI) categorising patients as; active, moderately active, moderately inactive and inactive against National PA Guidelines (9).

4.6.2.2 Three Question Physical-Activity Questionnaire (3Q) (7)

The Three Question Physical-activity questionnaire (3Q) is another short measure of PA developed for use during routine medical consultations. It measures the number of occasions of vigorous intensity activity of > 20 minutes in duration, and walking or moderate-intensity activity >30 minutes duration, reported in a usual week. The 3Q assesses participation in walking and moderate-intensity activity separately. The instrument classifies patients as adequately or inadequately active against the National PA Guidelines.

4.6.2.3 Actigraph accelerometer GT1M (8) (10)

Actigraph Accelerometers GT1M [477] [433] objectively measures PA by detecting vertical accelerations and it also measures steps taken. To eliminate the effect of wearing the accelerometer the device was encased in durable plastic, offering no indication to the wearer that the device was active. The accelerometers were calibrated according to manufacturer specification. The epoch interval used was set at one minute and output was expressed as mean counts per minute. Accelerometers function by integrating a filtered digitised acceleration signal over a specified interval of time known as an epoch [478]. The usual accelerometer stored magnitude of accelerations at fixed recording intervals such as one, four, 15 or 60 second intervals. These are known as an epoch. At the end of each epoch, the sum of PA is calculated; this process is repeated until data collection is completed [479, 480].

For this study, the epoch interval was set at 60 seconds (one-minute [479]. Seven consecutive days of PA data were monitored, measuring mean counts per day, steps per day and time spent in sedentary (<1.5 metabolic equivalents [MET]), low intensity (1.5–2.9 MET), moderate intensity (3.0–5.9 MET) and vigorous intensity (>6 MET) activity.

Accelerometer activity counts were recorded in 10 second intervals and aggregated into 1-min epochs, which were then used to compute time spent in the different activity intensities using existing cut points for sufficient and insufficient PA [481](35). Non-wear time was classified as periods of consecutive strings of zero-count epochs lasting at least 60 minutes. Interruption intervals were included in the calculation of non-wear time whereby up to two epochs of less than 100 counts that appeared in the middle of long strings of zero-count epochs, were filtered out (36).

Rules for determining usable data, non-wear time and interrupted wear time for the accelerometer were used to filter out non-usable data periods. Agreement between the two-instruments (GPPAQ, 3Q) was determined by comparing the proportion of patients categorised as sufficiently/insufficiently physically active, as per questionnaire responses and matched to accelerometer outcome data that indicated sufficient/insufficient PA. For the GPPAQ, participants classified as “Active” were considered sufficiently active. For the 3Q those ranked in the “adequate” or “high” (total PA) were classified as “sufficiently active”[26].

A single day of monitoring was considered valid when a participant wore the accelerometer for at least 10 hours. Epochs with more than 20 000 counts were considered to be spurious (37). Total percent agreement was calculated by corresponding accelerometer counts with the number assigned to the same category, in the questionnaires (GPPAQ and 3Q). That is, accelerometer counts were linked to the outcome from each questionnaire, of either meeting or not meeting National PA Guidelines and divided by the total number measured.

Tables 17 and 18 show the classifications for total activity that patients were assigned to, based on the GPPAQ and 3Q instruments (respectively). Classifications were based on National PA Guidelines categories for sufficient or insufficient PA.

4.7 Procedures

The study was made up of two sub-studies to determine: (1) Validity of the two instruments when administered by PNs and (2) Test re-test reliability of the two instruments. Procedures for the validation and reliability studies have been outlined separately below.

4.7.1 Validation study

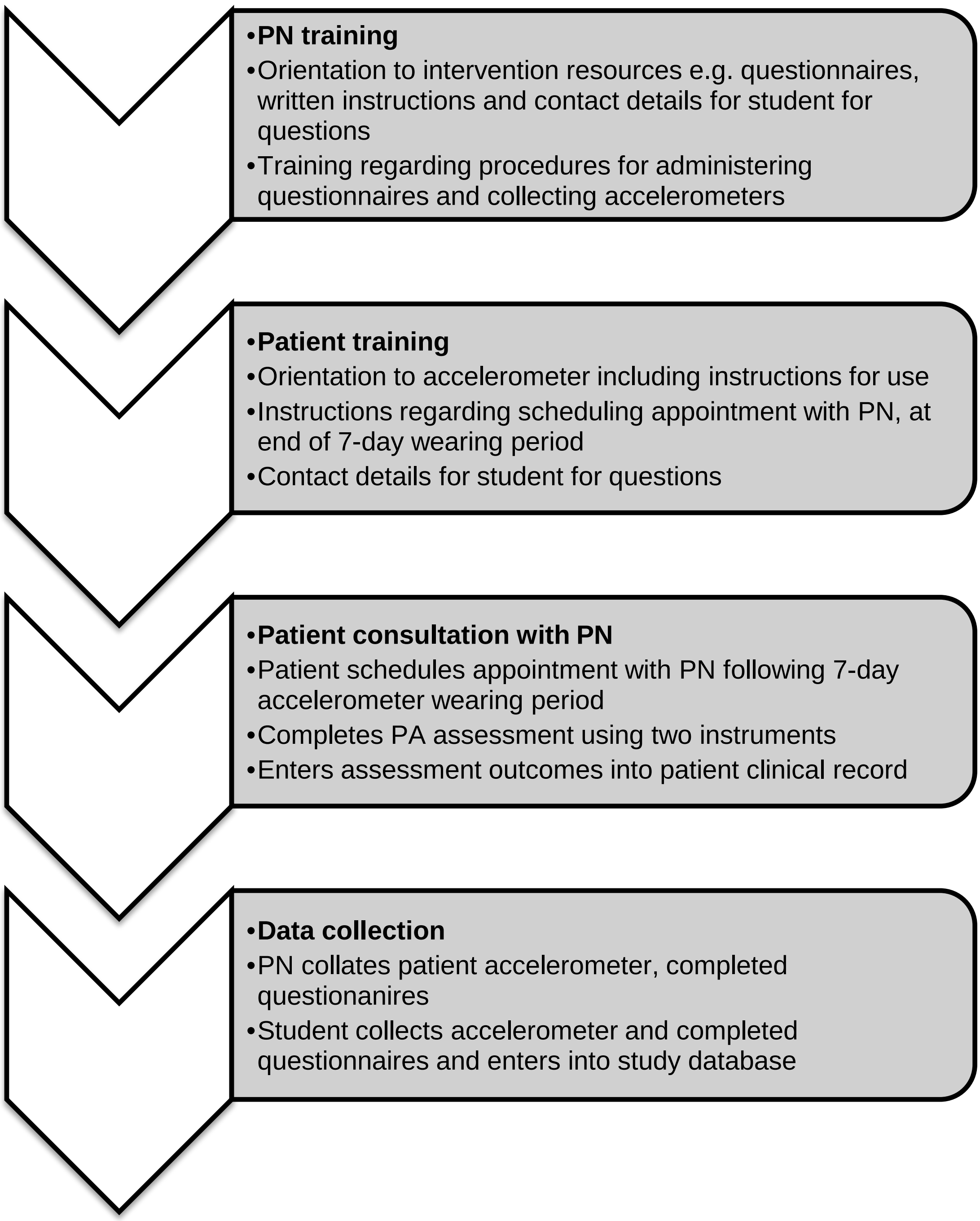
Consenting patients were allocated to the validation study if the PN from their usual general practice had consented to participate in the study. A 'usual' general practice was determined if the practice name was listed on the patient referral records. Identification of eligible general practices was aided by the local Division of General Practice database.

Consenting PNs administered the selected questionnaires. Questionnaire responses were compared against accelerometer counts worn by consenting patients in the previous seven-day period.

The validation study commenced with the provision of resources, training and instruction for participating PNs and patients. The student (SND) trained the PNs in the procedures for administering questionnaires, including delivering questions, without prompts. An emphasis was placed on the need to ask questions exactly as written (in the questionnaire). Training took approximately ten minutes and was conducted in the participating PN's practice.

Patients in the validation study received individual training from the student (SND) regarding the use of the activity monitor (accelerometer), which was set to commence recording at midnight the subsequent day. Instruments included asking patients to wear the Actigraph GT1M accelerometer (34) on the right hip, for a 7-day measurement period, removing it only for water-based activities and for sleeping. The patients were instructed to schedule an appointment to see their PN, to complete the two questionnaires (GPPAQ and 3Q) and return the accelerometer after seven days. Both instruments were administered consecutively in the same consultation with PNs so as to create a pseudo-routine consultation. Participating PNs advised the student on the arrival of the accelerometers and completion of follow up questionnaires. The student collated data from both accelerometers and questionnaires no more than 2 days following completion. Their PN was informed of the start date for wearing their accelerometer and anticipated appointment period for completion of the questionnaires. A summary of procedures undertaken is provided in Figure 7.

Figure 7 Procedures for the validation study.



4.7.2 Reliability study

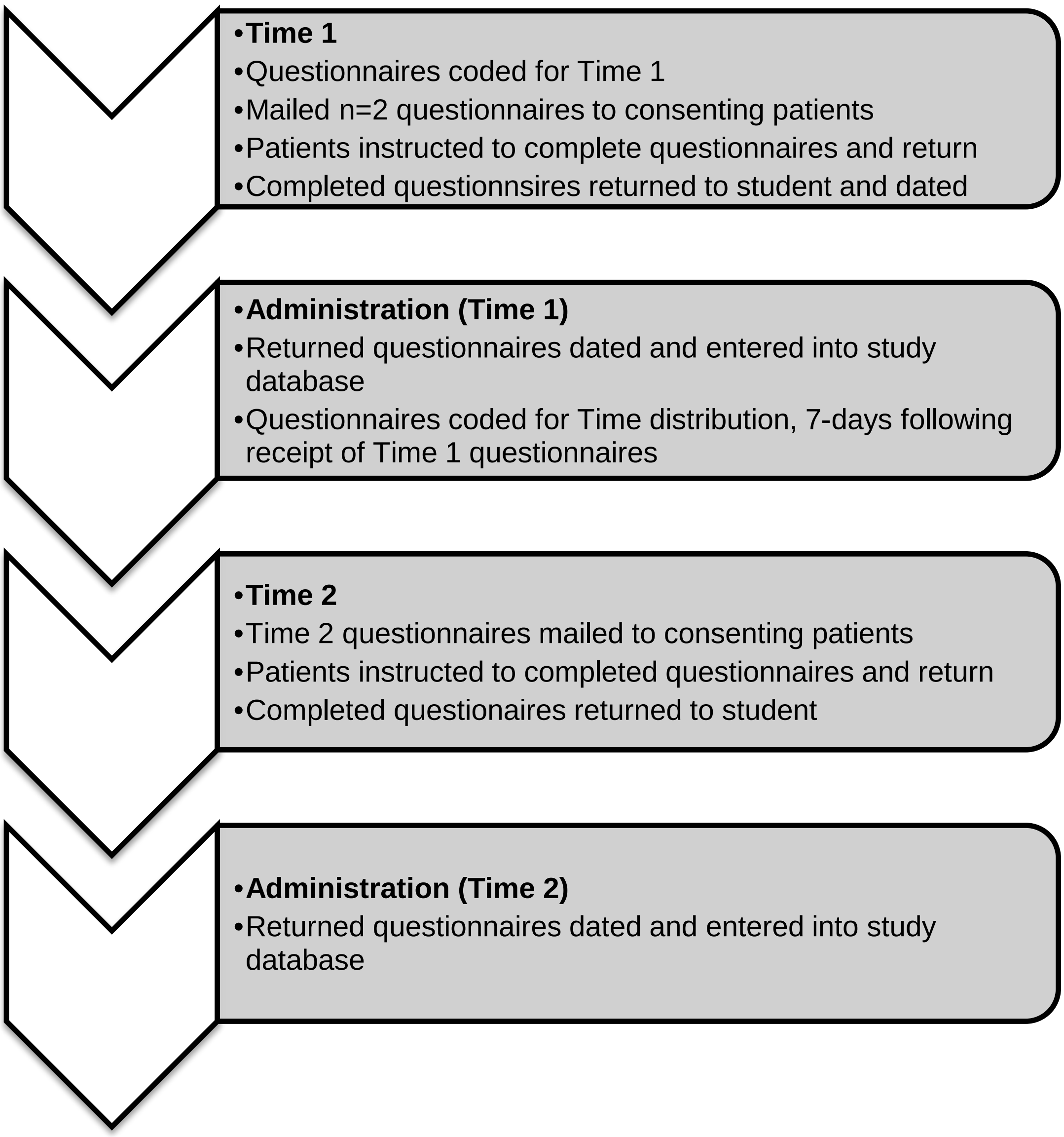
An additional sample of 43 patients was recruited to participate in a test retest reliability study of the same two instruments when used by patients to self-assess PA. Only patients over the age of 18 years with sufficient English language proficiency, who had participated in a local exercise referral scheme in the Sutherland Shire of Sydney in the previous six months, were invited to participate in the study.

Patients recruited to the reliability study were forwarded a copy of the two questionnaires (GPPAQ and 3Q) with instructions to complete both, and to return to the student (Time 1).

Time 1 questionnaires were dated on return and results entered into the study database. Using the return date as a baseline, the procedure was repeated seven days later (Time 2), in order to analyse test-retest reliability, between Time 1 and 2 for the questionnaires. Figure 8 provides a summary of procedures undertaken.

On both occasions, questionnaires were mailed to patients, with appropriate instructions regarding completion and return of the questionnaires. For both time one and two, patients were provided reply paid envelopes to ensure no costs associated with return of the questionnaires.

Figure 8 Procedures for the reliability study.



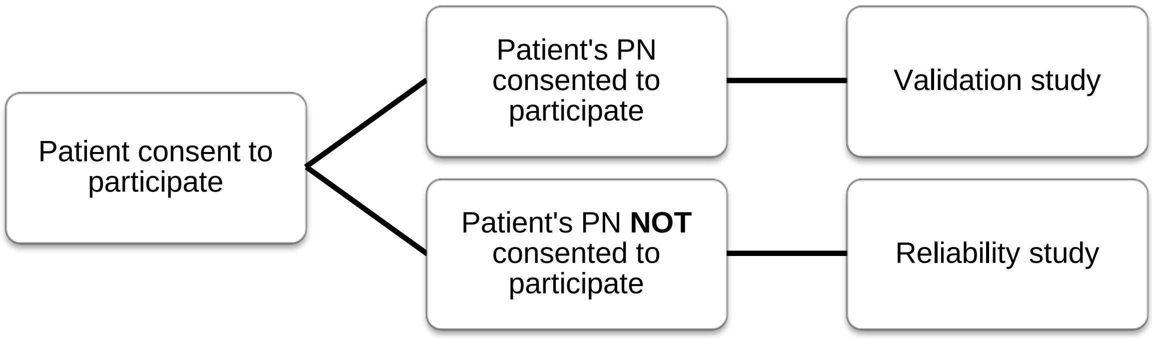
4.7.2.1 Ethical approval

Ethical approval was obtained from the University of NSW Human Research Ethics Committee HC13127.

4.7.2.2 Distribution to validation or reliability studies

Patients were distributed to either the validation or reliability study based on whether the PN from their regular general practice had consented to take part in the study. Patients from a general practice with a PN participating in the study were allocated to the validation study, whereas patients without a PN participating in the study were allocated to the reliability study. Figure 9 shows patient distribution to the validity and reliability studies.

Figure 9 Distribution of consenting patients to the validation or reliability studies.



4.7.2.3 Payment for GP consultation - gap fees incurred

Patients participating in the validity study were required to attend a brief consultation with their PN in the period following wearing accelerometers. This consultation involved the following:

- Discussion regarding the previous seven day period where the patient wore the accelerometer.
- Assessment of PA using the two instruments under investigation.
- Review of PA participation and other lifestyle advice (as required).
- Other lifestyle and/or biological assessments as required for the individual patient.
- Return of the accelerometer.

The consultation was considered part of the patient’s wider management of chronic disease/life style risk factor management. Specifically, this was evidenced from the patient’s previous referral to the Sutherland Division of General Practice GP Exercise Referral Scheme, indicating insufficient PA. The student (SND), obtained ethical approval for consultations relating to the study, could be billed using the Medicare Benefits Schedule (MBS) for GP attendance items. Approval was granted for a number of reasons including:

- Clinical relevance of PA assessment in terms of patient's previous referral to GP Exercise Referral Scheme.
- RACGP Red Book outlines that those at increased risk of developing chronic disease, which includes the cohort of patients referred to the GP Exercise Referral Scheme, should be questioned regarding current levels of activity and readiness to change at every opportunity [29].

To ensure patients did not incur 'out-of-pocket' expenses as a result of participation in the study, the student sourced funding from the Department of Health & Ageing through a small grant, to cover the costs of 'gap' consultation fees incurred. Ethical approval was obtained to enable payment of this reimbursement.

4.7.3 Statistical analysis

Nonparametric data were analysed using IBM SPSS Statistics 19 to determine criterion validity and inter-rater reliability between the PN administered questionnaires (GPPAQ and 3Q) and accelerometer counts. Validity was indicated by Spearman's rho correlations, classified as low (<0.30), moderate (0.30-0.59) and high (≥ 0.60) [482].

The Bland and Altman plots and Pearson's rank correlation statistical tests offer alternative methods of analysing correlation between raters [483-486]. In this case, data from PA assessment questionnaires (GPPAQ and 3Q) and accelerometer counts. Whilst both methods measure correlation, the Bland and Altman method estimates the mean bias and the 95 % limits of agreement (± 2SD of the difference) and is usually plotted as the difference between the methods against the mean of the methods for visual inspection of the error pattern throughout the measurement range; the dependence of error with the underlying level can be summarised in the error correlation coefficient. This statistical test quantifies the bias between the mean differences between raters, while this study required a measure of agreement suitability. Furthermore, the Pearson's rank analysis assumes the rating scale is continuous, whereas the data from this study was ordinal [483-486].

Kappa statistics assessed agreement between the PN administered questionnaires and the accelerometer data in the classification of participants as undertaking sufficient or insufficient activity against national PA recommendations (9). Agreement was categorised as poor (< 0), slight agreement (0.0 – 0.20), fair (0.21 – 0.40), moderate

(0.41 – 0.60) or substantial agreement (0.61 – 0.80). Participants were categorised according to questionnaire responses. For the GPPAQ, participants were classified as “Active” and for the 3Q those ranked in the “adequate” or “high” (total PA) categories were classified as “sufficiently active”(6). Refer to tables 17 and 18 for classification for PA based on GPPAQ and National PA Guidelines.

The test retest reliability was determined by comparing the participant responses from Time 1 to Time 2. The reliability analyses calculated intra-class correlation coefficients (ICC) using a two-way mixed model based on absolute agreement. The ICC was interpreted as indicating poor repeatability (<0.4), fair to good repeatability (0.4-0.75) and excellent repeatability (>0.75) [487].

4.7.3.1 PA classifications for questionnaires

The procedures for scoring the GPPAQ and 3Q instruments against National PA Guidelines has been outlined below.

4.7.3.1.1 Classification procedures for the GPPAQ

The GPPAQ classifies patients into one of four PA categories (Table 17), collectively known as the PA Index (PAI):

- Inactive.
- Moderately inactive.
- Moderately active.
- Active.

Researchers responsible for the development of the GPPAQ instrument have excluded questions concerning walking, housework, childcare and gardening/DIY from the PA algorithm. The reasons for this relate to limitations around the reliability of these measures. These questions were excluded from the scoring in this study also [26, 429].

Patients who recorded an ‘inactive’ to ‘moderately inactive’ score were classified as not meeting the Australian PA Guidelines. Patients classified as ‘moderately active’ and ‘active’ were classed as meeting the Australian PA Guidelines.

Table 17 Classification for physical activity based on GPPAQ and National Physical Activity Guidelines.

Category	Physical Activity Index (PAI)	Criteria	Code
0	Inactive.	• No PA.	Does not meet National PA Guidelines (**Code:1**)
	Inactive.	• Sedentary job.	
1	Moderately Inactive.	• < 1 hr/wk PA. • Sedentary job.	
2	Moderately Inactive.	• No PA. • Standing job.	
3	Moderately Active.	• Between 1 – 2.9 hr/wk PA. • Sedentary job.	Does meet National PA Guidelines (**Code: 2**)
4	Moderately Active.	• < 1 hr/wk PA. • Standing job.	
5	Moderately Active.	• No PA. • Physical job.	
6	Active.	• 3 hr/wk PA. • Sedentary job.	
7	Active.	• Between 1 – 2.9 hr/wk PA. • Standing job.	
8	Active.	• < 1 hr/wk PA. • Physical job.	
9	Active.	• Heavy manual job.	

4.7.3.1.2 Classification procedures for the 3Q

When classifying patient scores as meeting or not meeting the National PA Guidelines, a total PA per week was required to then compare against the guidelines. Calculating the total activity score required multiplying the number of vigorous PA sessions per week by two, then adding the number of moderate PA sessions conducted per week, i.e. Total activity sessions per week = moderate sessions per week + (2 x vigorous sessions per week) [18]. For calculation relating to the number of PA sessions, the midpoint in the response category was used e.g. one point five was given for a response of one to two sessions per week [18].

Scores from this calculation ranged from zero through to more than eight. Numeral scores corresponded to one of four PA categories (Table 18). Patients who recorded a ‘minimal’ score were classified as not meeting the Australian PA Guidelines. Patients classified as ‘low’, ‘adequate’ or ‘high’ were classed as meeting the Australian PA Guidelines (Table 18).

Table 18 Classification for based on the 3Q and National Physical Activity Guidelines.

Category	Level of PA	Criteria	Code
0-2	Minimal	• 0 sess/wk plus ≤ 1-2 sess/wk walking. • 0 sess/wk plus ≤ 1-2 sess/wk moderate activity.	Does not meet National PA Guidelines (Code:1)
3-4	Low	• 1-2 sess/wk vigorous plus ≤ 1-2 sess/wk walking or • 1-2 sess/wk vigorous plus ≤ 1-2 sess/wk • 0 sess/wk vigorous plus 3-4 sess/wk walking • 0 sess/wk vigorous plus 3-4 sess/wk moderate activity	Does meet National PA Guidelines (Code: 2)
5-7	Adequate	• ≥3 sess/wk vigorous. • ≥5 sess/wk walking. • ≥5 sess/wk moderate activity. • 1-2 sess/wk vigorous plus 3-4 sess/wk walking or • 1-2 sess/wk vigorous plus 3-4 sess/wk moderate activity.	
≥8	High	• ≥3 sess/wk vigorous plus ≥3-4 sess/wk walking. • ≥3 sess/wk vigorous plus ≥3-4 sess/wk moderate activity.	

4.7.3.1.3 Classification procedures for accelerometer

When classifying accelerometer outputs as meeting or not meeting the National PA Guidelines, a total PA per week was aggregated as minutes of moderate to vigorous PA (MVPA), for each participant. Cut points for MVPA, previously established by Feedson et al. [481] were used as cut points for sufficient and insufficiently PA, based on the National PA Guidelines. These cut points were:

- Insufficiently active:
    - Sedentary (<100 counts/minute).
    - Light (<1952 counts/minute).
- Sufficiently active:
    - Moderate (1952–5724 counts/min).
      Vigorous (>5724counts/min) PA.

4.7.4 Data handling and analysis

The IBM Statistical Package for Social Sciences (SPSS) Version 19 [488] was used to develop a database to store and analyse the data from the accelerometers and questionnaires. The data was stored on password protected computer software and the paper originals in a secure, locked cabinet at the University of NSW, in line with ethical requirements.

ActiLife actigraphy software [489] was used to configure each accelerometer (n=10) for deployment with participating patients, in addition to download, process, and securely manage data collected from activity monitors during the study.

Only the student (SND), had access to the databases or paper files. Data entry for the study was carried out by the student, based at the Sutherland Division of General Practice. Each data file was checked for missing or inconsistent data and verified and corrected if required.

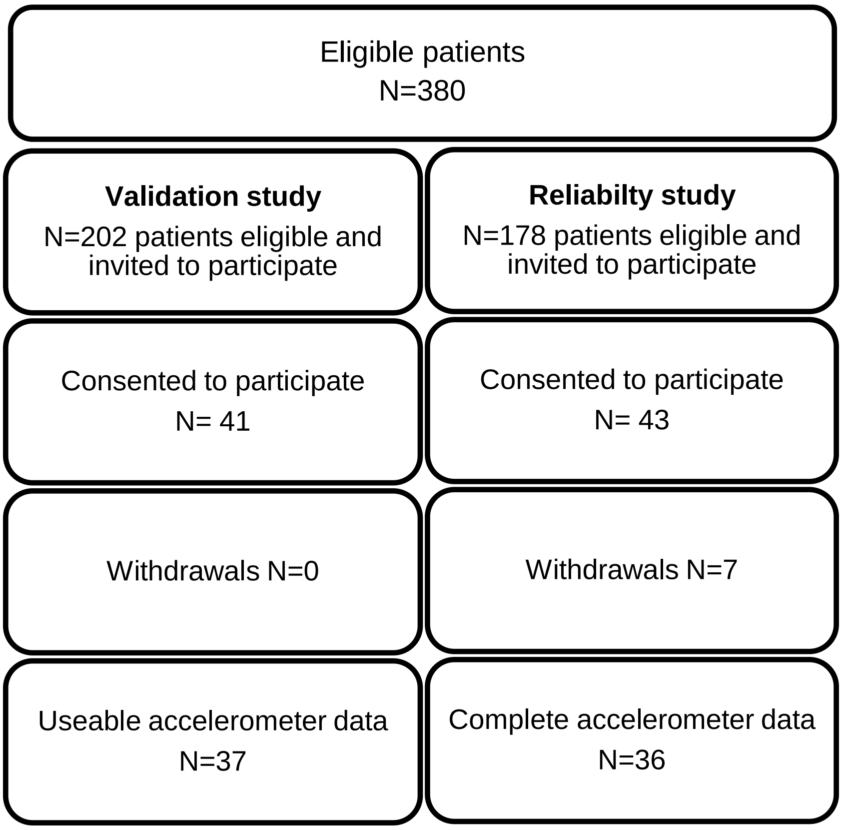
4.8 Results

4.8.1 Participant characteristics

Between May 2011 and October 2011, a total of 10 PNs eight general practices located in the Sutherland Division of General Practice boundaries. All of the nurses were female (n=10) and worked in group practices. Just over half (60%, 6/10) nurses were employed in small to medium sized general practice, with four or less GPs and at least one PN. The remaining PNs were from large general practices with five or more GPs and at least one PN.

During the same period, a convenience sample of n=84 patients consented to participate in the study. Of these patients that consented to participate, there were four patients whose data was excluded from the instrument validation study because their accelerometer data was unfeasible. In the reliability study, there were seven patients excluded because they did not complete both of the questionnaires. A summary of patient recruitment and distribution for the validation and reliability studies is shown in Figure 10.

Figure 10 Allocation of consenting patients to validation or reliability studies.



The characteristics of the patients with complete data are presented in Table 19. The majority of patients in the validation study were female, with the highest proportion aged between 50 and 69 years of age. In the reliability study, gender was equally distributed with the majority of patients aged between 60 to 69 years of age. There were seven withdrawals from the reliability study. Reasons for withdrawals were recorded, relating to personal circumstance. These included; holidaying overseas during the follow-up period (n=1), illness (3), family commitments (n=1), family bereavement (n=1) and one unknown (n=1).

Table 19 Patient characteristics feasibility study

	Patient characteristic	Validation study n = 37	Reliability study n = 36
Gender	**Male**	14	18
	Female	23	18
Age range	**30 – 39**	0	1
	40 – 49	0	1
	50 – 59	13	6
	≥60	24	28

4.8.2 Validity study: Criterion validity

Scores for the PAI derived from the GPPAQ assessments showed a low level of correlation with accelerometer counts, whilst the total activity scores derived from the 3Q showed fair to moderate levels of correlation (Table 20). However, the agreement between the GPPAQ assessments and the accelerometer counts in the classification for sufficient total activity was moderate, whereas agreement between the 3Q assessments and the accelerometer counts in the classification for sufficient total activity was fair (Table 20) [490]. This finding demonstrates the accuracy of each instrument in measuring patient PA levels, and classifying the patient as sufficiently or insufficiently physically active as per the National PA Guidelines. In this case, the GPPAQ demonstrated slightly higher agreement for classifying sufficient/insufficient PA status, than the 3Q.

Table 20 Concurrent and criteria validity for GPPAQ and 3Q instruments

Instrument	Spearman's rho (95% CI)	Kappa for meeting/not-meeting PA guidelines (95% CI)
GPPAQ	0.26 (0.12 – 0.39)	70.3 (0.56 – 0.85)
3Q	0.45** (0.30 – 0.61)	62.2 (0.47 – 0.78)

*** Correlation is significant at the 0.01 level (2-tailed).*

4.8.3 Reliability study – retest reliability

The self-report measures in the GPPAQ and 3Q questionnaires both demonstrated excellent repeatability with ICCs ranging from 0.82 to 0.95 for the GPPAQ and 0.94 to 0.98 (Table 21) for the 3Q. Test-retest reliability correlations were not significantly different between genders.

For both the GPPAQ and 3Q, the mean score at time one and two showed no differences in PA classification. The mean GPPAQ classification was between 'Moderately Inactive' to 'Moderately Active' and the 3Q was classified as 'Adequate' for Time 1 and 2. Table 21 shows the paired samples tests for time one and two for both instruments.

Table 21 Test-retest reliability for participant responses at time 1 and 2 for GPPAQ and 3Q

Questionnaire	Time 1 Median	Time 2 Median	ICC
GPPAQ	2.5	1.0	0.90 (0.82-0.95)
3Q	5.75	6.0	0.97 (0.94-0.98)

4.9 Discussion

The validation study showed that both instruments demonstrated reasonable rank order correlations for agreements against Actigraph accelerometers. The 3Q demonstrated strong measurement properties in terms of concurrent and criterion validity [18]. The GPPAQ showed fair rank order correlations, and higher agreement when compared against national PA guidelines in identifying participants as insufficiently active and sufficiently active, compared with the 3Q. PNs demonstrated that they could effectively measure PA using both instruments.

These findings were comparable to those obtained in similar studies that have evaluated the validity of self-report PA against accelerometers [18, 491]. Percentage agreement for both instruments (GPPAQ, 70.3% and 3Q, 62.2%) resulting from the criterion validity analysis (for determining adequate PA), are similar to other studies using self-report PA measures against accelerometers [492-494]. This level of agreement is considered acceptable in terms of self-reported PA assessment [490, 495].

Caution is needed in comparing measures of agreement between studies with different sample sizes and study populations. However, the results of this study suggest that the criterion validity of the GPPAQ and 3Q instruments were as good as longer self-report measures (for classifying people as insufficiently active and sufficiently active). In particular, the GPPAQ showed marginally higher agreement than the 3Q, indicating it may provide more guidance for those completing or administering it than the briefer 3Q. Key differences were noted in the instrument preferences provided by PNs and patients. The GPPAQ instrument ranked higher in preferences than the 3Q. The GPPAQ content used lay-person language and provided examples of PA to aid in describing vigorous and moderate intensity. It distinguished between incidental and planned activity and defined walking intensity [464, 496].

The modest sample size in this study (Validity n=37, Reliability n=36) is likely to have limited the statistical significance for the comparisons conducted. Post hoc analysis indicates that for a statistical power of 0.80 and alpha error 0.05, n=85 participants (for each study) was required to detect a fair (0.30) correlation. In addition, it is acknowledged that concurrent criterion-related validity is limited as a measure of correlation, however integration of established accelerometer cut points for MVPA, previously established by Feedson et al. [481] offers relative rigour to support the use of this measure.

The clinicians in this study may have been more interested in PA than the broader population of general practice providers and the consenting patients had previously participated in the same local exercise referral program. These limitations have implications for the generalisability of outcomes [497, 498]. Additionally, the validity and reliability studies used different methods of completion. That is, the validity study implored face-to-face administration of the instruments, whereas the reliability was mail to participants. The heterogeneity in these methods may impact on the strength of outcomes. Despite this, the relative rigour in the design on each study is likely to balance any potential limitation.

For some time, the measurement properties and brief design of the 3Q instrument have influenced researchers, and policy makers with strategies to increase the uptake of PA assessment [18]. Despite significant attempts to implement across general practice, PA assessment remains sub-optimal [16, 499, 500]. Lessons learned from this study may highlight the need to ensure PA assessment tools support the competency standards of those administering them.

The use of accelerometers as a measure for criterion validation has limitations regarding the types of activity measured. Actigraph accelerometers [489] are not suitable for use in water and only measure accelerations in the vertical plane, therefore activities without a strong vertical component such as cycling or rowing are underestimated. The effect of these not being detected by the accelerometer would mean that the reported estimates of criterion validity are conservative [501]. These weaknesses are traded off against the widely recognised strengths of accelerometers such as portability and capacity to keep a continuous record of the duration and intensity of movement [502, 503].

Finally, the test-retest reliability for both instruments demonstrated excellent repeatability. These results are encouraging, particularly given the instruments were administered by patients (self-completion), in different contexts and on two occasions. It is well documented that general practice experiences time limitations and increased workload in terms of patient demand [238, 329, 330]. Evidence indicates the possibility that patients may report inaccurate health behaviours to their GP; however this does not appear to have occurred to a significant extent in this study [504].

4.10 Conclusion

The measurement properties of two instruments were evaluated for measuring PA when administered by PNs and patients (self-completion). The results show a significant correlation for the 3Q whereas correlation for the GPPAQ was only fair, with some overlap between both instruments for kappa scores.

Correlation for the 3Q was higher than the GPPAQ, with the scores for both instruments residing within acceptable ranges for self-report PA assessment instruments [490, 495].Whilst most studies would look to favour the instrument with highest measurement rigour [505, 506], the outcomes from the previous qualitative study (Chapter 3) should not be ignored. The collective outcomes from this study, and the previous qualitative suggest the GPPAQ may offer a balance between user preference and measurement rigor to support PA promotion in general practice. This study highlights the need for rigorous and acceptable tools to support PA assessment by non-GP staff

Further research is required to investigate methods of supporting implementation of instruments such as those outlined in this study. This research would benefit from insight into the mediating variables for enabling implementation PA behaviour change interventions within the general practice setting.

4.11 Summary

This chapter has demonstrated sound measurement properties of the GPPAQ and 3Q instruments when administered by PNs (validity) and patients (reliability). Based on instrument preferences identified in Chapter 3 of this dissertation, and prior implementation of the 3Q instrument within Australian medical software, the GPPAQ was selected as an instrument for evaluating the implementation. The next chapter will describe how the GPPAQ instrument, which demonstrated highest preference in the qualitative study, outlined in Chapter 3, can be implemented in routine general practice to support PA behaviour change in patients.

5 A study to explore the implementation of physical activity in general practice

5.1 Introduction

The qualitative study outlined in Chapter 3 of this dissertation described the acceptability of a range of instruments for assessing PA in general practice patents. Two instruments, the GPPAQ and 3Q showed highest preference amongst clinicians. Both instruments demonstrated robust measurement properties, comparable with other, established self-report instruments, outlined in Chapter 4.

The 3Q instrument was introduced to Australian general practices almost ten years ago, however has demonstrated little impact on the rate in which PA interventions occur [18, 507]. Despite, access to an estimated 88% of the population, PA behaviour change interventions occur in less than one third of all general practice encounters [17, 20-24, 508]. To improve uptake, interventions require new approaches. The GPPAQ instrument [26] has been broadly adopted in the United Kingdom as a robust, acceptable and versatile option for PA assessment in general practice patients.

In the context of general practice, PA assessment is one part of the wider intervention to initiate behaviour change. Evidence suggests that successful behaviour change interventions involve five core activities for the GP; ask, advise, assess, assist (or agree), and arrange (5As). The RACGP Red Book suggests the 5As form part lifestyle risk factor behaviour change interventions to increase the chances of successful and sustained behaviour change in patients [454, 509]. Assessment of PA is a key step in the five elements of the 5As, in addition to the provision of resources such as patient education material and provider directories.

The following study examines how four general practices implemented the GPPAQ instrument as part of a behaviour change intervention, modelled on the 5As framework. The study used a mixed methods design to analyse the implementation of the instrument, and intervention in four general practices, located in the Eastern suburbs region of Sydney. It used a clinical audit to compare changes in markers related to PA before and after the intervention, in addition to qualitative methods were used to determine the process, barriers and enablers to the intervention.

5.2 Aims

This study aimed to understand how general practices implement a PA assessment and advice intervention using the GPPAQ instrument, patient education material and PA referral directories. In particular, it aimed to gather preliminary information to inform challenges relating to the uptake of PA behaviour change in general practice by describing the experience of participating general practices. Specifically, this study responded to the following three statements:

1. Describe how participating general practices implement PA assessment before and after the intervention.
2. Describe how participating general practices implement PA advice before and after the intervention.
3. Describe the key features, processes, barriers, enablers and influences of each intervention implemented by practices during the intervention?

5.3 Study Design

This study was a before-and-after formative design, exploring implementation of PA assessment and advice in participating general practices. Qualitative methods were used to understand clinician attitudes, behaviour and understanding of PA assessment and practice processes relative to the intervention. Quantitative methods were used to provide context and validate qualitative measures.

5.4 Methods

This study used a mixed methods protocol to explore implementation of PA assessment and advice in participating general practices. An intervention was developed using the instrument (GPPAQ) identified from the previous two studies in this dissertation (Chapters 3 and 4). The intervention involved execution of the GPPAQ, disease specific patient education material and PA referral directories. Each intervention was implemented using customised processes for participating general practices, tailored to their specific requirements.

Qualitative data was collected at baseline and follow-up to describe participant characteristics and behaviours, beliefs and understanding of PA behaviour change, interactions with patients and providers, and systems and processes.

Quantitative methods included a clinical audit which provided raw quantitative data with summary statistics to describe changes in data completeness. Quantitative data was collated and analysed at baseline and follow-up points for the purpose of providing context to qualitative data, and inform the interpretation of the PA interventions on a practice by practice basis.

The study was conducted in general practices located in the Eastern Sydney Medicare Local (ESML) region, between September 2013 and February 2014, with an additional follow-up (qualitative) component conducted in September 2014.

5.4.1 Medicare Local partnership

The investigators partnered with the Eastern Sydney Medicare Local for the implementation of the study. The partnership involved jointly branded letters to eligible general practices. The partnership was included within ethical approval documents for the study (HREC13127). A copy of the letter of support from Eastern Sydney Medicare Local is provided in Appendix 13 of this dissertation.

The Medicare Local published notifications of the study in their fortnightly newsletters and mailed invitations using their practice database. Additional support from Medicare Local staff was provided through their General Practice Support Program, disseminating follow-up invitations to general practice. General practices expressing an interest in the study were contacted via telephone to discuss and those interested gave their consent to take part in the study.

5.5 Sample

A purposive sample of general practices (n=4) from the Eastern Sydney Medicare Local region in Sydney were recruited to participate in the study. Participating practices consisted of a range of large, medium and solo general practices across the region.

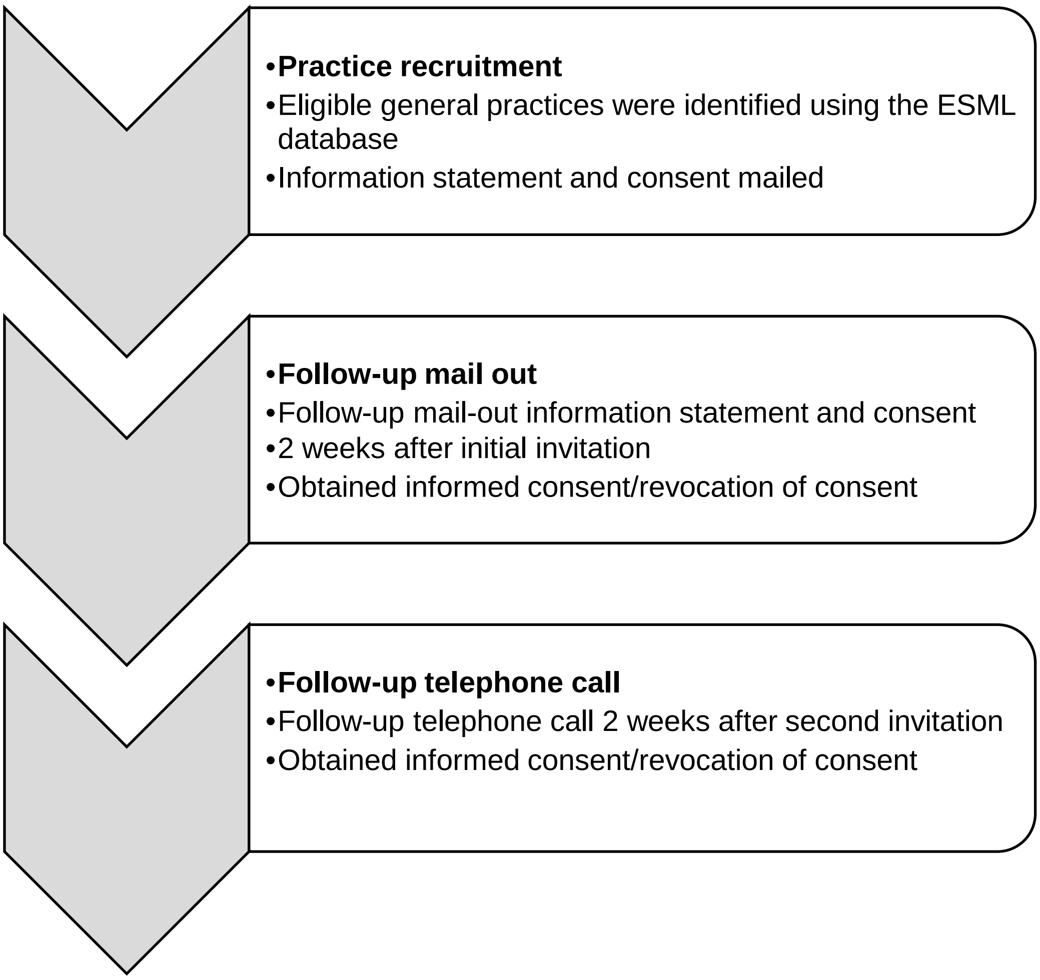
5.6 Recruitment

Eligible practices included any general practice located within the Eastern Sydney Medicare Local region. These practices were mailed an Information Statement (Appendix 14 and 15), addressed to the principal GP, within the region. Practices expressing an interest in the study were contacted by via telephone, and provided specific details about the study including:

- Length of the study/intervention.
- Clinical audit process and markers used for comparison.
- Education and training for participants.
- Details of what is involved for each practice staff member and patients.

Follow-up mail-outs were conducted, two-weeks after initial invitation, followed by a telephone call to provide clarity around areas of uncertainty and collate informed consent/revocation of consent. Figure 11 summarises the recruitment process for study.

Figure 11 Recruitment process for the implementation study.



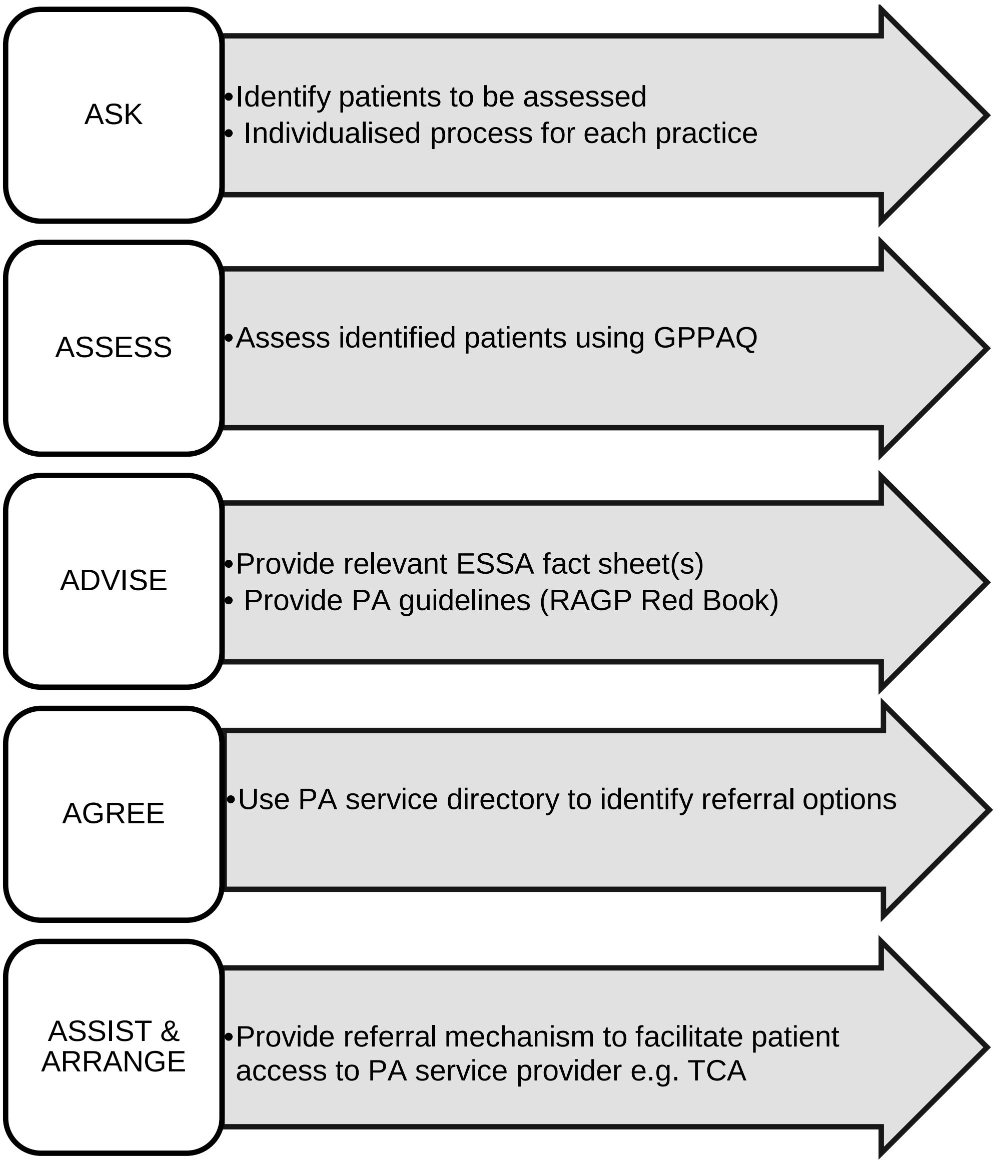
5.7 Individually tailored interventions

This study used the 5As framework for the development of customised interventions for each practice. It synthesised the 5As framework with the PA guidelines, published within the RACGP Red Book [510]. The GPPAQ instrument had a dual purpose as the assessment instrument, and supporting the ‘Ask’ and ‘Assess’ section of the 5As framework. Patient information material developed by the Exercise and Sports Science Association of Australia (ESSA) resourced the ‘Advise’ component. Directories of PA services/providers were developed to ‘Assist’ and ‘Arrange’ within the intervention. Figure 12 provides an outline of the 5As framework, including the GPPAQ for this study. This framework was used during a series of facilitation visits between the student (SND) and the practice to develop individually tailored interventions for each practice.

These resources were designed to provide the practice with the resources they needed to develop and implement an intervention. They were not prescriptive in terms of how a practice should implement them, because it was critical that each practice developed its own intervention based on their individual circumstance and requirements.

The implementation of the individual interventions for each of the participating practices within this study was based on methods for tailored interventions [511-514]. Recent research in the area of tailored interventions calls for researchers to equip research participants with evidence based resources and guidance to overcome individual and perceived barriers [511-514]. This method aims to pre-empt barriers experienced when implementing a new intervention [39, 513, 515]. Studies have shown that a growing number of health care clinicians prefer to tailor the delivery of health care to their own protocols, strengths, weaknesses and their patients. It is therefore important to incorporate tailored interventions into research so that the findings can contribute to implementation practice [511-514].

Figure 12 PA Guidelines synthesised against the 5As framework.



5.7.1 Practice facilitation visits

The student (SND) has extensive experience working with general practices in facilitation or practice support roles. The student also has skills and experience in offering guidance around teamwork, organisational, clinical, and business functions for general practices in the context of chronic disease prevention and management and Aboriginal and Torres Strait Island health. During practice visits, the student provided any or all of the following support depending on practice need:

- Training for staff regarding PA guidelines as referenced in the RACGP Red Book.

- Training for staff regarding completion of the GPPAQ questionnaire, scoring, interpretation and resources to support use e.g. electronic template made available on clinical desktop.
- Reflection on the data from the clinical record audit of preventive care in practice.
- Suggestions on ways in which the clinical, operational and business functions of the practice could be modified to support improved preventive care. These may include:
    - *Changes/clarification to staff roles and activities (e.g. reception/administrative staff in making referrals, nursing staff in providing assessments or education.*
    - *Guiding the practice in identifying an overall prevention coordinator within the practice.*
    - *Aligning the intervention processes to practice systems and resources (e.g. access to education materials, recording PA questionnaire outcomes in medical records, aligning to Medicare incentives such as Team Care Arrangements and Health Assessments).*
    - *Using the PA service directory.*
    - *Risk stratification, disease registers and recall and reminder systems.*
    - *Identification and targeting of barriers/difficulties individual to the practice and staff involved in the intervention.*

There were two facilitation visits conducted with participating practices to guide the development of their intervention. The steps taken during these facilitation visits have been outlined in Table 22.

Table 22 Outline of steps taken during facilitation sessions 1 and 2.

	Practice facilitation visit 1	Practice facilitation visit 2
Aim	Identify methods of implementing the 5As approach to PA behaviour change, within the context of the practice.	Define the intervention to be implemented during the study period.
Content	Facilitation session 1 was guided using the following prompts: 1. **How will they identify patients for PA intervention** e.g.: *a. Patients considered insufficiently active.* *b. Patients diagnosed with chronic disease.* *c. Patients with an existing lifestyle risk factor.* 2. **How they would ideally implement the following**: a. Assess PA status using GPPAQ. b. Distribute disease specific fact sheet developed by ESSA. *c.* Refer patient using the directory of PA services. *d.* Record the PA assessment and GPPAQ score in clinical software. *e.* Record referral to PA provider/service in clinical software (if relevant). **3. Reflect on proposed intervention in light of the following questions:** a. What existing structures, roles/responsibilities could the intervention be aligned to? b. What existing or desired functions could the intervention be aligned/leveraged? c. What existing practice resources could the intervention be aligned or leveraged? d. What is the current capacity of the personnel to implement the intervention? e. What individual circumstances does the practice present to be considered when designing the intervention e.g. patient demography, GP interests, and the availability of resources such as AHPs?	At the end of the second facilitation session, each practice was able to identify how they would implement the following: **1. A process for how they would identify patients to be targeted for PA assessment.** **2. Process for implementing PA assessment in identified patients, using the GPPAQ instrument including recording outcome data in medical records.** **3. Outline how they would use the patient information resources provided by ESSA.** **4. Define a process for referring patients requiring PA behaviour change, using the directory of PA services/providers.**

5.7.2 Clinical audit protocol

The study involved a baseline and follow-up clinical audit, using the Pen CAT clinical audit tool [516, 517].[1] The PEN CAT Clinical Audit Tool was used to audit the medical records of participating general practices as an adjunct to qualitative measurements exploring changes in clinician practice. Data from the clinical audit was used to provide context to qualitative data, and inform the interpretation of the PA interventions on a practice by practice basis. The audit assessed changes in data completeness for a selection of clinical markers for each of the participating general practices, at baseline and follow-up (12 weeks).

Clinical markers included; body mass index, waist circumference, fasting blood glucose, fasting blood lipids (TC, LDL-C, HDL-C, TG), and blood pressure for patients with and without established hypertension.

The RACGP guidelines for preventive activities in general practice define the frequency at which clinicians should measure these markers i.e. waist, BMI, blood pressure, triglyceride and cholesterol measures on a 12 month cycle, absolute cardiovascular risk in the past two years and fasting blood glucose in the past three years. This clinical audit measured changes in data completeness for clinical measures based on the frequency outlined by the RACGP guidelines, at baseline and 12 weeks following the intervention.

The PEN CAT Clinical Audit Tool was developed for the Royal Australia College of General Practitioners (RACGP) to extract de-identified, clinical data from GP software systems. It aggregates data allowing comparison against established clinical management guidelines. The tool also facilitates a range of other functions to improve both the quality and completeness of patient information [518]. In order to detect changes, the PEN CAT clinical audit tool was programed to measure the volume of patients assessed for each clinical measures in the ‘last 12 months’.

Medical records for patients aged 18 years or over, who had attended the practice for a GP or PN consultation within the previous 12 month period, were audited using the PEN CAT Clinical Audit Tool and recorded using an audit data collection form

[1] A clinical audit has been defined as the provision of a summary of clinical information over a specified period of time

(Appendix 16). The PEN CAT Tool extracted and aggregated select markers for completeness between baseline and follow-up audit points.

For the purposes of the study, data not correctly recorded in designated data fields within the (practice) medical software was not extracted, and was subsequently counted as missing. Data was then analysed using descriptive statistics including mean and standard deviation. The findings of the audit were compared against the National PA Guidelines, adapted by the RACGP to benchmark against best practice. The information was then fed back to participating practices in a clinical audit report. A summary of the intervention protocol is outlined in Figure 13.

Data collected from the clinical audit was analysed and presented in a report to each practice for reflection. The report presented baseline and follow-up data and outlined where the practice had implemented change that had resulted in a change in data reporting. It also included recommendations to streamline and/or continue implementation. It was presented to practices between two and four weeks after the follow-up visit. At this time, the practice completed an audit reflection form (Appendix 17), providing feedback regarding the audit report, usefulness of the results in addition to considering barriers experienced during the intervention period and how these might be resolved in the future.

5.7.3 Physical Activity Assessment and Advice Protocol

The PAAA survey was used obtain insight into GP attitudes and understanding of PA assessment and advice at baseline and follow-up intervention points. The questionnaire was completed by the participating GP from each practice administered by the student, at baseline and follow-up data collection points for the clinical audit. Clinicians self-completed the questionnaire and returned to the student.

The instrument was designed to capture variables within scope of GP roles and responsibilities, rather than PNs or reception/administrative personnel. Subsequently, the PAAA was completed by GPs only.

5.7.4 Observational protocol

Observational data was collected by the student (SND) at five points throughout the study outlined in Figure 13. Data from observations was used to develop profiles for participating general practices, details of how practices tailored their intervention and provided context for the clinical audit data collected in the quantitative phase. This enabled investigators to prepare flowcharts/maps of individual processes implemented by participating practices. A template was used to guide the capture of key observational data, ensuring consistency in data collection across the study (Appendix 20). Direct and incidental observations were undertaken under the following broad categories:

- Behaviours of practice personnel
- Intra and extra team interactions
- Activities consummate with teamwork
- Systems or processes in place or developed for the purpose of the intervention
- Physical characteristics of the practice setting
- Explore variability associated with, implementation of individual interventions.

At each data collection point, observations were recorded whilst seating within the facility e.g. waiting area, consultation rooms or liaising with practice personnel such as during facilitation visits. These opportunities provided insight into roles and responsibilities of personnel, team work, procedures, initiatives or incentives in place within each practice (Table 23).

5.7.5 Semi structured interview protocol

Semi-structured interviews were conducted within participating general practices, in two phases. The first phase (baseline) was aimed to explore participant characteristics and behaviours, interactions with patients and providers, and systems and processes that influenced the uptake of the intervention. The second phase of interviews (follow-up) was conducted six months after completing the intervention. These interviews aimed to describe longer term (practice) behaviour change including barriers and enablers to implementing PA assessment and advice six months after completing the intervention. Figure 13 demonstrates the points at which semi-structured interviews were conducted in relation to the intervention.

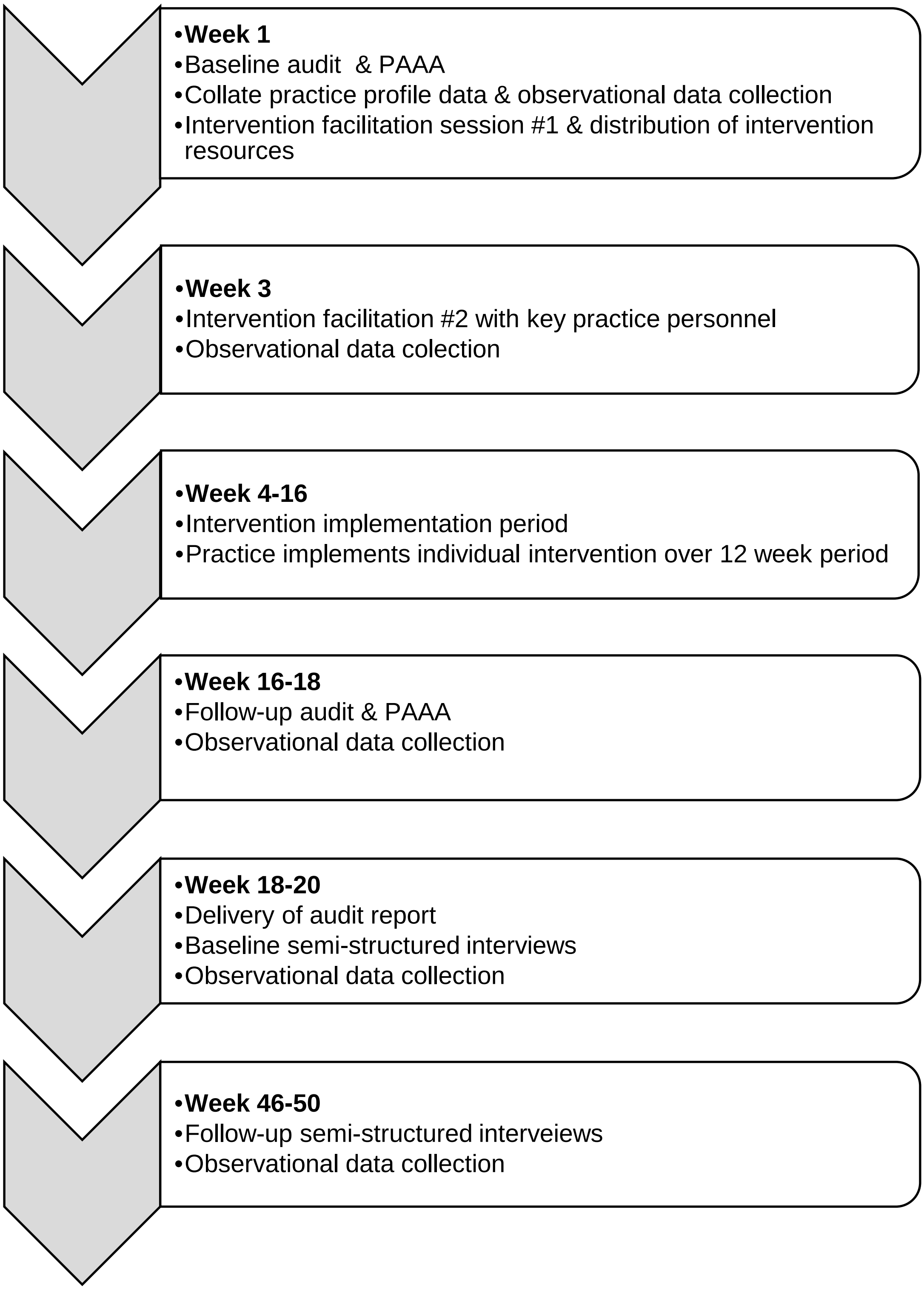
A sample of practice staff were invited to participate in an interview which explored questions relating to processes and mechanisms used to implement the intervention, the usefulness of the instruments provided or the intervention, literacy around PA assessment and advice and barriers and enablers to implementation

Representatives eligible to participate in the interviews included any personnel involved with facilitating lifestyle risk factor assessment and management in the practice. This included GPs, PNs and reception/administrative staff.

Table 23 Summary of practice observation area.

Area of observation	**Detail**
Facility	• Size and space of each area. • Functioned in terms of patient access. • Display of health promotion and patient education material. • Other relevant to this category.
Practice personnel	• Composition of GPs, PNs, practice/reception staff). • Other health professionals e.g. AHPs. • Gender. • Full-time-equivalent (FTE).
Teamwork	• Interactions/communication between clinical and non-clinical staff. • Formal and informal methods of communication such as staff meetings, clinical conferences or patient care provided by two or more personnel.
Access	• Requirement for appointments. • Waiting periods for appointments and consultations. • Patient disease registers. • Recall and reminder systems.
Billing	• Bulk billing. • Private billing.
Patient demography	• Total number of practices recorded on the patient database. • Ratio of males to female patients.
Initiatives/incentives in place	Initiative and/or incentives in place: • GP Management Plans, Team Care Arrangements, Diabetes Annual Cycle of Care and Health Assessments. • Notations regarding how the practice implemented initiatives were included i.e. incidental or systematic implementation.
Networks or links established	• Links with external services/providers were made e.g. AHPs or other health or community services.
GP interests and/or services	• GP or practice special interests e.g. women's/men's health, Aboriginal and Torres Strait Islander health.

Figure 13 Summary of intervention protocol and timeline.



5.7.6 Professional development points

The investigators obtained Category 1 Quality Improvement (QI) Activity approval from the RACGP for the project to ensure GPs were provided with professional development points from the audit and to assist with recruitment to the study. Similarly, PNs participating in the study were offered appropriate documentation to claim continuous professional development points through the Australian Practice Nurse Association (APNA) assessment scheme. A total of 10 APNA points were provided.

The QI status was included with recruitment resources forwarded during the recruitment period.

5.7.7 Baseline data collection

The baseline data collection was conducted during a face-to-face visit by the investigator at the practice premises with nominated practice personnel.
It included:

1. Clinical audit data extraction of the practice medical software, using the PEN CAT Clinical Audit Tool to determine the proportion of patients with recorded clinical markers.
2. Completion of the Physical Activity and Advice (PAAA) in general practice (Appendix 18); Self-reported attitudes & understanding of PA assessment and prescription from the participating GP for each practice.
3. Observational data collection; including - teamwork, systems/processes, physical characteristics of practice setting, explore implementation of interventions.
4. Provision of clinician training regarding the audit protocol and the intervention procedure between baseline and follow-up audit points. Training took approximately ten minutes and was delivered by the student (SND) within participating general practices. At the same time, participants were provided with a the following information regarding the audit:
    - *Overview of the audit process.*
    - *Copy of the audit data collection form.*
5. Collection of practice characteristics including practice demographic data such as staff roles and responsibilities, clinical and administrative software, policies and procedures relevant to implementation of study.

5.7.7.1 Follow-up data collection

A follow-up clinical audit was conducted in participating practices following the implementation of a 12-week intervention. The follow-up audit process involved the same procedures as for the baseline audit including:

1. Clinical audit data extraction of the practice medical software, using the PEN CAT Clinical Audit Tool.
2. Completion of the PAAA (Appendix 18); self-reported attitudes & understanding of PA assessment and prescription from the participating GP from each practice.
3. Observational data collection; including - teamwork, systems/processes, physical characteristics of practice setting, explore implementation of interventions.

5.8 Intervention resources

5.8.1 Physical activity assessment questionnaire

5.8.1.1 GP Physical Activity Questionnaire (GPPAQ)

This study used the GPPAQ instrument as the PA assessment instrument; drawing on findings from the previous two studies (Chapters 3 and 4) which identified both the GPPAQ and 3Q as acceptable and feasible options for assessing PA assessment; however the decision to use GPPAQ for this study was based on the following:

- The GPPAQ demonstrated higher preference amongst clinicians than the 3Q, and greater versatility, in terms of methods of administration such as; patient self-completion.
- Criterion validity scores showed higher agreement for GPPAQ, than the 3Q, suggesting marginally better precision in terms of classifying patients as insufficiently active and sufficiently active.
- There have been no significant improvements in PA uptake of PA assessment in general practice since the introduction of the 3Q in 2005 [7].
- The GPPAQ has been broadly adopted in the United Kingdom as a robust, acceptable and versatile option for PA assessment in general practice patients and not previously evaluated in the Australian setting.

The GPPAQ was developed in 2002, in the United Kingdom by the Department of Health through the London School of Hygiene & Tropical Medicine. The aim was to establish a short measure of PA, for use in general practice. The instrument has since been ratified by the United Kingdom National Institute of Clinical Excellence (NICE) through the PA intervention framework, published in March 2006 [22]. This framework recommends that general practice clinicians should take the opportunity, whenever possible, to identify adults insufficiently active and advise them to aim for 30 minutes of moderate activity on 5 days of the week (or more). Practitioners should use a validated tool, such as the GPPAQ, to undertake this assessment process.

The GPPAQ was provided to participants within the resource pack for the audit and used by participants to assess patient PA status during the intervention period of the audit (Appendix 9) [26].

5.8.2 Practice resources

5.8.2.1 PA Guidelines – RACGP Guidelines for Preventive Activities in General Practice 8th Edition (Redbook)

The RACGP Redbook recommends providing general practice patients identified as not performing adequate levels of PA with brief advice regarding how to increase levels of activity to recommended levels.

The book states that adults should be advised to participate in 30 minutes or more of moderate activity on most, preferably all days of the weeks (at least 2.5 hours or 150 minutes per week). While moderate PA is recommended for health benefits, more vigorous exercise may confer additional cardiovascular health and cancer prevention benefits. If carried out for a minimum of 30 minutes, 3-4 times a week. The amount of PA can be accumulated in 10 minute bouts. The amount of PA required for weight loss is greater; it is recommended that at least 60 minutes of moderate intensity activity (e.g. brisk walking) every day may be required in order to achieve measureable weight loss over a number of months.

5.8.2.2 PA Assessment and Advice (PAAA) Survey (Baseline & follow-up)

The PAAA Survey was adapted from the Preventive Medicine Attitudes and Activities Questionnaire (PMAAQ) questionnaire [519] found to validly and reliably measure cardiovascular disease prevention behaviours of clinicians. The PMAAQ questionnaire was designed to obtain insight into clinician beliefs and behaviours with respect to preventive medicine [519].

The PAAA used the same structural and philosophical stance as the PMAAQ, collecting information regarding clinician behavior with respect to assessment of patient

PA, advice they have provided in the previous 3 months, their confidence, understanding and barriers to implementing PA behavior change in routine practice [519]. It was completed by the participating GP from each practice at the baseline and follow-up points of the audit to determine clinician beliefs, attitudes and behaviours regarding PA, at baseline and follow-up points.

5.8.2.3 PA fact sheets developed by Exercise and Sport Science Australia

A total of 19 disease specific fact sheets were provided by the Exercise and Sports Medicine Australia (ESSA), Exercise is Medicine Initiative (EIM). Resources detailed the dose response relationship between PA and the given medical condition, types and tips for prescribing PA for each medical condition. A list of the disease represented with a fact sheet has been provided in Table 24.

Table 24 ESSA Fact Sheets by disease disseminated during the intervention phase of the study.

• *Asthma*	• *Coronary Heart Disease*	• *Dyslipidaemia*
• *Osteoporosis*	• *Chronic Heart Failure*	• *Falls*
• *Osteoarthritis*	• *Chronic pain*	• *Hypertension*
• *Breast cancer*	• *Depression*	• *Lower Back Pain*
• *Cancer*	• *Diabetes (type 1)*	• *Metabolic syndrome*
• *Prostate cancer*	• *Diabetes (type 2)*	• *Parkinson's Disease*
• *Kidney disease*		

5.8.2.4 PA service directory

A directory of PA providers delivering services within the ESML region was collated and made available in hard copy and electronic format to all participants. The directory contained contact, location and service delivery and access information, including cost. Professional categories included; Exercise Physiologists, Personal Trainers, Gentle Exercise, Walking groups. The directory was provided to participants within the audit package and made available in electronic and hard copy format.

5.8.2.5 Practice resource/intervention kit

Participating practices received a resource kit which was designed to provide them with an overview of the study and support them in the development and implementation phases of their intervention. The contents of these kits have been outlined in Table 25.

Table 25 Practice resource kit contents.

Resource	**Hard copy**	**Soft copy**	**Hyperlink**
Overview of study	✓	✓	N/A
RACGP Red Book PA Guidelines	✓	✓	✓
PA Service Directory	✓	✓	N/A
GPPAQ Questionnaire (Hard copies) including the document for calculating the PA index	✓	✓	N/A
ESSA Fact Sheets (x 20 copies each)	✓	✓	✓

5.9 Outcome measures

The primary aim of this study was to explore clinician and practice behaviour change with respect to PA assessment and advice, resulting from participation in a PA intervention. Both qualitative and quantitative measures were used to describe how general practices implemented the intervention, however quantitative data was used for the sole purpose of providing context to qualitative data, which informed the interpretation of the PA interventions on a practice by practice basis.

Qualitative data was used to develop profiles for participating general practices and to provide an understanding of how practices tailored their intervention. This was used to prepare flowcharts/maps of individual processes implemented by participating practices. Outcome variables for quantitative and qualitative measures have been outlined in Tables 26 and 27.

Quantitative data collected from a clinical audit provided context for qualitative data when describing the implementation of each intervention for each of the participating general practices. A range of clinical markers were identified because of their association with PA behaviour change and the incidence of chronic disease (Table 26). These markers were included as measures within the clinical audit. They included; blood pressure and hypertension, blood lipids (total cholesterol (TC), LDL-Cholesterol, HDL-Cholesterol), waist circumference, body mass index (BMI), fasting blood glucose (FBG), Triglycerides (TG), Absolute CV risk [453, 454] (Table 26). The RACGP provides recommendations regarding the type and frequency of clinical assessments for preventing and/or managing chronic disease [29, 232]. Measuring clinician adherence to these guidelines is possible by extracting and aggregating data from practice software via a clinical audit to detect changes in the clinical adherence to these guidelines. An outline of each of the clinical markers included in the audit and the relevant RACGP recommendations has been outlined below:

Blood pressure/hypertension

Increasing PA levels, contributes to lowering hypertension and controlling blood pressure [520]. Improvements in systolic (<140mm Hg) and diastolic (<90mm Hg) blood pressure are expected at the follow-up audit point, for patients categorised as hypertensive, at baseline [29, 520]. The RACGP recommends blood pressure/hypertension measures be repeated every 12 months [29, 232].

Blood lipids including triglycerides

Evidence indicates the increases in PA can result in favourable changes in blood lipids and lipoproteins in both normolipidemic and dyslipidemic individuals [521-523]. Changes in PA levels between baseline and follow-up points are expected to improve total cholesterol measures below 4 mmol/L, LDL-cholesterol less than 2.5 mmol/L, HDL-cholesterol above 1.0 mmol/L and triglycerides less than 2 mmol/L [29, 521-523]. The RACGP recommends blood lipids including triglycerides measures be repeated every 12 months [29, 232].

BMI and waist circumference

Despite the causes of overweight and obesity being complex, physical inactivity is considered an important causal factor with BMI and waist circumference quantifying patients within a healthy/unhealthy for waist circumference and healthy weight, overweight or obese range [524, 525]. The RACGP recommends BMI and waist circumference measures be repeated every 12 months [29, 232].

Increasing PA levels, contributes to controlling body weight, measured via BMI and waist circumference [48]. In this study, improvements in BMI scores are expected at the follow-up audit point for patients classified in the overweight range (25 - 29.9) and those in the obese range (>30), at baseline [29, 524, 525]. For waist circumference, increased PA is likely to enact reductions for patients classified in the increased risk range at baseline (94cm for men and below 80cm for women). For patients classified in the high risk range at baseline, reductions below 102cm for men, and below 88cm for women are anticipated.

Fasting blood glucose

Studies show that exercise can help prevent the onset set of type 2 diabetes and improve blood glucose control measured via fasting blood glucose measures [526, 527]. For this study, improvements in FBG scores are expected at the follow-up audit point for patients classified at increased risk (5.5 – 7 mmol/L) and high risk range (> 7.0 mmol/L) [29, 526, 527]. The RACGP recommends fasting blood glucose measures be repeated every three years [29, 232].

Absolute cardiovascular risk

Assessment of cardiovascular disease risk on the basis of the combined effect of multiple risk factors (absolute CVD risk) is more accurate than the use of individual risk factors, because the cumulative effects of multiple risk factors may be additive or synergistic. Modifying PA behaviour can be detected by the absolute cardiovascular risk assessment [528]. The RACGP recommends absolute cardiovascular risk measures be repeated every two years [29, 232].

Increasing PA levels, can contribute to reducing absolute cardiovascular risk. In this study, reductions in absolute cardiovascular risk scores are expected at the follow-up audit point for patients classified in the increased risk range (10-15%) and high risk range (>15%), at baseline [29, 528].

Patient Risk Categories

The RACGP Guidelines for preventive activities in general practice are a synthesis of evidence-based guidelines from Australian and international sources, outlining recommendations for routine use in general practice [29]. The threshold measures for the guidelines outlined within the Red Book have been collated to form recommendations for general practice activities to monitor patients. For the purpose of this study, each clinical marker has been classified into three categories, based on values for diagnosis and/or management protocols, outlined within the Red Book [29]. These thresholds include:

- Patients with values for each marker, within the established **'healthy range'**
- Patients with values for each marker, within the established **'increased risk range'**
- Patients with values for each marker, within the established '**high risk range'**

Physical activity management

Clinicians provided self-reported measures of PA management during the intervention period. Data regarding frequency of PA assessment and advice was collected at baseline and follow-up points (Table 26).

Clinical markers, their corresponding risk category and the time at which measures were collected have been outlined in Table 26.

Table 26 Clinical audit outcome measures and data collection points

Quantitative measures	Measure	Risk category values	Baseline	Follow-up
Clinical audit - data completeness & risk profile	BMI	Healthy range: 18.5 - 24.9	Week 1	Week 16-18
		Increased risk: 25 - 29.9		
		High risk: ≥ 30		
	Waist circumference	Healthy range: < 94cm male, < 80cm female		
		Increased risk range: ≥ 94cm male, ≥ 80cm female		
		High risk range: ≥ 102cm male, ≥ 88cm female		
	Fasting Blood Glucose	Healthy range: <5.5 mmol/L		
		Increased risk range: 5.5 – 7 mmol/L		
		High risk range: > 7.0 mmol/L		
	Total cholesterol (TC)	Healthy range: < 4 mmol/L		
		Increased risk range: ≥ 4 mmol/L		
	LDL-Cholesterol	Healthy range: < 2.5 mmol/L		
		Increased risk range: >2.5 mmol/L		
	HDL-Cholesterol	Healthy range: > 1.0 mmol/L		
	Triglycerides (TG)	Healthy range: < 2 mmol/L		
		Increased risk range: > 2 mmol/L		
	Blood pressure	Healthy range: < 140/90 mm Hg		
		Increased risk range: BP >140/90 mm Hg		
	Absolute CV risk	Healthy range: <10%		
		Increased risk range: 10-15%		
		High risk range: >15%		
PA management	Self-reported number (n) of patients assessed for PA.		Week 1	Week 16-18
	Self-reported number (n) of patients referred for PA provider.			

Table 27 Qualitative measures and data collection points

Qualitative measures	Measure	Baseline	Follow-up
PAAA Survey	• Self-reported attitudes & understanding of PA assessment and prescription.	Week 1	Week 16-18
Semi-structured interviews with practice personnel	• Conducted with a selection of practice personnel immediately following completion of the intervention (Week 18-20), and six months (Week 46-50) following the intervention. • Convenience sample of practice personnel selected to participate including: o *GP(s) who played an active role in the intervention.* o *Less connected GPs.* o *Reception/administrative staff.* o *PNs.* o *Figure 13 summaries the intervention protocol and timeline.* • Interviews followed a written interview guide designed to focus on areas of interest to the study (Appendix 19 developed using the Theoretical Domains Framework (TDF selected because of its capacity to integrate multiple behavioural determinants, across a range of scientific explanations for human behavior • Interviews were conducted face to face with participating practice personnel. • Each interview was audio-recorded and transcribed verbatim.	Week 18-20	Week 46-50
Direct and incidental observations	Observations undertaken to gather data: • Behaviours of practice personnel, • Intra and extra team interactions • Activities consummate with teamwork • Systems or processes in place or developed for the purpose of the intervention • Physical characteristics of the practice setting • Explore variability associated with, implementation of individual interventions. • Template was used to capture key observations and standardise across participating practices (Appendix 20)	Week 1, 2, 16-18, 18-20, 46-50	

5.10 Data handling and analysis

5.10.1 Qualitative

Observational data were recorded on five occasions throughout the study. Opportunities for observations were captured using the practice observation template (Appendix 20). Observations recorded included; the practice characteristics, facility, practice personnel, teamwork and intra-team interactions, access to the practices such as appointment types and billing, initiatives and incentives and referral pathways or networks in place. Table 27 provides an outline of the characteristics for participating practices across the following variables;

- Period the practice had been established for
- Geographical location and subsequent demography
- Description of the practice facility including the size of number of consultation rooms

Semi-structured interviews were conducted within four weeks following the completion of the intervention period (Interview-1), and six-months following completion of the intervention (Interview-2). See Table 27 for a summary of interview points.

Themes were developed based on social processes including; causes, contexts, contingencies, consequences, co-variances, and conditions to understand the patterns and relationships among these elements [529]. The QSR NVivo9 software research software was used to support the analysis of interview content obtained through the qualitative phases of the study. Thematic analysis was conducted following the framework analysis approach [466, 467]. Primarily, it was used to identify emergent themes from interview transcripts and additionally, for its ability to explore the implementation of the PA assessment, identifying variations in clinician experience and perspective rather than quantifying the frequency of themes/categories, as is the case with content analysis which was an alternative method of analysis [468]. GP and PN were analysed together. The student (SND) read and re-read all transcripts and coded emergent themes and subthemes. The transcripts were coded using the 18 theoretical domains and 112 constructs from the TDF [3, 4, 18, 39, 40]. The TDF was selected because of its capacity to integrate 33 constructs across 18 domains of behavioural determinants, covering the full range of scientific explanations for human behaviour (e.g. ‘Knowledge’, ‘Skills’, ‘Social/professional role and identity’ and ‘Beliefs about capabilities'). The coding was discussed with members of the research team and modified following discussions.

To ensure analytical rigour, a second iteration of this process was performed, with re-review of transcripts to identify any important quotes or subthemes missed or misallocated. It was noted whether subthemes arose solely by GPs, PNs or both. The final synthesis and interpretation involved considering each theme/domain and subtheme in the context of the whole set of interviews. The strongest domains were those mentioned by most clinicians; where the most sub-themes were developed; which were discussed at greatest length; and/or which were judged by the investigators to be invested with considerable intensity, passion, or sentiment by clinicians.

The GP from participating practices completed the PAAA survey at baseline and follow-up points, collecting basic demographic characteristics of the GP and self-reported changes in confidence and understanding of PA assessment and advice. Data was used to examine whether any patterns of preventive care improvements emerged according to practice location, size, and teamwork arrangements.

5.10.2 Quantitative

Clinical audit data were synthesised on a practice by practice basis to identify changes in data completeness. Measures for data completeness were used for the purpose of providing context to qualitative data and inform the interpretation of PA interventions implemented by each practice. To indicate if changes in data completeness occurred, the proportion and absolute change for each clinical marker, by practice and for each risk category (i.e. healthy, increased and high risk) was determined between baseline and follow-up points.

Data was collected from practices using the PEN CAT Audit Tool by the Health Promotion Officer from the Eastern Sydney Medicare Local. This staff member was trained in the use of the PEN CAT tool including extraction of de-identified data, transfer and aggregation of data. This staff member had previously received training in extraction and aggregation of data using this tool.

The IBM Statistical Package for Social Sciences (SPSS) Version 19 [488] was used to develop a database to store and analyse the data from the PEN CAT tool. All data was stored on password protected computer software and the paper originals in a secure, locked cabinet at the University of NSW, in line with ethical requirements.

5.10.3 Ethical approval

Ethical approval was obtained from the University of New South Wales Human Research Ethics Committee, approval number HC13127.

5.11 Results

The results have been presented in the following six sub-sections:

1. Key study milestones.
2. Practice characteristics.
3. Clinical audit outcomes.
4. Intervention design.
5. PAAA outcomes.
6. Semi-structured interviews.

5.11.1 Study milestones

The study period ranged from 29th September 2013 through to 17th September 2014. During this period, participating practices took part in seven key activities including; audit points, facilitation sessions, intervention implementation, audit reporting and semi-structured interview points. These have been outlined in Table 28 for participating practices.

Table 28 Key milestones for the study period for participating practices.

	Practice 1	Practice 2	Practice 3	Practice 4
Baseline audit & intervention facilitation #1	**Date**: 29th September 2013 • Baseline audit conducted. • Baseline PAAA data collected. • Resource pack distributed. • Practice facilitation with: GP (n=1), Reception (n=1), PN (n=1).	**Date**: 13th November 2013. • Baseline audit conducted. • Baseline PAAA data collected. • Resource pack distributed. • Practice facilitation with: GP (n=1), PS (n=1), PN (n=1).	**Date**: 31st October 2013. • Baseline audit conducted. • Baseline PAAA data collected. • Resource pack distributed. • Practice facilitation with: GP (n=1), PS (n=1), PN (n=1).	**Date**: 31st October 2013. • Baseline audit conducted. • Baseline PAAA data collected. • Resource pack distributed. • Practice facilitation with: GP (n=1), PS (n=1), PN (n=1).
Practice facilitation #2	**Date**: 6th November 2013. • Observational data collected.	**Date**: 15th November 2013. • Observational data collected.	**Date**: 7th November 2013. • Observational data collected.	**Date**: 6th November 2013. • Observational data collected.
Intervention implemented	**Date**: 24th October.	**Date**: 20th November 2013.	**Date**: 18th November 2013.	**Date**: 11th November 2013.
Follow audit	**Date**: 29th January 2014. • Follow-up audit. • Observational data collected. • Complete follow-up PAAA.	**Date**: 3rd February 2014. • Follow-up audit. • Observational data collected. • Complete follow-up PAAA.	**Date**: 29th January 2014. • Follow-up audit. • Observational data collected. • Complete follow-up PAAA.	**Date**: 20th January 2014. • Follow-up audit. • Observational data collected. • Complete follow-up PAAA.
Practice clinical audit report	**Date**: 13th February 2014. • Audit report delivered. • Semi-structured interviews: GP (n=1), Reception (n=1). • Observational data collected.	**Date**: 13th February 2014. • Audit report delivered. • Semi-structured interviews: GP (n=1), Reception (n=1). • Observational data collected.	**Date**: 7th February 2014. • Audit report delivered. • Semi-structured interviews: GP (n=1). • Observational data collected.	**Date**: 13th February 2014. • Audit report delivered. • Semi-structured interviews: GP (n=1), Reception (n=1). • Observational data collected.
Follow-up interview	**Date**: 17th September 2014. • Follow-up semi-structured interviews with: GP (n=1), Reception (n=1), PN (n=1).	**Date**: 24th September 2014. • Follow-up semi-structured interviews with: Reception (n=1), PN (n=1).	**Date**: 19th September 2014. • Follow-up semi-structured interviews with: GP (n=1), Reception (n=1).	**Date**: 17th September 2014. • Follow-up semi-structured interviews with: GP (n=1), Reception (n=2).

5.11.2 Characteristics of participating practices

Consenting practices included three large general practices (≥5 GPs) and one solo practitioner, which were made up of four GPs, two PNs and five reception/administrative personnel. There were a total of 19,812 patients represented by the four practices, with the mean patient population 4,953 (SD 1,809.4). Practice 4 recorded the highest patient population, understandably being the largest general practice, with seven GPs. In contrast, Practice 1 had the smallest patient population despite being a large general practice. This practice was established in 2011, the smaller population likely accounted for by this.

A summary of the practice characteristics is outlined in Table 29.This includes data reflecting the composition of participating general practices including personnel, methods used to communicate between personnel and evidence of teamwork.

Table 29 Characteristics of participating practices.

		Practice 1*	Practice 2*	Practice 3*	Practice 4*
Practice characteristics	**Practice established**	Established 2011	Established >40 years	Established >30 years	Established >20 years
	Geographic and demographic characteristics	• Located in the south eastern section of Randwick LGA. • LGA population profile: o 137, 757. o 1.3% ATSI [42].	• Located in the south eastern section of the Waverley LGA. • LGA population profile: o 63,486. o 0.4% ATSI [42]	• Located in the south eastern section of Randwick LGA. • LGA population profile: o 137, 757. o 1.3% ATSI [42].	• Located in the south eastern section of Randwick LGA. • LGA population profile: o 137, 757. o 1.3% ATSI [42].
	Patient population	At the time of this study: • Total patients= 3,222. • 52.8% female.	At the time of this study: • Total patients= 5,874. • 67.3% female.	At the time of this study: • Total patients=3,260. • 53.4 % female.	At the time of this study: • Total patients= 7,456. • 59.5 % female.
Facility	**Size**	• Accommodated ≤5 clinicians. • 1 room dedicated to PN services.	• Accommodated ≤6 clinicians. • Consultation rooms across 3 floors. • 1 room for PN or EP.	• Accommodated ≤1 GP. • No PN.	• Accommodated ≤5 clinicians. • No PN.
	Waiting area	• Seating for 10. • Adjacent to reception. • Patient education offered including: current brochures, posters & audio-visual program.	• Seating for 14. • 2 areas not located in proximity to reception. • Patient education offered including: current brochures & posters.	• Seating for 6. • Adjacent to reception • Patient education offered including: brochures & posters (some out-of-date).	• Seating for 12. • Adjacent to reception. • Patient education offered including: current brochures & posters.

Complete observational data templates for each practice are shown in Appendices 21, 23, 25 and 27

5.11.3 Description of personnel, communication and teamwork

Practice 1 was a relatively new general practice (established 2011), and without recognised methods of communicating between clinical personnel and reception/administrative personnel (Table 30).

In contrast Practice 2 had a total of 17 personnel, with six clinicians consulting from the premises at any one time. The size and variableness of personnel made it difficult to equitably distribute workload and communicate across the practice. Personnel did not meet as a group and relied on the practice manager as a conduit to communication between other staff. In addition, the facility was a converted residential building offering various rooms that had been converted to waiting areas, consultation, reception areas and administrative rooms, limiting intra-team communication and procedural flow (Table 30).

Practice 3 was a sole general practice with no PN and only two reception/administrative staff that shared the role. The practice had been established for more than 40 years, in the same location and same GP. The practice population had a slightly higher proportion of females (53.4%) and generally had a long standing relationship with the GP. The facility was small in size with one consultation room, waiting and reception area and separate room for storage. The practice was located in close proximity to suburban shops, transport and a local hospital (Table 30).

Practice 4 was considered a large general practice with seven GPs and found reception/administrative staff. The ratio of staff to patients was higher than the other group practices (1.0FTE:888). During the intervention implemented by Practice 4, reception/administrative personnel were responsible for distributing the GPPAQ questionnaire, as patients arrived for their consultation. It was evident from observations that reception/administrative staff had longstanding relationships with patients, some spanning more than 20 years allowing them to promptly troubleshoot queries arising from patients completing the questionnaire. Additionally, this approach served to fill time spent waiting for the GP consultation as the GP would often run late for appointments, sometimes as long as 1.15 hours (Table 30).

A summary of the practice structure, methods of communicating and evidence of teamwork is outlined in Table 30.

Table 30 Description of practice personnel, communication and teamwork

	Practice 1	Practice 2	Practice 3	Practice 4
Practice personnel	• Total = 12 • FTE=8.2 • GPs=4 • PNs=2 • Reception=4	• Total = 17 • FTE= 11.0 • GPs=8 • PNs=1 • Reception=7	• Total =3 • FTE= 2.0 • GPs=1 • PNs=N/A • Reception=2	• Total = 12 • FTE= 8.4 • GPs=7 • PNs=N/A • Reception= 4
Teamwork and intra-team interactions	• All staff meetings monthly. • Administrative meetings conducted weekly. • No formal method for clinician communication - relied on incidental communication between clinicians.	• No staff meetings. • PM responsible for communicating between clinicians and reception or administrative personnel. • Administrative meetings conducted weekly. • Clinical meetings – monthly.	• No staff meetings. • Clear delineation of GP role and reception or administrative staff role.	• Administrative meetings conducted weekly, conducted at regular calendared intervals. • Clinical meetings conducted monthly.

5.11.4 Description of methods for access and billing

Practice 1 was a relatively new general practice and did not have established methods of recalling patients or patient disease registers (Table 31). The demographic profile of the region surrounding this practice included high rates of socioeconomic disadvantage, incidence of chronic disease and lifestyle risk factors and representation from cultural sub-groups including the Aboriginal and Torres Strait Island community. This practice supported the needs of the patient population through relatively short wait time for appointments and for consultations. In addition, they offered bulk billing for all patients, and attempted to implement Indigenous Health Assessments offered through the Closing the Gap Medicare incentive program (Table 31) [241].

Practice 2 encouraged patients to make prior bookings, but accepted walk-in appointments which were scheduled in between established bookings. Impromptu appointments were common, with the practice accommodating up to six 'walk-in' appointments each day. The PN was impacted directly by these appointments, given her part-time employment status and large workload, and without the option of sharing responsibilities. She was often co-opted as a support for impromptu consultations such as; vaccinations, wound dressings, electro cardio graph (ECG) and spirometry (Table 31).

Practice 3 elected to identify patients for the intervention using an incidental approach. Despite having an electronic database and the option of establishing a patient register stratifying those to be assessed, the GP elected to implement the process incidentally rather than systematise the process. This was largely related to perceived barriers identified by the GP which included; time limitations, inadequate workforce uncertainty regarding what PA advice or referral options to provide and perceived lack of interest from patients (Table 31).

Practice 4 maintained a formal appointment system permitting drop-in consultations. However, the GP ran perpetually behind time for appointments, taking longer than the scheduled 20 minute consultation, subsequently wait time was used as a quarantined time for patients to self-complete the GPPAQ (Table 31).

A summary of methods used by practices to identify patients for the intervention is outlined in Table 31. Variables related to patient access have also been considered including billing, wait time and appointment booking policies.

Table 31 Description of methods of access and billing for participating practices.

	Practice 1	Practice 2	Practice 3	Practice 4
Access	• Accepted impromptu, 'walk-in' appointments. • Pre-scheduled appointments 1-2 days. • Waiting periods on the day of an appointment 10 - 45 minutes. • No formal disease registers or formal recall and reminder systems in place.	• Accepted impromptu, 'walk-in' appointments and scheduled in-between previously scheduled appointments (up to 6/day). • Pre-scheduled appointments 2-3 days. • Waiting periods on day of appointment 15 – 60 mins. • Patient disease registers for: o Cervical screening. o Vaccinations. o GPMP/TCA. o Health assessments. o Diabetes cycle of care.	• Pre-scheduled appointments only. • Pre-scheduled appointments 5-7 days. • Home visits and consultations at local residential aged care facilities offered to existing patients. • Waiting periods on day of appointment 30- 75 mins. • No formal disease registers or formal recall and reminder systems in place.	• Pre-scheduled appointments 5-7 days. • Home visits and consultations at local residential aged care facilities for existing patients. • Pre-scheduled appointments usually available within 5-7 days. • Waiting periods on day of appointment 30- 75 mins. • Patient disease registers for: o Cervical screening. o Vaccinations. o Health assessments.
Billing	• Bulk-billing only.	• Private billing. • Discretional bulk billing.	• Private billing. • Discretional bulk billing.	• Private billing. • Discretional bulk billing.

5.11.5 Description of initiatives implemented & provider networks

Practice 1 used an incidental/blanket approach to implement the intervention and where applicable linked the intervention to Medicare financial incentives such as the Indigenous Health Assessment, GP Management Plans and Team Care Arrangements however they were unable to systemically link the PA intervention with these initiatives, without a robust patient database [2]. Prior to participation in this study, this practice relied on referring patients to public hospital based services, for PA behaviour change. Following completion of the study, the practice had identified several community based and PA focused services/providers (Table 32).

Practice 2 systematically implemented a range of initiatives including; Medicare Service Incentive Program (SIP) for cervical screening and Type 2 diabetes, 4 year old health check, GP management plans, Team care arrangements and 75 year old health checks. Prior to participation in this study, Practice 2 had limited referral pathways for PA behaviour change, predominantly focused on referrals to exercise physiologist co-located at the practice. Following participation in this study, the practice generated an increase the volume of referrals to the co-located exercise physiologist from the intervention (Table 32).

Practice 3 participated in a range of initiatives using incidental methods of implementation. Examples include: GP Management Plans, Team Care Arrangement, vaccination reminders for children and vaccinations for patients aged 75 years and older. The practice was unable to systematically link the PA intervention with these initiatives. This practice had established referral networks with local public hospital based services; however participation in the study did not appear to generate referrals beyond these pathways (Table 32).

Practice 4 regularly prepared GP Management Plans, Team Care Arrangements and a range of health assessments. This practice had previously established pathways with public hospital services including medical specialists and outpatient clinics. Additional pathways were established with private allied health professionals for the following services; Psychology, Podiatry, Dietetics and Physiotherapy (Table 32).

A summary of initiatives and/or incentive programs in place within each practice was recorded in addition to networks or links with external providers was collated at baseline and follow-up points (Table 32)

Table 32 Description of initiatives implemented by participating practices and networks with external providers.

	Practice 1	Practice 2	Practice 3	Practice 4
Initiatives/incentive programs in place	• Incidental (not planned care) Medicare incentives: o GPMP and TCA. o Aboriginal Health Assessments.	• Planned care approach to Medicare incentives: o GPMP and TCA. o Cervical SIP. o Diabetes SIP. o Health assessments.	• Incidental (not planned care) Medicare incentives: o GPMP and TCA. o Vaccinations.	• Planned care approach to Medicare incentives: o Cervical screening. o Vaccinations. o Health Assessments. o Incidental (not planned care) for GPMP/TCA.
Networks or links established	**Pre intervention:** • Public hospital based services e.g. medical specialists & outpatient clinics. **Post intervention:** • Network of local private AHPs and community based services. Including an EP for referral of patients using TCA.	**Pre intervention:** • Public hospital based services e.g. Medical specialists & outpatient clinics. • In-house EP, with limited referrals. **Post intervention:** • Network of local private AHPs and community based services. • Referrals to on-site EP.	**Pre intervention:** • Public hospital based services e.g. Medical specialists & outpatient clinics. • Selection of AHPs e.g. Physiotherapy, Dietetics, Podiatry and Psychology. **Post intervention** • Referrals to local facilities and services offering free access.	**Pre intervention:** • Public hospital based services e.g. medical specialists & outpatient clinics. **Post intervention** • Network of local private AHPs and community based services, including EP for referral of patients using TCA.

5.11.6 Observed barriers to implementation of the intervention

A range of barriers were identified as inhibiting the implementation of the PA intervention, for each practice. The following is a summary of barriers identified within participating practices. This is supplemented by the information presented in Table 33.

As a relatively new service, Practice 1 did not have a comprehensive patient database and no formal follow-up process for tracking patient PA behaviour change. Through participation in this study, the practice acknowledged the need to establish formal processes tracking and monitoring patient progress such as disease registers, recall and reminder systems (Table 33).

Practice 2 described lack of time and difficulty communicating with patients as barriers to implementing PA behaviour change, at both baseline and follow-up points. Additionally, the practice experience limitations with intra-team communication due to the (large) size and composition of the practice. Limitations with communication were escalated with a lack of formal mechanisms such as team meetings (Table 33).

Practice 3 expressed lack of patient interest as a key barrier to implementing PA behaviour change, which subsequently influenced the design of the PA intervention. Additionally, Practice 3 described uncertainty regarding what PA advice to provide, or the types of referral options for those assessed as insufficiently active (Table 33).

Lack of time was raised as a key barrier to the implementation of PA assessment for Practice 4. Facilitation and observational data identified significant wait timed for patients waiting for appointments. This influenced the intervention design with the practice keen to utilise the time spent in the waiting area efficiently, by completing the GPPAQ prior to their appointment with the GP (Table 33).

A summary of observed barriers to the implementation of each intervention, for each practice has been outlined in Table 33.

Table 33 Observed barriers to implementation of the intervention.

	Practice 1	Practice 2	Practice 3	Practice 4
Observed barriers	• No formal follow-up process in place for tracking patient PA behaviour change progress. • Practice acknowledged the need to establish formal processes tracking and monitoring patient progress such as disease registers, recall and reminder systems.	• Limited intra-team communication. • Dysfunctional communication between GPs, PNs and reception staff, compounded by size and variety of shifts amongst personnel. • High number of impromptu appointments each day. PN directly impacted by impromptu appointments, created fragmented environment.	• GP expressed cynical outlook on patient behaviour change. Not particularly optimistic that intervention would produce changes, except amongst patients with a history of compliance.	• GP runs perpetually late for scheduled appointment times.

5.11.7 Clinical Audit Results

5.11.7.1 All practices

Data has been presented as both absolute and proportion changes for data completeness, between baseline and follow-up for audit measures achieving ≥10% improvement (Figure 14 and Table 34).

Practice 1 demonstrated improvements in data completeness for all patients, with a mean change of 9.1%. This practice had varied changes in absolute values across measures for all patients, in this risk category. Values ranged from 3.7% (n=118) for FBG through to reductions in data completeness for LDL (n=-40) and waist circumference (n=-1) measures (Table 34).

Practice 2 demonstrated a slight reduction in data completeness for all patients (-2.2%), between baseline and follow-up points. Changes in absolute values between baseline and follow-up varied. Most notable reductions were evident for Triglycerides (n=-62) and closely followed by HDL (n=-61) and LDL (n=-61) cholesterol measures. There was a slight increase in absolute change for absolute CV risk (0.4%, n=23) (Table 34).

Practice 3 demonstrated improvements in data completeness for most clinical markers, across all patients (14.9), between baseline and follow-up points. This practice demonstrated an increase in absolute values across all measures, however the range of improvements varied from 1.5% (n=48) for BP, through to 0.1% (n=2) for absolute CV risk (Table 34).

Practice 4 demonstrated improvements in data completeness for most of the clinical markers between baseline and follow-up points. This practice had varied changes in absolute values varied across measures for all patients, ranging from 1.2% (n=90) for FBG, through to reductions in data completeness for HDL (n=-43) (Table 34).

Table 34 shows baseline and follow-up outcome measures, including the mean changes in data completeness, expressed as a percentage of the change and absolute change. The data represents complete data for all patients across participating practices. Figure 14 shows the number of audit measures achieving ≥10% improvement, for all patients, across participating practices

Figure 14 Number of audit measures achieving ≥10% improvement, for all patients, across participating practices.

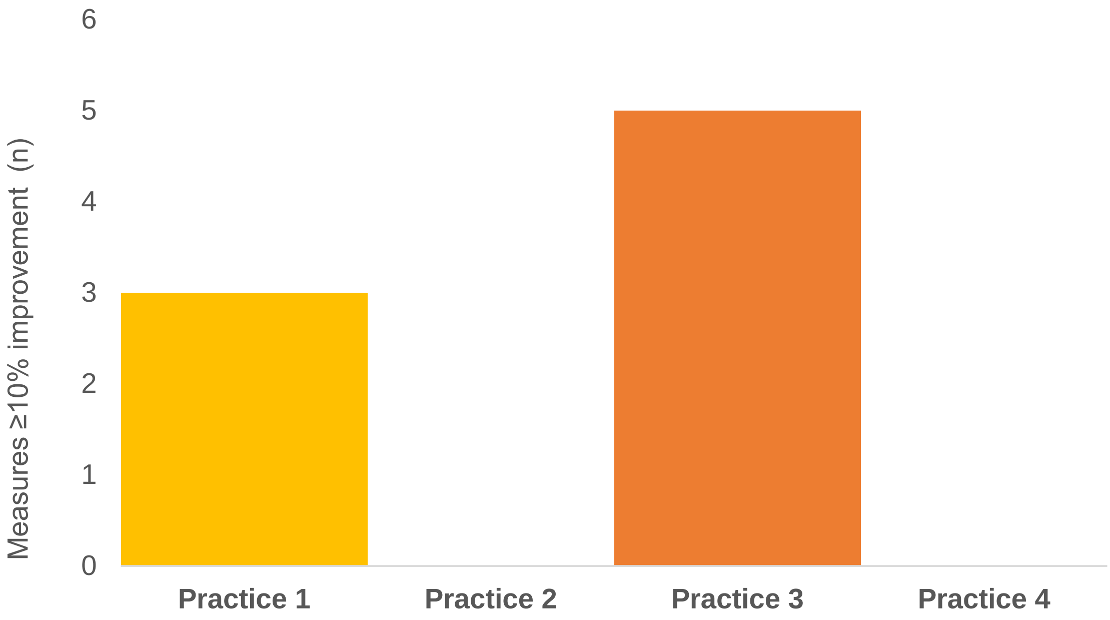


Table 34 Baseline, follow-up measures and number measures with improvements ≥10%, for participating practices - all patients risk range.

All patients (n)																
	Practice 1 (n=3222)				Practice 2 (n=5874)				Practice 3 (n=3260)				Practice 4 (n=7456)			
	BL	FU	% △*	Abs	BL	FU	% △*	Abs	BL	FU	% △*	Abs	BL	FU	% △*	Abs
Waist past 12 mths	14	13	-7.1	-1.0	321	315	-1.9	-6.0	68	74	8.8	6.0	42	46	9.5	4.0
BMI [A] past 12 mths	375	469	25.1	94.0	2203	2203	0.0	0.0	460	476	3.5	16.0	1398	1418	1.4	20.0
BP [B] (Pts w/o hypertension) past 12 mths	1093	1200	9.8	107.0	2912	2858	-1.9	-54.0	1010	1058	4.8	48.0	2878	2849	-1.0	-29.0
BP [B] (Pts with HT) past 12 mths	268	289	7.8	21.0	354	350	-1.1	-4.0	320	334	4.4	14.0	537	529	-1.5	-8.0
HDL [C] past 12 mths	609	658	8.0	49.0	1081	1020	-5.6	-61.0	22	29	31.8	7.0	1278	1235	-3.4	-43.0
LDL [D] past 12 mths	603	563	-6.6	-40.0	1078	1017	-5.7	-61.0	21	28	33.3	7.0	1246	1231	-1.2	-15.0
Triglycerides past 12 mths	614	667	8.6	53.0	1112	1050	-5.6	-62.0	48	59	22.9	11.0	1305	1291	-1.1	-14.0
Absolute CV [E] risk(past 2 yrs	307	364	18.6	57.0	935	958	2.5	23.0	20	22	10.0	2.0	341	367	7.6	26.0
FBG [F] past 3 yrs	681	799	17.3	118.0	1335	1327	-0.6	-8.0	40	46	15.0	6.0	1352	1442	6.7	90.0
Audit measures with ≥10% improvement (n)	-	-	**3**	-	-	-	**0**	-	-	-	**5**		-	-	**0**	-

Footnotes 1 for Table 34

*% change was calculated by determining the proportion change from baseline to follow-up points

Abs: Absolute　△: Change　BL: Baseline　FU: Follow-up

A: Body mass index　B: Blood pressure　C: High density lipoprotein

D: Low density lipoprotein　E: Cardiovascular　F: Fasting blood glucose

5.11.7.2 Healthy risk range

Data has been presented as both absolute and proportion changes for data completeness, between baseline and follow-up for audit measures achieving ≥10% improvement (Figure 15 and Table 35).

For the healthy risk range, practice 1 demonstrated an increase in data completeness for all measures, with the exception of waist circumference. Between baseline and follow-up audit, the highest mean change in data completeness was observed for BMI (0.8%, n-3,222), Absolute CV Risk (0.5%, n=3,222) and Triglyceride measures (0.5%, n=3,222), respectively (Table 35). The lowest difference was observed for cholesterol measures, with a mean change of 0.3% (n=3,222) (Table 35). This practice demonstrated an increase in absolute values across most measures however the range of improvements varied from 3.9% (n=125) for BP and 3.5% (n=114) for HDL, however values for waist circumference were negligible (n=-1) (Table 35).

There were little or no changes in data completeness between baseline and follow-up for practice 2. Some markers showed small reductions in data completeness, with the most notable being BP (-1.2%, n=5874) (Table 35). Absolute values for this practice were variers between baseline and follow-up. The greatest improvement was observed for absolute CV risk (n=20), whereas absolute values for BP reduced (n=-73) (Table 35).

Practice 3 demonstrated increases in data completeness for all measures within the healthy target range. Between baseline and follow-up audit, the highest mean change was observed for BP (1.7 %, n=3,260) and BMI (1.3%, n=3,260). There were small increases in the remaining variables (Table 35). This practice demonstrated an increase in absolute values across all measures however the range of improvements varied from 1.7% (n=57) for BP and 1.3% (n=43) for BMI, through to 0.1% (n=2) for LDL cholesterol (Table 35).

Within the ‘Healthy risk’ category, practice 4 demonstrated increases in data completeness for all measures, with the exception of waist circumference. Between baseline and follow-up audit, the highest mean change was observed for Triglycerides (1.2%, n=7,456), and HDL Cholesterol (1.1%, n=7,456), followed by FBG (1.0%, n=7,456) (Table 35). Figure 15 shows the number of audit measures that achieved

≥10% improvement, for patients within the healthy risk range. Absolute values for this practice varied between measures ranging from 1.1% (n=87) through to a reduction in data completeness for waist circumference (n=-1) (Table 35).

Figure 15 Number of audit measures achieving ≥10% improvement, for patients in the healthy risk range, across participating practices.

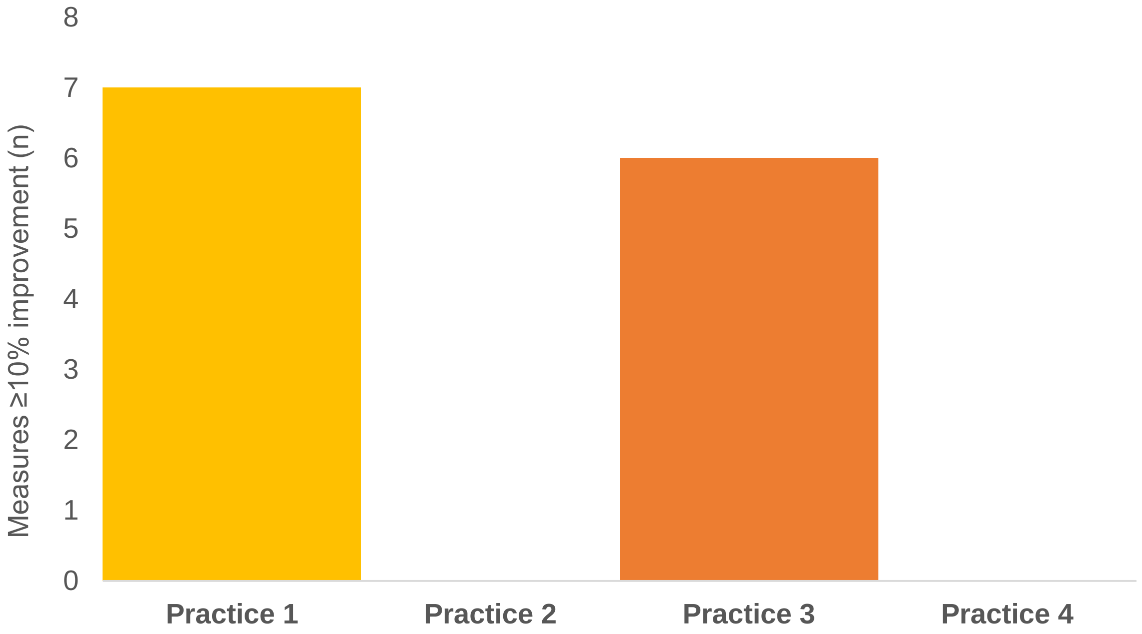


Table 35 Baseline, follow-up measures and number measures with improvements ≥10%, for participating practices - healthy risk range.

Healthy Risk Range																
	Practice 1 (n=3,222)				Practice 2 (n=5,874)				Practice 3 n=3260				Practice 4 n=7456			
	BL (n)	FU (n)	% △*	Abs	BL (n)	FU (n)	%△*	Abs	BL (n)	FU (n)	% △*	Abs	BL (n)	FU (n)	% △*	Abs
BP [A] < 140/90 past 12 mths	1114	1239	10.1	125	3474	3401	-2.1	-73	1282	1339	4.4	57	3344	3397	1.6	53
Cholesterol < 4 mmol/L past 12 mths	118	130	9.2	12	217	218	0.5	1	70	79	12.9	9	327	339	3.7	12
Triglycerides < 2 mmol/L past 12 mths	608	712	14.6	104	2002	1990	-0.6	-12	86	100	16.3	14	1734	1821	5	87
HDL [B] > 1.0 mmol/L past 12 mths	656	770	14.8	114	2100	2093	-0.3	-7	61	71	16.4	10	1735	1818	4.8	83
LDL [C] < 2.5 mmol/L past 12 mths	197	219	10	22	598	596	-0.3	-2	32	34	6.3	2	539	592	9.8	53
Waist [D]; <94cm male, <80cm female past 12 mths	3	2	-50	-1	290	297	2.4	7	8	11	37.5	3	15	14	-6.7	-1
BMI [E] (18.5 to 24.9) past 12 mths	85	114	25.4	29	1291	1288	-0.2	-3	205	248	21	43	510	516	1.2	6
FBG [F] (<5.5 mmol/L) past 3 yrs	550	633	13.1	83	1269	1288	1.5	19	31	34	9.7	3	1144	1222	6.8	78
Absolute CV [G] risk (<10%) past 2 yrs	239	286	16.4	47	848	868	2.4	20	9	12	33.3	3	296	325	9.8	29
Audit measures ≥10% improvement (n)	-	-	7	-	-	-	0	-	-	-	6	-	-	-	0	-

Footnotes 2 for Table 35

*% change was calculated by determining the proportion change from BL to FU points

Abs: Absolute   △: Change   BL: Baseline   FU: Follow-up

A: Body mass index   B: Blood pressure   C: High density lipoprotein   D: Low density lipoprotein   E: Cardiovascular   F: Fasting blood glucose

5.11.7.3 Increased risk range

Data has been presented as both absolute and proportion changes for data completeness, between baseline and follow-up for audit measures achieving ≥10% improvement (Figure 16 and Table 36).

Practice 1 demonstrated increases in data completeness observed across most variables, within the increased risk range. The highest mean change was observed for BMI (0.7%, n=3,222) and FBG (0.7%, n=3,222) measures, and lowest observed for blood pressure (0.1%, n=3,222) (Table 36). This practice demonstrated an increase in absolute values across all measures for this risk category, however the range of improvements varied from 3.2% (n=103) for Cholesterol, through to negligible change for both waist circumference (n=0) and absolute CV risk (n=1) (Table 36).

As with the healthy target range data, data completeness for measures for practice 2, within the increased risk range showed no improvements (Table 36). There a relatively large decrease in data completeness triglycerides (-35.4% n=5874) between baseline and follow-up. Other measures showed smaller decreases in data completeness including LDL Cholesterol measures (8.4%, n=5874) and waist circumference (5.1%, n=5874) (Table 36). Absolute values for this practice demonstrated reductions in data completeness for most measures in this risk category. The largest change occurred for Triglycerides (n=2077), through to Cholesterol (n=12) (Table 36).

There were increases in data completeness observed for practice 3 across all variables within the increased risk range, except for absolute CV risk (baseline to follow-up) (Table 36). The highest mean change was observed for BMI (3.8%, n=3,260). Conversely, the lowest mean change was observed for BP, triglycerides and FBG (0.1%, n=3260) (Table 36). This practice demonstrated an increase in absolute values across most measures however the range of improvements varied from 3.8% (n=123) for BMI through to a small reduction in absolute CV risk (n=-1) (Table 36).
For the ‘Increased risk range’, practice 4 demonstrated increases in data completeness between baseline and follow-up points, for five of the eight variables (Table 36). Of those that showed an increase in data completeness, cholesterol (Total Cholesterol and LDL) showed the highest mean change with 0.6% and 0.4% respectively (n=7,456). Figure 16 shows the number of audit measures that achieved ≥10% improvement, for patients in the increased risk range, across participating practices.

Absolute values for this practice varied between measures ranging from 0.6% (n=47) for Cholesterol through to a reduction in data completeness for BP (n=-34) (Table 36).

Figure 16 Number of audit measures achieving ≥10% improvement, for patients in the increased risk range, across participating practices.

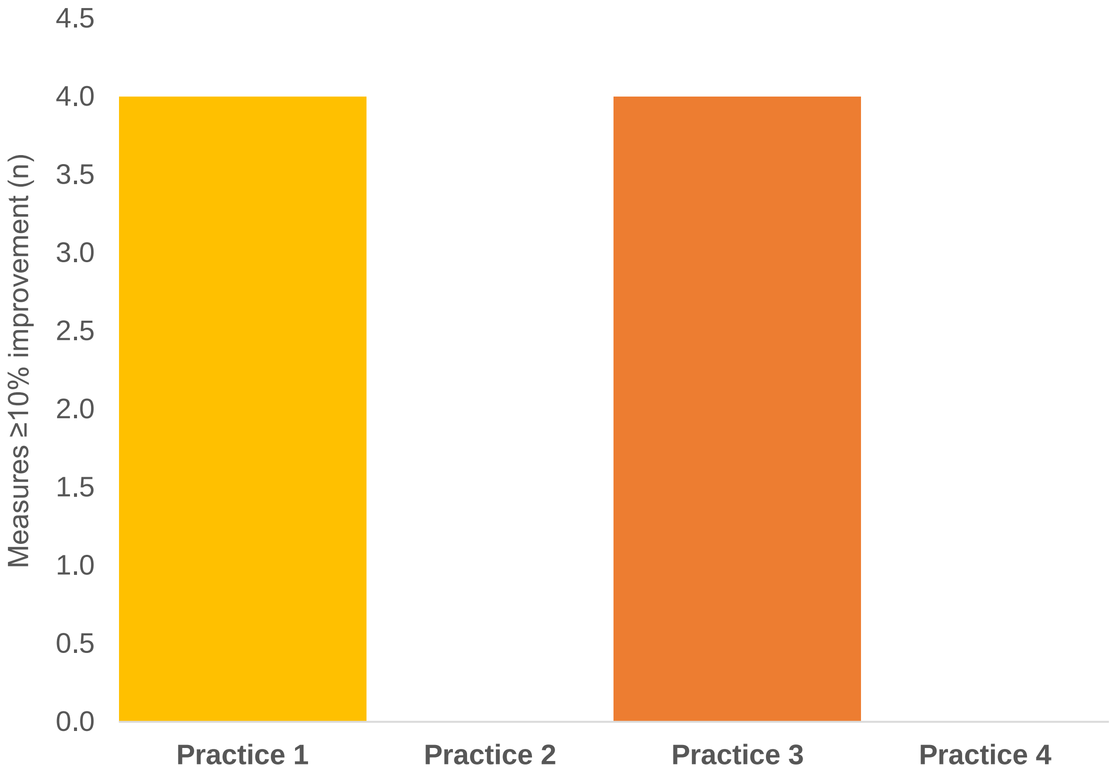


Table 36 Baseline, follow-up measures and number measures with improvements ≥10%, for participating practices - increased risk range.

Increased risk range																
	Practice 1 (n=3,222)				**Practice 2 (n=5,874)**				**Practice 3 n=3260**				**Practice 4 n=7456**			
	BL (n)	FU(n)	% △*	Abs	BL (n)	FU (n)	% △*	Abs	BL (n)	FU (n)	% △*	Abs	BL (n)	FU (n)	% △*	Abs
BP [A] (>140/90) past 12 mths	255	267	4.5	12.0	473	456	-3.6	-17.0	426	430	0.9	4.0	587	553	-5.8	-34.0
Cholesterol ≥ 4 past 12 mths	616	719	14.3	103.0	2028	2016	-0.6	-12.0	207	227	9.7	20.0	1867	1914	2.5	47.0
Triglycerides > 2 mmol/L past 12 mths	124	135	8.1	11.0	2312	235	-89.8	-2077.0	18	22	22.2	4.0	169	165	-2.4	-4.0
LDL [B] >2.5 past 12 mths	523	613	14.7	90.0	1592	1099	-31	-493.0	37	45	21.6	8.0	1284	1313	2.3	29.0
Waist [C]; ≥ 94cm male, ≥ 80cm female past 12 mths	11	11	0	0.0	460	253	-45	-207.0	68	73	7.4	5.0	59	63	6.8	4.0
BMI [D] (25 to 29.9) past 12 mths	85	110	22.7	25.0	689	388	-43.7	-301.0	154	277	79.9	123.0	265	277	4.5	12.0
FBG [E] (5.5 – 7 mmol/L) past 3 yrs	100	130	23.1	30.0	257	136	-47.1	-121.0	14	17	21.4	3.0	229	241	5.2	12.0
Absolute CV[F] risk (10-15%) past 2 yrs	35	36	2.8	1.0	37	5	-86.5	-32.0	5	4	-20	-1.0	19	18	-5.3	-1.0
Audit measures with ≥10% improvement in data completeness (n)	-	-	**4**		-	-	0	**-**	-	-	**4**		-	-	**0**	-

Footnotes 3 for Table 36

*% change was calculated by determining the proportion change from baseline to follow-up points

Abs: Absolute   △: Change   BL: Baseline   FU: Follow-up

A: Body mass index   B: Blood pressure   C: High density lipoprotein

D: Low density lipoprotein   E: Cardiovascular   F: Fasting blood glucose

5.11.7.4 High risk range

Data has been presented as both absolute and proportion changes for data completeness, between baseline and follow-up for audit measures achieving ≥10% improvement (Figure 17 and Table 37).

The greatest improvement in data completeness for practice 1 was observed for the high risk category of patients with a 13.5% improvement in data completeness, between baseline and follow-up points (Table 37). Absolute CV risk showed the greatest mean change (0.8%, n=3,222) for patients in this criteria. There was no change to waist circumference at baseline or follow-up points (Table 37). This practice demonstrated an increase in absolute values across most measures for this risk category, with improvements range from 0.5% (n=16) for BMI to nil for waist circumference (n=0) (Table 37).

Practice 2 showed slight increases in data completeness observed for two of the four measures within the high risk category, between baseline and follow-up audit points. Absolute CV Risk demonstrated the highest mean change, with an increase of 0.2% (n=5874) in patients within this criteria, followed by BMI, which increased by 0.1% (n=5874) (Table 37). Absolute values for this practice demonstrated varied changes in data completeness for most measures in this risk category. The largest change occurred for BMI (n=9), through to a reduction in data completeness for waist circumference (n=-4) (Table 37).

Practice 3 demonstrated increases in data completeness for all three variables within the high risk range category. The highest mean change in data completeness was observed for BMI (0.3, n=3260) (Table 37). This practice demonstrated an increase in absolute values across most measures in this risk category, with changes ranging from 0.3% (n=11) for BMI, through to nil change for absolute CV risk (n=0) (Table 37).

Data completeness for practice 4 remained relatively stable for measures within the ‘High risk range, with negligible changes across most variables. The exception was waist circumference, which demonstrated a 6.8% improvement in data completeness between baseline and follow-up points (Table 37). Change in absolute values for this practice were small with the largest change observed for waist circumference (n=3) and a reduction for BMI (n=-3) (Table 37). Figure 17 shows the number of audit measures that achieved ≥10% improvement, for patients in the high risk range.

Figure 17 Number of audit measures achieving ≥10% improvement, for patients in the high risk range, across participating practices.

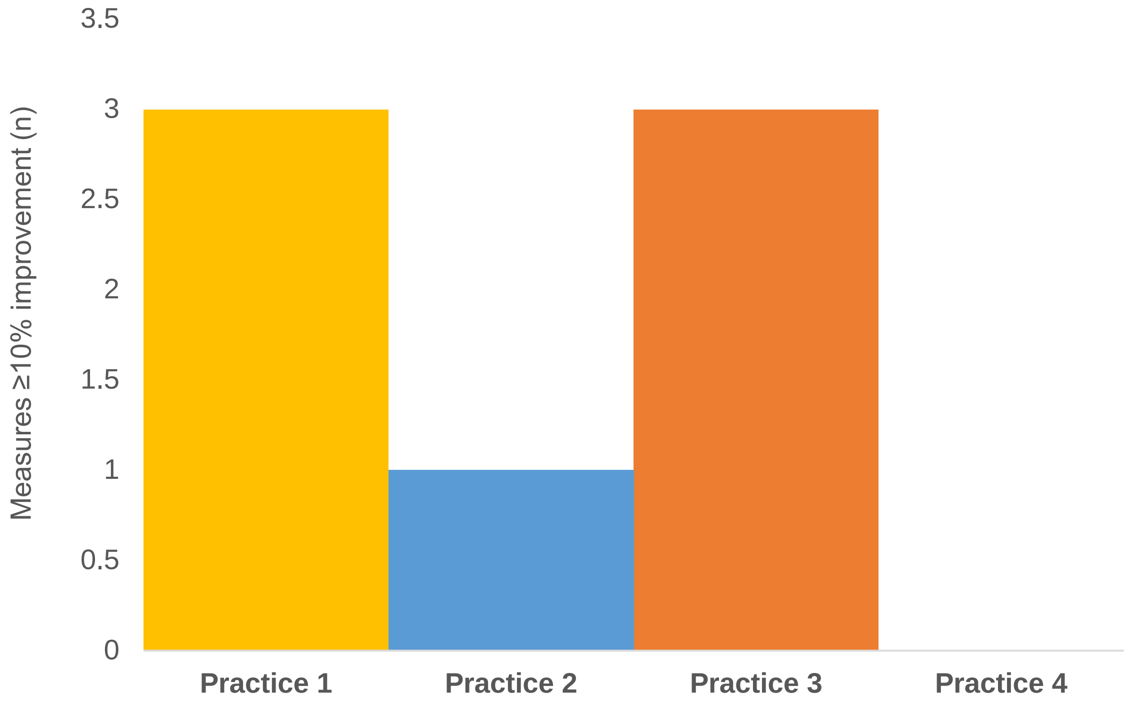


Table 37 Baseline, follow-up measures and number measures with improvements ≥10%, for participating practices - high risk range.

High Risk Range																
	Practice 1 (n=3,222)				**Practice 2 (n=5,874)**				**Practice 3 (n=3260)**				**Practice 4 (n=7456)**			
	BL (n)	FU (n)	% △*	Abs	BL (n)	FU (n)	% △*	Abs	BL (n)	FU (n)	% △*	Abs	BL (n)	FU (n)	% △*	Abs
Waist [A] (≥ 102cm male, ≥ 88cm female) past 12 mths	9	9	0	0	233	229	-1.7	-4.0	37	41	10.8	4.0	44	47	6.8	3.0
BMI [B] (≥ 30) past 12 mths	107	123	13	16	284	293	3.2	9.0	159	170	6.9	11.0	140	137	-2.1	-3.0
FBG [C] (> 7.0 mmol/L) past 3 yrs	31	36	13.9	5	51	50	-2	-1.0	4	8	100	4.0	52	53	1.9	1.0
Absolute CV [D] risk (>15%) past 2 yrs	33	42	21.4	9	50	55	10	5.0	6	6	0	0.0	26	24	-7.7	-2.0
Audit measures with ≥10% improvement in (n)	-	-	**3**	-	-	-	**1**	**-**	-	-	**2**	-	-	-	**0**	-

Footnotes 4 for Table 37
*% change was calculated by determining the proportion change from baseline to follow-up points

Abs: Absolute   △: Change   BL: Baseline   FU: Follow-up
A: Body mass index   B: Blood pressure   C: High density lipoprotein
D: Low density lipoprotein   E: Cardiovascular   F: Fasting blood glucose

5.11.7.5 PA management activity

Changes in the frequency of self-reported PA assessment and referral between baseline and follow-up have presented in Figure 18 and 19 respectively and discussed in the proceeding section.

Practice 1 demonstrated the greatest absolute improvement (13.6%, n=3222) in PA assessments between baseline and follow-up points, followed by practice 2 (7.6%, n=5874) and then practice 4 (4.4%, n=7456). The smallest improvement for PA assessment was observed for practice 3 with a 1.7% (n=3,260) increase in PA assessment between baseline and follow-up points.

All practices demonstrated improvements in the frequency of referrals to PA providers between baseline and follow-up points. Practice 2 showed the largest absolute change with a 6.8% (n=5874) in number of referrals, closely followed by practice 1 (6.8%, n=3222), practice 4 (2.9%, n=7456) and then practice 3 (1.4%, n=3,260). Figure 18 shows the frequency of self-reported PA assessment between baseline and follow-up points, for participating practices. Figure 19 demonstrates the frequency of self-reported PA referral to PA providers, by practice between baseline and follow-up points.

Figure 18 Frequency of self-reported physical activity assessment by each practice, at baseline and follow-up.

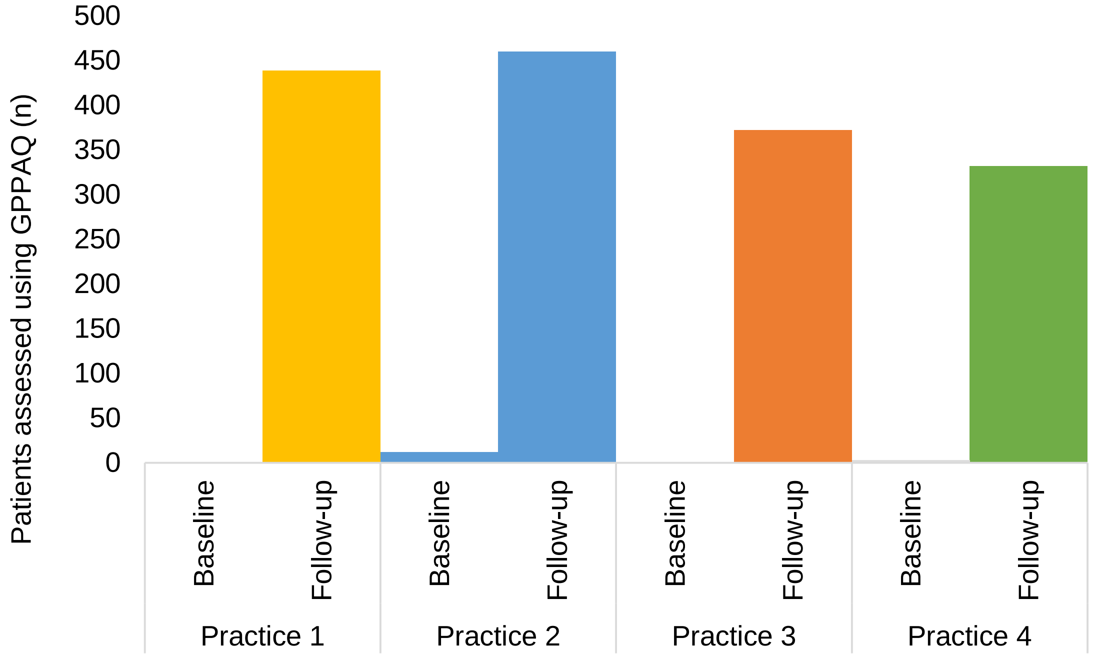
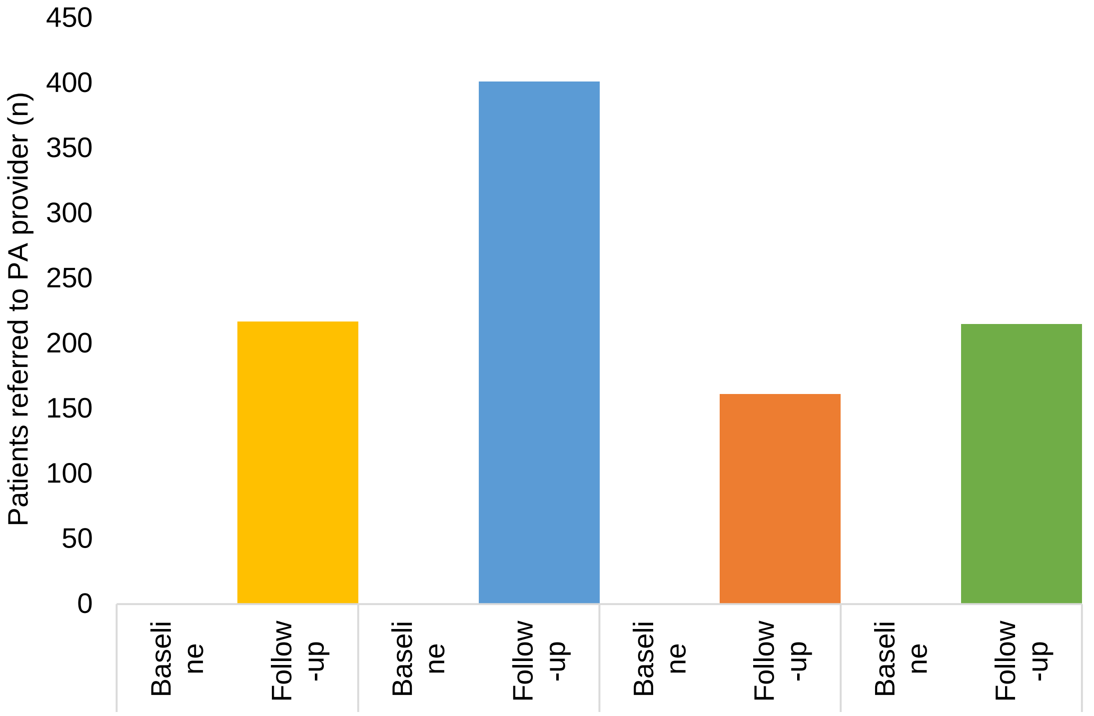


Figure 19 Frequency of self-reported physical activity referral to providers, by practice, at baseline and follow-up.



5.11.8 Intervention

Each practice developed an individually tailored intervention, based on the framework provided during the facilitation visits. Approaches implemented by participating practices varied across a range of variables including; the patient target population, approach and flow of the intervention including the points at which resources were integrated into the intervention, personnel involved and follow-up procedures, if any. Key elements of the interventions implemented by each practice have been outlined in Table 38. A detailed roadmap for each intervention has been provided for participating practices in Appendices 22, 24, 26 and 28.

Table 38 Key intervention features for participating practices.

	Practice 1	Practice 2	Practice 3	Practice 4
Patient target population & approach implemented	• Blanket-style approach targeting all patients. • Appendix 21 and 22 observation template and intervention roadmap.	• Select approach amongst a identified patients, stratified using Medicare chronic disease criteria [241, 311]. • Appendix 23 and 24 observation template and intervention roadmap.	• Discretionary approach. • GP opportunistically identified patients considered likely to make PA behaviour changes. • Appendix 25 and 26 observation template and intervention roadmap.	• Blanket-style approach targeting all patients. • Appendix 27 and 28 observation template and intervention roadmap.
Intervention flow & personnel involved	• All patients arriving for self-completed GPPAQ, and returned to the reception staff, prior to GP consultation. • Reception staff distributed GPPAQ to patients as they arrived, collection and storage once complete. • PA discussion at the discretion of GP.	• Practice staff conducted a search of the patient database to identify eligible patients and added a reminder to conduct the PA assessment. • Eligible patients were assessed at next consultation. • PN conducted GPPAQ with patient, prior to GP consultation and with other clinical e.g. BP, INR tests.	• When a patient was deemed suitable for assessment, the GP and patient co-completed the GPPAQ, during the consultation. • ESSA Fact sheets were distributed to the patient with as copy of the PA service directory. • Patients were instructed to select a PA service/provider of their choice, using directory.	• All patients self-completed GPPAQ, and returned to the reception staff. • Reception staff distributed GPPAQ to patients as they arrived, collection and storage once complete. • GP distributed ESSA resources and referred using directory.
Follow-up	• No formal follow-up procedure. • GPs used reports from AHPs or medical specialists to monitor progress.	• Follow-up process integrated within GPMP and TCA process.	• No formal follow-up procedure. • The GP relied on established relationships with patients to discussion progress.	• No formal follow-up procedure.

5.11.9 Physical Activity Assessment and Advice Survey results

The GP from each practice completed the PAAA survey, at baseline and follow-up points. Most GPs indicated a positive change in confidence related to PA assessment, advice and/or referral between baseline and follow up points and subsequent improvements to confidence in relation to understanding of the PA Guidelines, conducting PA assessment and/or referral, with the exception of the GP from Practice 3.

Access to relevant patient education material appeared a common challenge for participating practices, prior to participation in the intervention, but showed improvement at follow-up. Similarly, identifying appropriate PA services and providers were considered a barrier to PA referral prior to participation in the study, improving at baseline for Practices 1 and 4.

Workforce capacity and lack of time were listed as the most limiting factors to implementation, followed by the availability of financial reimbursements and perceived lack of interest from patients,

A comparison of baseline and follow-up outcomes for each practice, across the four key variables within the PAAA; PA behaviour change activity, confidence in PA assessment/referral, resourcing PA behaviour change interventions and barriers to uptake of PA intervention, have been outlined in Table 39 and 40.

Table 39 PAAA Results - behaviour change, confidence and resources for uptake of physical activity intervention.

		Practice 1		Practice 2		Practice 3		Practice 4	
		Baseline	**Follow-up**	**Baseline**	**Follow-up**	**Baseline**	**Follow-up**	**Baseline**	**Follow-up**
PA behaviour change activity	**PA assessment**	Sometimes	Sometimes	Often	Often	Sometimes	Sometimes	Usually	Usually
	Refer to RACGP Red Book	Rarely	Rarely	Always	Always	Rarely	Rarely	Sometimes	Sometimes
	Advise about PA	Sometimes	Sometimes	Always	Always	Sometimes	Sometimes	Usually	Usually
	Difficulty finding PA providers to refer to	Often	Sometimes	Sometimes	Sometimes	Often	Often	Half the time	Sometimes
Confidence in PA	**Assessment**	Somewhat confident	Moderately confident	Somewhat confident	Very confident	Somewhat confident	Somewhat confident	Moderately confident	Very confident
	Understanding guidelines	Minimally confident	Somewhat confident	Somewhat confident	Very confident	Somewhat confident	Somewhat confident	Somewhat confident	Very confident
Resourcing PA behaviour change interventions	**Inadequate patient education material**	Moderately important	Moderately important	Somewhat important	Somewhat important	Very important	Moderately important	Somewhat important	Not very important
	Financial incentives	Somewhat important	Moderately important	Moderately important	Moderately important	Somewhat important	Not very important	Somewhat important	Not very important

Table 40 Physical Activity Assessment and Advice results - barriers to uptake of physical activity intervention.

		Practice 1		Practice 2		Practice 3		Practice 4	
		Baseline	**Follow-up**	**Baseline**	**Follow-up**	**Baseline**	**Follow-up**	**Baseline**	**Follow-up**
Barriers	**Lack of time**	Very important	Very important	Very important	Very important	Somewhat important	Moderately important	Moderately important	Very important
	Uncertainty regarding what preventive (PA) care to provide	Somewhat important	Not very important	Not very important	Not very important	Somewhat important	Somewhat important	Somewhat important	Not very important
	Difficulty communicating with patients	Somewhat important	Somewhat important	Moderately important	Moderately important	Not very important	Not very important	Not very important	Not very important
	Perceived lack of interest from patients	Very important	Very important	Moderately important	Very important	Moderately important	Moderately important	Not very important	Very important

5.11.10 Semi-structured interviews

Semi structured interviews were conducted with representatives from each practice immediately following the completion of the intervention (week 18-20), and six months after the completion of the intervention (Time 2, week 46-50).

A total of four GPs and three practice/reception staff took part in the interviews immediately following the completion of the audit, and three GPs, two PNs and five practice/reception staff at follow-up interviews conducted six months following the completion of the audit (Table 28).

Coding was conducted by the chief investigator (SND) and identified five-themes that were linked to domains from the TDF. Not all domains were found to be relevant to the context of the interviews. Data has been presented according to the themes identified from the TDF and include:

- *Social/professional role and identity (D3).*
- *Innovation (D9).*
- *Innovation strategy (D13).*
- *Social influences (D14).*
- *Behavioural regulation (D17).*

5.11.10.1 Social/Professional role and identity (D3)

This theme represented the social and professional roles/identify of personnel within the practice, and within the intervention. It includes structures and/or processes that existed prior to the intervention and those established for the intervention.

For the purposes of the intervention, participating practices clearly defined the roles and responsibilities of personnel involved with the intervention, and communicated these to whole practice team. Efficiencies created by the dispersions of tasks appeared to be linked with expediting the implementation of the intervention, during the study period. Practice/reception staff played an active role in disseminating the GPPAQ in two of the practices and were intricately involved in preparing disease registers for another. For example, practice 4 applied a team approach to the implementation of the intervention, outlining specific roles for both clinical and non-clinical staff. Staff discussed how the intervention involved a whole practice approach. It *"… involved all of us …GPs and the reception staff."* (GP2 – practice 4). Their approach enabled a broad range of patients to be assessed using the GPPAQ questionnaire, and this was reflected in changes in data completeness across all risk categories.

Apportioning (intervention) tasks to non-clinical personnel generated greater clinical capacity for GPs and/or PNs to undertake tasks such as discussing GPPAQ outcomes, referral and provision of PA fact sheets. Participants referred to the teamwork that was generated by dispersing tasks across team members. Practice staff referred to participation in the intervention across the practice as *"… a real team effort.* (Practice staff #6 – practice 1). The same practice indicated the interdependent role each member of the practice team had in the implementation of their intervention: "*The [Practice staff] make sure that all of our patients have the opportunity to check whether they're doing enough exercise [assess PA]... Most of the patients get an information sheet that [the GP] prints them off, and some of them get referred to a service to help them [exercise]."* (Practice staff #6 – practice 1).

Practices demonstrated the usefulness of having clearly defined professional identities amongst personnel for the implementation of the intervention. There was an acknowledgement from participating practices of the significance and key function that multiple team members can play in executing the PA behaviour change intervention. This included the role that both intra and inter team members can play in the execution of the PA behaviour change. This included the role that PA providers have in executed PA behaviour change intervention such as Exercise Physiologists. For example, the practice representative indicated that inter and intra practice team members can complement *"… one-another rather than one [the GP] just trying to do everything… GPs are, G-E-N-E-R-A-L practitioners, not specialists in everything"* (Practice staff #1 – practice 2).

Additionally, the increased responsibility assigned to practice/reception staff, directly involved with the intervention appeared to provide a heightened sense of accountability. A GP referred to their observation of his practice staff during the period of the intervention, indicating high satisfaction amongst reception staff: *"… reception staff seemed to like being involved in more than just bookings and billings."* (GP4 – practice 1).

Practice 2, demonstrated a fragmentation of roles and responsibilities, compounded by dysfunctional communication between GPs, PNs and practice/reception staff and the size and variability in their shifts. In addition, links for shared decision making or communication such as team meetings did not occur. To compound the issue was the high number of impromptu appointments that the practice enabled each day. This had a direct impact on the PNs capacity to systematically manage patients within the intervention. Despite claims from the practice that they were a well-functioning, multidisciplinary team their results for data completeness demonstrated limited or no improvements in data completeness, between baseline and follow-up time points.

5.11.10.2 Innovation (D9)

This theme refers to any independent characteristics of the intervention that influence the development of the intervention. Most notably, the resources provided to participating practices were linked to this theme. These included the GPPAQ questionnaire, PA directory of services/providers, RACGP PA guidelines and the ESSA Fact Sheets.

The resources provided within the intervention resource kit appeared to encourage practices to implement activities associated with the intervention. These included; the GPPAQ, PA fact sheets and PA service directories. A PN from practice 2 indicated that the GPPAQ provided support and/or guidance during the administration of the assessment with patients. This PN stated: *"… I find it [GPPAQ] really good to help me what to ask." (*PN1 – practice 2). Similarly, another practice indicated their preference for the GPPAQ outlining: *"…I really liked it [GPPAQ]. It was simple and fast to complete."* (Practice staff #3 – practice 1). Furthermore, participating practices indicated satisfaction with the GPPAQ because of its simplicity, applicability to their patient population and the role it has in leveraging a discussion about PA behaviour change during a consultation. The GP from practice 4 indicated how they used the GPPAQ as a conduit to a discussion about PA during a consultation: *"It was good that way, normally I struggle a little to raise exercise with patients that are overweight or obese."* (GP2 – practice 4).

The fact sheets developed by ESSA indicated the contribution the resources made in patient self-management and reinforcing behaviour change advice provided during the intervention. The GP from practice 1 indicated that *"I liked the idea of giving the* *patients something to reinforce what I was telling them. They seemed to like getting the reading material, especially the ones that were really engaged by the discussion."* (GP4 – practice 1)

The service directory outlining local PA services and providers was highlighted as effective by participating practices and resulted in its formal integration into the medical software for ongoing referrals. For example practice 1, integrated the directory into the practice database. The GP recalled how they asked practice/reception staff to integrate the service directory within their medical software: *"… I asked my receptionists to enter the providers into Medical Director so that I can prepare a referral for patients."* (GP 4 – practice 1)

There were barriers associated with the format of the GPPAQ related to its limited electronic application. The GPPAQ was not available as a self-calculating, electronic instrument within Australian medical software applications. This limited its use in using merge fields for templates, referrals and management summaries. For example, practice 2 highlighted the steps that were required to use the GPPAQ template for the intervention and their preference for an instrument that offered the functions of other instruments that were standard applications within the software. For example, the PN from this practice recalled: *"…at the moment I have to save the health assessment template and also save the survey [GPPAQ]. It's very clunky."*(PN1 – practice 2) Another practice described their preference to have the GPPAQ available electronically within their medical software *"… would have liked to have it [questionnaire] in MD [Medical Director]… It was a bit of a hassle."* (Practice staff #3 – practice 1)

5.11.10.3 Innovation strategy (D13)

Whereas the previous theme 'Innovation' (D9) refers to the independent characteristics of the intervention that influenced implementation, this theme refers to the collective characteristics of the intervention that influenced its implementation. In the context of this study this theme referred to new and/or existing processes, structures or resources aligned to the intervention to facilitate implementation.

Patterns in the implementation of interventions amongst participating practices demonstrated a large degree of familiarity, or alignment with existing systems or processes such as administrative functions previously undertaken by the practice. For example, one practice recalled the similarities between the processes they used to distribute the GPPAQ with the distribution of practice satisfaction surveys: *"It was a bit like what we do when we have new patients or a practice satisfaction survey."* (Practice staff #2 – practice 4) The same practice indicated their satisfaction in using an established process that was familiar to personnel and did not impact on the existing workloads of clinicians: *"… [The process] suited the practice because we don't have any free clinicians or time to do it elsewhere. And, because its [GPPAQ] is so simple, it's easy enough for the patients to complete."* (Practice staff #3 – practice 1)

Most practices identified existing capacity limitations to avoid overextending existing capacity restrictions. Practices' highlighted the need to determine capacity limitations prior to implementing the intervention to allocate tasks. For example, practice 1 excluded PNs on the basis of their capacity limitations. This practice suggested that PNs were *"… flat out with wounds, INRs, blood pressures etc…The girls at reception are awesome. They do their thing [distribute GPPAQ) to help save time for [GP]. We're flat out, so it great that it doesn't fall in our [PN] basket either."* (PN2 – practice 1)

For most practices, consideration regarding opportunities to increase their capacity to implement the intervention was undertaken. In most cases, this included how the intervention could be implemented without using additional clinician time. Practice 4 considered the wait time for GP appointments, with one of their GPs regularly running over the scheduled appointment time of 20 minutes. Their approach aimed to reduce clinical load, whilst identifying underutilised time. This shifted the responsibility for completing the questionnaire from GP to patient, whilst capitalising on unused time in the waiting area. The practice referred to how the process utilised the patient time in the waiting room: *"…this was something they [the patients] could do while they were waiting. You know, pass the time."* (Practice staff #5 – practice 4). The approach was viewed as an extension of the GP consultation. The practice suggested that this approach extended the consultation by enabling the assessment to be completed prior to the consultation: This practice referred to this process as *"…starting their appointment early."* (Practice staff #2 – practice 4). Another practice recalled how they determined the method of administering the assessment. This practice had originally considered drawing on their PN workforce however decided against this approach because their PNs did not have capacity to support PA assessment. They approach involved patient self-administration in the waiting area. The practice indicated that: "…

completing [it]… before the patient came to see me, was the best flow for us. It didn't seem to disrupt our usual processes." (GP4 – practice 1)

Practice 3 maintained a broad local knowledge of the region and provided insight to patients when referring patients to services and/or providers. This knowledge was combined with established and long-standing relationships with patients that informed who the GP selected to refer the patient to. For example, the GP considered costs associated with accessing formal PA services. The GP provided options for patients in this circumstance suggesting activities they were familiar within the proximity to the practice. For example, the GP recalled suggesting to patients that they *"…could go for a walk at the beach or along the Bronte to Bondi walk. It's free and has a nice view. I made sure I went through the recommendations on the information sheet with these patients first. For example, I gave my patients living with T2D that information sheet and about heart and lung resistance training. I suggest using the exercise equipment in one of the parks around here. You know, one like the one at North Bondi." (*GP3 – practice 3)

5.11.10.4 Social influences (D14)

Social influences were identified as a theme impacting on the implementation of the intervention in this study. In the context of this study, social influences, social identify including gender and/or social stereotypes or standards. These include provisions within the intervention for gender and the interpersonal relationship between patients and participating practices.

The practice (patient) population appeared to influence the way in which the intervention was implemented. Practices reflected on the specific requirements of their patients and how the intervention interfaced with the group. The GP from practice 4 said that their patient population was made up of a high proportion of females. This GP indicated that implementing an intervention that ensured the psychological and social wellbeing of their patients, was a high priority. This practice outlined: *"…A lot of my patients are female. … To be able to have them [patients] feel safe and secure when they come to their doctor is very important to me."* (GP4 – practice 4)

Similarly, another practice reflected on the demographic and social profiles of their patients. This practice outlined how they tailored their intervention to meet the demographic profile of their patients including socioeconomic status, disease prevalence and incidence of lifestyle risk factors amongst patients. For example, this practice described the patient population as having a high proportion of patients with lifestyle risk factors including high rates of smoking; alcohol consumption, poor nutrition and low levels of PA. Additionally, this practice indicated a high proportion of their patients resided in government housing, and were from a broad range of cultural backgrounds and maintained a higher proportion of Aboriginal and Torres Strait Islander patients than other practices in the same region. The practice described how they prepared a Medicare GP Management Plan and Team Care Arrangement for eligible patients, to provide financial reimbursement for services delivered and facilitate patient access to AHP services, at a reduced cost. The GP from this practice outlined how they referred patients to local community based, low cost PA options. For example: *"… the local council gym and the walking group; listed ... These seemed the cheapest options. My patients wouldn't be able to afford anything like the private … gyms."* (GP4 – practice 1)

The interpersonal relationship that existed between the clinician and patient appeared to influence the execution of an intervention. Consideration of how the patient would receive an intervention was judged prior to commencing a discussion about PA, indicating limited openness to change on the part of the clinician. For example: *"… I have a high number of concessional patients. Many of these maintain poor lifestyle habits. So that I can continue to an effective doctor and patient relationship, I have to be careful about how I approach some things."* (GP4 – practice 1). Similarly, practice 3 based the intervention on long standing relationships the GP had established with patients. This GP indicated he had a thorough understanding of his patients' needs and whether they had a history of compliance with advice. For example: *"I've been here for many, many years. I know my patients well…I know which of my patients are likely to listen to me about doing more exercise and who won't. I have a lot of older patients that just won't change their ways…"* (GP3 – practice 3)

5.11.10.5 Behavioural regulation (D17)

Behavioural regulation of participating practice personnel was identified as a theme linked with the implementation of the PA intervention in this study. In the context of this study, this theme relates to changes or adaptations made resulting from the intervention, including managing changes that resulted from the intervention.

As a result of participating in this study, several practices indicated they would implement several changes to ensure continued implementation of the intervention. For example, practice 1 indicated they would implement several changes to ensure continued implementation of the PA behaviour change activities. This practice acknowledged the importance of establishing a structured approach to implementing a PA intervention including identifying and targeting patients and following up on advice. Proposed changes included the introduction of a formal follow-up structure and procedures. Personnel from this practice referred to steps required to maintain the intervention: *"… set up a recall system where we can log patients that need a reminder 3, 6, 12 months down the track."* (Practice staff #6 – practice 1)

Similarly, practice 2 indicated a need to improve the integrity of medical records so that patient registers, recall and reminders could be used to better effect. Participation in the audit had highlighted their limited data accuracy. The practice acknowledged the need to improve the completeness and accuracy of their database: *"… improve our databases to make sure we record our records accurately. This is a work in progress." (*PN1 – practice 2). Practice 4 made a concerted effort to ensure the intervention decreased additional clinical burden for GPs, whilst at the same time screen a broad range of patients from the practice. Placing the responsibility of distributing the PA assessments questionnaires with practice/reception staff created a system for the practice. This practice recalled how the process had become routine indicating that it had become *"… just second nature"* (Practice staff #5 – practice 4). The process established for the intervention then became an independent routine that was implemented beyond the end of the intervention, as evidenced at the Time 2 semi-structured interview point.

In addition to the process for implementing the intervention, practice 4 was able to establish a referral pathway with an external service provider. This pathway was identified from the PA directories, which was duplicated in the medical software by the reception staff. Practice staff were responsible for entering service provider details into the electronic medical software so that clinicians could use this information for electronic referrals. The practice/reception staff from this practice indicated that they *"… entered them [service providers] into our [software] so that they [GPs] can produce electronic referrals and use them in the templates for care plans…. The [ESSA]* *information sheets were useful too..."* (Practice staff #2 – practice 4). In addition to the process for implementing the intervention, practice 1 was able to establish a pathway for referral to a local Exercise Physiologist, who catered to the needs of patients. For example the EP *"… waived the gap fee for most of the patients…"* (Practice staff #3 – practice 1) referred by the GP based on their concessional status.

Despite the intention to change processes or systems in most practices, the GP from practice 3 remained steadfast with established protocols. This GP had been in the same practice and location for more than 20 years. The GP's philosophy regarding interested or uninterested patients remained the strongest influence for action in terms of implementing the PA assessment and did not account for patients that may have changed their behaviour, irrespective of the GP assumptions. For those patients perceived to be uninterested or unlikely to make change, they did not receive any aspect of the intervention, despite the GP acknowledging that *"…most of them [patients] really needed a referral…. but they have a history of non-compliance*." (GP3 – practice 3)

5.12 Discussion

This study suggests that successful implementation of PA behaviour change interventions in general practice can be achieved if the practice is provided with acceptable PA behaviour change resources, defining the roles and responsibilities of personnel in terms of the intervention, and ensuring clear communication between team members. In addition, acknowledging interpersonal relationships that exist between patients and the practice, and leveraging these for the benefit of the intervention.

This study found that the degree to which each practice was able to embed the intervention within their routine activities, was linked to their ability to implement the intervention, this was supported by structured practice systems, which facilitated execution of activities.

5.12.1 Changes in data completeness

Of those practices participating in this study (n=4), three demonstrated improvements in data completeness during the audit period. The remaining practice showed little or no improvement in data completeness. The reasons for this included inconsistent use of the lifestyle risk factor management guidelines outlined in the RACGP Red Book [29, 232] and incomplete or imprecise recording in the electronic patient records [530-532].

Given the outcomes of this study were largely dependent on the quality of information entered into the patient database, practices with small changes in data completeness are likely to have been a reflection of imprecise or partial completion of electronic medical records [532]. Contrary to the findings here, is the probability that practices in this study would have demonstrated greater improvements in data completeness, if they had more comprehensive patient records, including complete, and correctly coded electronic data [530-532].

Of the practices that demonstrated improvements in data completeness, two practices showed greater than 10% improvement for several measures, and across multiple risk ranges. The high risk range saw the greatest (proportionate) improvement in data completeness, of greater than 10%, followed by the healthy risk, and increased risk range. It is probable that this finding was related to the characteristics of patients within the high risk category. That is, patients in this category had morbidities such as raised blood lipids, blood pressure, cardiovascular risk scores, and comorbidities such as, BMI greater than 25, and waist circumference measures greater than the recommended gender thresholds [29]. Based on their profile, these patients were likely to experience symptoms associated with their morbidities, and visit the GP more often than those without these morbidities [15, 29, 259] and the details of the consultation and tests recorded.

5.12.2 Improvements in PA assessment and referral

All practices demonstrated improvements in self-reported PA assessment and referral behaviours between baseline and follow-up audit points. The proportion of improvement ranged from 1.7% (Practice 3, n=3,260) through to 13.6% (Practice 1, n=3222). The frequency of assessments reported during the audit period appeared to reflect the individual approaches implemented by practices, with practices one and three using blanket style approaches, assessing all adult patients. This approach offered increased opportunity for conducting assessment and referral. In contrast, practice 3 implemented the most selective approach to identifying patients for PA assessment than other practices. This was likely to be the reason for their smaller improvement.

5.12.3 Key features, barriers & enablers to uptake of physical activity intervention

Triangulation of data from the audit, self-reported PA assessment and referral, and qualitative data found a range of key features that influence the uptake of PA behaviour change interventions in general practice. These have been outlined below.

5.12.3.1 Access to acceptable and versatile PA behaviour change resources

Previous research has identified the need to consider the resources required for general practice to feasibly implement PA behaviour change interventions [476, 533]. This study identified the importance of providing acceptable resources to general practices that allow versatility in the way they implement the intervention. Whilst the quantitative study (Chapter 4) demonstrated higher correlation for the 3Q for assessing PA against PA guidelines, than the GPPAQ, the later instrument remained within acceptable limits of other similar self-report instruments for PA assessment [490, 495]. The difference in the findings presented here are that the GPPAQ was selected for the implementation study based on its higher preference amongst clinicians. Traditionally, studies of this nature defer to the measurement values when selecting an instruments for use, however this research drew on the collective findings from the quantitative and qualitative studies to identify an instrument (GPPAQ) offering a median between measurement rigour and acceptability. It found that the more acceptable GPPAQ appeared to increase the uptake of self-reported PA behaviour change, during the intervention period.

Previous research indicated that clinician attitudes, knowledge, beliefs and behaviour interact to influence encounters with patients [35, 302]. Despite this evidence, little is known about the individual characteristics of general practice clinicians and their impact on delivering PA assessment [35, 302]. The findings of this study suggest that the GPPAQ questionnaire addressed knowledge limitations of personnel, guiding them through the administration of the PA assessment. These findings are unique in terms of their applicability to Australian general practice, given that the GPPAQ has not previously been implemented within the Australian general practice landscape, despite widespread implementation in the United Kingdom [26].

For clinicians, the GPPAQ acted as a tool to guide a discussion with patients about PA, and reinforce the behaviour change advice delivered during the intervention. For patients, the GPPAQ appeared to act as an educational resource, to independently manage PA behaviour beyond the end of the consultation. In addition, it served as a method of communicating details of the intervention to significant others, such as family and/or carers.

This study highlighted the need to provide resources to general practices in a format that is compatible with existing information management, and technology systems. Most practices in this study described the cumbersome processes involved with recording the PA assessment using the GPPAQ, and then duplicating the information in the medical software. It is important that the GPPAQ or equivalent PA assessment instruments align with practice software systems. Ensuring instruments are available in a format that complies with methods used by general practices, was highlighted as an important element of implementing the interventions. This finding adds to a very limited body of knowledge about the acceptability of PA intervention tools and general practice information management systems [30, 534].

5.12.3.2 Defined roles, responsibilities and communication within practice

Roles and responsibilities

Research regarding teamwork and planned care has highlighted the need to consider individual variations between general practices and their personnel, including their roles and responsibilities with respect to the delivery of care [39, 511-515]. This study found that acquiring an understanding of the human resources available for each general practice to feasibly implement an intervention was an integral element of planning the implementation of an intervention [39, 513, 515]. This should include a period for determining the roles and responsibilities of personnel, where personnel are allocated to tasks that make up the intervention [232, 268].

During the facilitation sessions for this study, practices were encouraged to reflect on the structure and composition of practice personnel. This included reviewing current and potential capacity limitations of staff, and how the intervention would complement this. Practice 1 and 4 both considered capacity restrictions of clinicians within their practice and opted for non-clinical modes of administering the GPPAQ. It found that understanding the composition not only required reflection on the availability of resources, but appraisal of the capacity limitations in terms of the patient population, and the individual, and collective contribution of the practice team. That is, the practice must first acknowledge individual capacity limitations of personnel, or opportunities to disperse additional responsibilities across the whole practice, rather than increase the workload of overburdened GPs.

Communication

Whilst the quality of electronic medical records was linked to changes in data completeness outlined in section 5.11.1 of this chapter, the quality of intra-team communication appeared to be linked to the operational management of practices. That is, those practices with comprehensive communication mechanisms in place, demonstrated the greatest improvements in data completeness. In contrast, practices that did not have robust communication mechanisms in place demonstrated minimal changes in data completeness. This indicated that structured, comprehensive and regular communication amongst team members was relevant to the effective implementation of PA intervention, in particular the role of communication in ensuring accurate and reliable practice medical records. For example, practice 2 demonstrated negligible changes in data completeness and showed fragmented intra-team communication, including no whole-of-practice meetings, and monthly clinical meetings that were only attended by a proportion of clinical staff. Compounding this issue was the large number of personnel (n=17) within the practice, including a high clinical load operating concurrently within the practice (n=6 GPs). This added greater complexity to already hampered communication amongst personnel.

Networks

The social ecological model for understanding behaviour change in the health sector, describes three levels of the health care system, including micro, meso and macro levels [435]. The social ecological model outlines the role of meso level providers in their support of interventions such as PA behaviour change. In the context of this study, this meant the support that meso providers played in addressing inactivity in patients, identified through the general practice intervention.

Research regarding the role that multidisciplinary health care providers play in the provision of consumer centred care is well established, however many general practices have not been adequately resourced to facilitate access to networks of providers [35, 302, 312-314, 434, 535]. Whilst the PA service directory in this study provided a resource for practices to facilitate access to external PA providers, it offered an impetus for general practices to establish referral networks with local multidisciplinary providers. This was demonstrated by several practices establishing referral networks to complement the PA intervention delivered by the practice [35, 302, 312-314, 434, 535].

5.12.3.3 Maintain structured internal systems

Data integrity

Whilst this study did not evaluate methods used by general practices to ensure accurate and reliable electronic medical records, it identified a need to ensure systems for maintaining the integrity of patient medical records, primarily to support ongoing patient care, and secondly to maximise the outcomes of quality improvement activities such as clinical audits.

Practice capacity

Evidence indicates that most PA assessment activities that occur in general practice are the responsibility of clinical personnel [338, 533, 535]. This then generates an additional workload for clinicians, which was a contributing factor in poor uptake of assessment. The GPPAQ questionnaire was administered in a number of different ways which reduced the burden for GPs in delivering the assessment. This had a positive impact on the capacity of clinicians to undertake additional clinical duties.

This study identified the need to consider the capacity limitations of practice personnel, to avoid overburdening task laden staff and where possible, and assign to non-GP members. Dispersing responsibilities associated with the intervention can increase the capacity of clinical personnel such as GPs and/or [358]. The versatility of the intervention resources allowed practices to implement the intervention in a variety of ways, and using a range of personnel [511-514]. For example, some practices elected to have reception staff disseminate the GPPAQ so that patients could self-complete prior to the GP consultation. Others used PNs to administer the assessment and remaining practices relied on GP administration. Similarly, there was a mix of approaches implemented to support behaviour change advice provided during the intervention such as written referrals to PA providers, provision of patient education material or disseminating a list of PA options. For example, practice 1 determined that PNs would not be involved in the intervention due to capacity limitations. Reception staff were assigned responsibility for disseminating and collating the GPPAQ from patients. The GP was then responsible for discussing and recording the findings from the PA assessment. In contrast, practice 2 demonstrated little or no changes in data completeness during the intervention period. This practice had inconsistent appointment schedules, facilitating drop-in appointments, in between scheduled consultations. This subsequently reduced clinician capacity to capture and record data. This likely manifest as the minimal changes to data completeness, observed between baseline and follow-up points. Additionally, communication amongst personnel was fragmented with limited opportunities for defining roles and responsibilities with respect to capturing and recording patient data.

5.12.3.4 Interpersonal relationship between patient and practice

GPs often have established and longstanding relationships with their patients and as such GPs are considered a trusted source of information for their patients [260].This study underlined the precariousness of the GP/patient interpersonal relationship and how GPs navigated the interpersonal relationship to ensure the relationship was maintained. All participating general practices referred to factors that either contributed to the preservation of existing patient relationships, or factors that worked to propagate new relationships. Other approaches drew on the GPs knowledge of patient compliance to determine the feasibility of an intervention in an effort to preserve the GP/patient relationship (practice 3).

Interpersonal relationships, interactions and teamwork are considered key elements of effective teamwork. Teamwork generates capacity for the general practice to implement tailored interventions [472, 535-540]. This study identified a number of interpersonal relationships between patients and practice personnel including GP, PN and reception staff that either expedited or had potential to hinder implementation of the intervention. For example, practice personnel distributed questionnaires to patients, in two of the four practices participating in this study. In these examples, the practice leveraged trust and familiarity offered by existing relationships between the patient and reception staff to ask patients to accept the questionnaire, and secondly comply with their request to complete the assessment. The same concept was demonstrated for clinicians in determining whether to implement the PA assessment or not, based on their prior knowledge of the patient's compliance to advice.

5.12.4 Limitations

This study did not examine the uptake of advice received by patients. Additional research is required to determine the acceptability and feasibility of these interventions in terms of patient outcomes both short and long term, including how practices follow-up and offer continued support to patients.

Further research is required about patient perspectives in regards to methods of administration. Evidence indicates that GP are considered a credible source of advice, however evidence about patient perspectives in terms of other forms of administration, and is scarce [49, 541-543].

Caution is needed in generalising the findings from this study due to the small sample size and relative geographical and population heterogeneity. However, the results suggest that the implementation of PA interventions in general practice can be increased if versatile and relevant resources are provided that support the 5As approach and are tailored to the requirements of individual practices.

5.13 Conclusion

This study demonstrated that increases in PA assessment, advice and referral can be achieved in Australian general practices using the GPPAQ questionnaire, combined with resources to support patient education and referral. Whilst this study demonstrated improvements in the uptake of PA assessment and referral, for participating general practices, changes in data completeness varied between practices, with one practice demonstrating little or no change during the audit period.

The GPPAQ instrument can assist general practices to increase the frequency of PA assessment by offering greater versatility in how it can be administered, support clinical knowledge of PA behaviour change and act as a tool to educate patients about requirements for PA behaviour change. Established PA assessment instruments in Australian general practices include the 2Q and 3Q instruments. Despite widespread dissemination of these instruments, they have had little impact on the uptake of PA behaviour change in this setting. This study suggests the need to consider the GPPAQ as a supplementary instrument in supporting the implementation of PA behaviour change, for this setting, including how it can be implemented via the dispersion of roles across the general practice team.

Whilst this study focused on the implementation of the GPPAQ instrument in a selection of Australian general practices, several themes emerged which have the potential to influence the uptake of future PA behaviour change interventions, using a range of PA assessment instruments. These themes relate to how a practice can operationalise PA behaviour change, and generate effective and efficient patient care.

There is a need to establish structured and systematic processes within general practices to facilitate both immediate and planned care for patients. This means, ensuring systems are in place to provide relevant and timely information about the status of a patient so that both, episodic and longer term decisions about patient care can be made. For example, ensuring accurate and reliable patient data facilitates options for practices to stratify patients according to risk, diagnosis or other variables derived from medical records. The findings suggest that systems for ensuring data accuracy and completeness are required within each practice to facilitate access to patient data, in addition to quality improvement purposes, and subsequent assessment of quality and safety standards assessed.

Finally, this study highlighted the need to provide resources that are compatible to existing general practice information management, and technology systems. Most practices in this study discussed how recording patient data using the GPPAQ, requiring duplicate processes to ensure the assessment was firstly complete, and secondly recorded within the patient record. The same limitations exist for the established 2Q and 3Q instruments [18, 440]. Whilst these issues relate to the need to ensure a seamless process for recording the PA assessment, within the patient medical records, it also relates to the need to access data previously recorded. There are many instances when practices require access to existing data records, however software applications restrict extraction of PA related data. This impacts on the ability of general practices to extract PA information for tasks such as referrals, summaries of care and clinical audits. Moving forward, this issue is likely to amplify with the ongoing roll out of Australian Government's digital health strategy, which focuses on using electronic medical records for point-to-point communication [30, 534, 544].

The findings of this study may contribute to a limited body of knowledge regarding implementation of PA assessment in the Australian general practice setting, by offering considerations for researchers, policy makers and general practice personnel. It acknowledges previous research that identifies barriers to PA assessment in general practice and proposes approaches to circumvent these.

6 Discussion

6.1 Overview

This dissertation describes three studies that investigated the acceptability, feasibility and implementation of specific PA assessment instruments for use in routine general practice encounters in Australia. The first study identified two PA assessment instruments that were acceptable, noting reasons for clinician preference. This provided insight into barriers and enablers of PA assessment. Subsequently an evaluation to determine the measurement properties (validity and reliability) of the two instruments was conducted. Finally, an implementation study investigated methods used to implement PA assessment in routine practice, using one of the two instruments identified in the earlier studies.

The concept of the studies in this dissertation are considered novel in a number of ways, contributing new evidence to the literature around PA assessment in the Australian general practice setting. Firstly, the acceptability study is unique in considering instrument preferences and suitability for the general practice setting. Whilst many studies have investigated the measurement properties of some of the instruments presented here, few have considered their acceptability, particularly when administered by different individuals with varying levels of understanding and interest in PA [18, 26, 44, 408]. Not only is there a need to identify acceptable and feasible instruments for assessing PA in general practice, there is also a need to address the gap between evidence and practice and the low level of implementation of PA behaviour change interventions by general practice clinicians. Secondly, the GPPAQ has not previously been validated for use in the Australian general practice setting, despite wide dissemination in the United Kingdom [26, 429]. Finally, to the candidate's knowledge, there have been no other studies that have evaluated methods to implement PA assessment, nor use the GPPAQ in the Australian general practice setting.

6.1.1 Research questions 1 and 2

Research question 1	*What instruments are preferred by general practice clinicians for assessing PA amongst patients in routine practice?*
Research question 2	*What reasons do clinicians state for preferring one instrument above another, before and after using instruments?*

The study described in Chapter 3 was the first to comprehensively examine a collection of PA assessment instruments, with respect to clinician preference and acceptability, parallel to a review of the components of selected of PA assessment instruments. In this study, the GPPAQ and 3Q were identified as preferred by participating clinicians for use in routine patient encounters. It found that variations in clinician preference for PA assessment instruments existed, and were influenced by a range of intrinsic and extrinsic variables. These variables included individual clinician characteristics, such as their level of own PA, understanding and knowledge with PA assessment and the design and content of the instrument.

Evidence indicates preventive care, including PA behaviour change is acknowledged as an central part of the role of general practice [441, 442]. Whilst GPs recognise the need for preventive care, they are uncertain about the effectiveness of the interventions they deliver, citing knowledge limitations, lack of resources and discomfort providing advice about PA [238, 329, 330, 443]. Recent research indicates a lack of understanding of the intricacies required to appropriately support general practices deliver strategies to prevent and manage chronic disease and lifestyle risk factors [17, 18, 449, 460, 461].

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In this study, clinicians classified as insufficiently active demonstrated lower levels of knowledge, whereas those with higher knowledge were likely to be sufficiently active, consequently instrument preferences were influenced by level of knowledge also. These findings support previous research which indicate the uptake of PA behaviour change interventions in general practice can be enhanced with the provision of acceptable resources, by boosting knowledge, competence and confidence on the topic [30, 32, 33]. Greater knowledge and confidence is linked with an increased likelihood of delivering PA behaviour change interventions [30, 32, 33].

Clinician time constraints have been considered the most noteworthy barrier to the uptake of PA behaviour change in general practice [238, 329, 330]. To date, responses have focused on the development of brief instruments with the objective of reducing the burden of time required to complete the assessment [18]. These instruments have demonstrated significant analytical rigour for assessing PA in this setting, however the uptake of PA assessment in this setting has remained unsatisfactorily low [18, 338, 455]. In this study, several clinicians indicated that they would prefer to use the instrument that was longer in length (GPPAQ), because it provided them with greater insight into the patient PA. The same clinicians indicated that the GPPAQ, whilst longer, was easier and required less time to complete. In addition, differences were observed between the GPPAQ and 3Q instrument variables determined from the preferred instrument review. This review provided a degree of detail not previously identified regarding features, format and content of PA assessments instruments and how these may address variations in clinician characteristics and knowledge [18, 429].

These findings have implications for future research in this field, given the significant investment already made in findings brief PA assessments instruments, to address time limitations [18].

Strengths and limitations

Strengths of this study included preliminary work undertaken to understand gaps and/or limitations experienced by general practice and PA behaviour change. This understanding provided guidance in the selection of instruments for the study. It also contributed to identifying instruments that offered a cross section of features that addressed previously identified gaps/needs of general practice in the uptake of PA behaviour change.

Limitations of this study include the small sample size and representation from urban general practices only. Despite this, there was equal representation of GPs and PNs. All clinicians had prior experience in referring patients for PA behaviour change via the local GPERS. As a result, it is recognised that this sample represents clinicians who may be more interested in PA assessment and preventative care, than the wider general practice clinician population [460, 475, 476]. However, these health professionals are more likely to offer meaningful input regarding their application of PA assessment instruments, than those without prior involvement as they had an established commitment to preventative care. Future research efforts should look to investigate the PA literacy needs of general practice clinicians with limited knowledge. Outcomes would aim to enhance understanding of the type of support mechanisms required.

6.1.2 Research questions 3 and 4

Research question 3	*What is the validity of the GPPAQ and 3Q for assessing PA when administered by PNs and compared against accelerometry over the same period?*
Research question 4	*What is the reliability of GPPAQ and 3Q instruments when self-administered by patients?*

Measurement studies for PA assessment instruments are not new, however variations in the number and type of instruments available, methods of administration, and the settings they can be administered in, are constantly developing. At the same time, the contemporary nature of health care requires ongoing consideration for factors that may or may not influence PA behaviour change intervention such as modifying instruments to embrace the emerging PN workforce and address the imbalance in acute care needs [266, 268, 275, 276, 291].. Subsequently, there is a need for enduring measurement studies to establish and/or maintain the validity of PA assessment instruments that are fit for purpose [456].

The measurement properties of the 3Q and GPPAQ PA assessment instruments were demonstrated in this study, indicating that both instruments had reasonable rank order correlations for agreements against Actigraph accelerometers. The 3Q showed strong measurement properties in terms of concurrent and criterion validity [18]. The GPPAQ showed fair rank order correlations, and higher agreement when compared against national PA guidelines in identifying participants as insufficiently active and sufficiently active. Most notably, PNs demonstrated that they could effectively measure PA using both instruments.

Traditionally, most studies have favoured instruments with highest analytical rigour [505, 506], however the outcomes from the previous qualitative study (Chapter 3) provide valuable insight into the potential uptake of PA assessment instruments. Collectively, the findings from this study and the previous qualitative study (Chapter 3) have implications for researchers considering topics of this nature. They imply a disproportion in the emphasis placed on quantifiable measurement studies, versus qualitative data. Traditionally, research has conducted validity and reliability estimates, in the first instance. The result may be restrictive, resulting in identification of instruments that are not acceptable to clinicians, therefore limiting uptake. Switching the order to evaluate the acceptability of proposed instruments first, may provide a more efficient and effective method of identifying instruments.

In Australia, there is an increasing number of PNs working in general practice with recent data indicating as many as one PN for every two point three GPs. Whilst many general practices have meaningfully engaged PNs in clinical tasks, they have largely re-distributed GP workload, failing to shift demand for acute care, and forgoing preventive action [266, 268, 275, 276]. Researchers have indicated a gap in evidence regarding the impact of PNs and their role in increasing capacity of general practice, to move from largely acute focused work to preventive medicine [291, 293-303]. The findings of this study suggest that PNs can play a key role in the identification and capture of PA measurement data through the use of valid and reliable PA assessment instruments. The combined outcomes from this study and those of the previous qualitative study (Chapter 3), suggest a number of dimensions that PNs can draw on to integrate PA behaviour change into routine care such; health assessments, care plans or supporting population sub groups such as mothers of young children and aging patients.

Strengths and limitations

Accelerometers are considered the gold standard in objectively measuring population levels of PA [19, 433, 479]. Their use in this study offered relative accuracy in measuring raw movement of patients, whilst also being free from errors associated with self-reported data collection [19, 433, 479]. Movement counts provided a distinction between the duration and intensity of PA, which was tailored to distinguish vigorous and moderate activity, in line with National PA guidelines [502, 503].

A limitation of this study was the small sample size. The health professionals in this study may have been more interested in PA than the broader population of general practice clinicians because they had previously participated in a local exercise referral program and had already demonstrated a commitment to PA assessment and intervention. These limitations have implications for the generalisation of outcomes [497, 498].

Actigraph accelerometers are limited in the type of activity they are able to measure. Activities that do not vary significantly within the vertical plane such as water based activities, cycling and rowing are not well detected by the Actigraph accelerometer [489]. This is likely to underestimate activity undertaken with the effect limiting estimates of criterion validity [501]. These weaknesses are traded off against the widely recognised strengths of accelerometers such as portability, and capacity to keep a continuous record of the duration and intensity of movement [502, 503].

Caution is needed when comparing measures of agreement between studies with different sample sizes and study populations. However, the results of this study suggest that the criterion validity of the GPPAQ and 3Q instruments are as good as longer self-report measures for classifying people as insufficiently active and sufficiently active. In particular, the GPPAQ showed marginally higher agreement between accelerometer counts and national PA guidelines than the 3Q, indicating it may provide more guidance for those completing or administering it than the briefer 3Q. Whilst the findings of this study are important in determining the measurement properties of the instruments in question, they should not be considered alone.

6.1.3 Research questions 5, 6 and 7

Research question 5	*Are there changes in data completeness for PA related (patient) clinical markers before and after the intervention?*
Research question 6	*Are there changes in the uptake of PA assessment and referrals conducted by clinicians, before and after the intervention?*
Research question 7	*What are the key features, processes, barriers, enablers and influences of each intervention implemented by practices during the intervention?*

Chapter 5 was a formative study which described the implementation of a PA intervention using the GPPAQ instrument, patient education material and PA referral directories, in four general practices. This study aimed to inform efforts to improve rates of PA assessment in general practice, which are estimated to be as few as 30% of all general practice consultations [338, 455]. Outcomes identified a range of barriers and enablers that are likely influencers to the uptake of assessment and advice in this setting. [338, 455]

The previous two studies outlined in this dissertation identified the GPPAQ instrument as acceptable to clinical members of the general practice team, in addition to providing a valid and reliable instrument for assessing patient PA status against PA guidelines. Collectively, these findings may serve to inform interventions designed to increase the uptake of PA assessment in the general practice setting.

Previous research has identified several barriers to the uptake of PA assessment in general practice [238, 329, 330]. Despite this, there are translational gaps regarding strategies to support general practice identify and address barriers to implementation [324, 355]. Investigation requires consideration of the resources (infrastructure and human) required, in addition to the organisation of these resources across each element of the Five As (5As) for PA behaviour change [356]. Taylor et al [35], proposed a range of barriers and enablers were identified that can be categorised into the following dimensions:

- Influencing variables such as patient characteristics of individual general practices.
- Reinforcing factors related to personnel from the general practice such as; individual characteristics, knowledge, beliefs and behaviours.

- Enabling factors such as; availability of resources, structures, guidelines and procedures.

Research indicates that GPs are a trusted source of information, based on established and longstanding relationships with their patients [260]. Influencing factors identified from this study suggest that the patient-practice or patient-clinician relationship influenced how the intervention was implemented. Participating practices customised their intervention to either preserve existing relationships, or propagate a new one. For example, select practices leveraged existing relationships to introduce the PA assessment in waiting areas. These relationships enhanced the chances of patients complying with their request. In contrast, some practices used prior knowledge of the patient's compliance to determine if the intervention was implemented.

Reinforcing factors such as the attributes, capability and capacity of general practices were identified in this study. These findings provide some granularity to the 'reinforcing' dimension discussed by Taylor et al. [35]. The facilitation sessions conducted as part of the intervention design phase of this study shed light on areas of the practice best placed to facilitate or, dissimilarly impede implementation [39, 513, 515]. Additionally, the role of team work, intra-practice communication and planned care were raised as reinforcing variables in this study, suggesting the equitable dispersion of roles, can expedite the implementation of the PA intervention [239].

Independently, the method selected by practices for integrating the GPPAQ instrument appeared to play a role in forecasting whether a PA discussion would occur, similar to approaches to planned care described for other conditions [310, 312, 314].

The intervention resources, practice structures and communication were considered enabling factors relating to the uptake of the PA intervention in this study [35].The study highlighted the need for resources that align with existing information management and technology systems such as medical software. Most practices in this study described their frustration with not being able to access outcomes of the PA assessment using medical software, nor extract these data for advice and referral tasks. Resources such as the PA service directory and patient education material were highly regarded by practices and indicative of whether they felt they could adequately support insufficiently active patients.

Ensuring mechanisms were in place to facilitate comprehensive and meaningful intra-team communication were also identified as an enabling variable [35]. Modern Australian general practice has been described as a multidisciplinary unit of professionals who take responsibility for whole-of-patient care [278, 279]. Members are not limited to GPs, but integrate resources such as PNs, AHPs, medical specialists, community, social and welfare providers [280]. Administrators, practice managers and/or reception staff often contribute to intra and inter-team communication, expediting collaboration and enhancing communication which in turn, builds consensus. At the epicentre of the multidisciplinary team is the patient, this includes ensuring a patient is involved in, and has responsibility for health-care decisions [281-283].

This study poses implications for future research for general practice based behaviour change and implementation studies. It suggests the consideration for individuality when approaching PA interventions for general practice, highlighting tailored interventions that offer customised responses to individual barriers and enablers.

Strengths and limitations

This study used the PEN CAT clinical audit tool to analyse a defined set of patient records [518]. This approach is considered best practice in auditing clinician records, within general practice and is increasingly being used as a quality improvement activity in this setting [516, 518, 545]. The benefit of using an electronic audit tool, such as PEN CAT is its ability to define the parameters of the audit [518]. Whilst clinical audit tools cannot yet extract patient PA status from GP software, measures relative of improvements in PA were used as an indication of the uptake of PA behaviour change interventions. That is, measures relative of PA such as blood pressure, blood lipids, BMI, weight, and CV risk assessment were used to indicate changes in clinician uptake of PA behaviour change interventions [516, 517].

Benefits associated with the use of electronic clinical audit tools such as PEN CAT include the ability to identify gaps in data completeness, adherence to clinical management guidelines, and stratify patients according to risk [516, 517].Whilst there are strengths associated with the use of clinical audit tools such as PEN implemented within this study, there is a balance of limitations. These include the inability to capture clinical records that have not been recorded correctly. That is, if clinical records are incomplete or clinical data is not recorded accurately, the audit tool is unable to extract data. For clinical audits, this presents a gap in the evidence they provide [516, 545]. The findings here should be considered within the context of these limitations. That is, the audit tool detected clinical tasks that were recorded accurately within medical software, When data was not recorded correctly, which was the case for practice one, the audit tool was not able to extract the corresponding data.

This study did not examine the uptake of advice received by patients. Additional research is required to determine the acceptability and feasibility of these interventions in terms of patient outcomes for both the short and long term, including how practices follow-up and offer continued support to patients.

Caution is needed in generalising the findings from this study due to the small sample size and relative geographical and population heterogeneity. However, the results suggest that the implementation of PA interventions in general practice can be increased if versatile and relevant resources are provided, that support the 5As approach and are tailored to the requirements of individual practices.

6.2 Implications

The National PA guidelines have been developed to provide guidance for the Australian population around minimum PA to achieve health benefits [453, 454]. The Getting Australia Active Report indicated general practice as one of seven strategies for promoting PA behaviour change [546]. Despite acknowledging the role of general practice in PA behaviour change, the sector has struggled to impact upon population levels of PA [15, 259].

The studies described in this dissertation offer evidence to inform how the uptake of PA behaviour change interventions might be increased in general practice. In particular, the evidence contains pertinent information relevant to the Australian general practice context with potential implications for primary health care systems internationally. This dissertation, which comprises three, interlinked studies investigating the acceptability, measurement properties and methods of implementation for a selection of PA assessment instruments, in the context of Australian general practice.

Each study; both independently and collectively offer translational potential, in terms of research knowledge and clinical practice. In Chapter 2 of this dissertation, the social ecology model was discussed in terms of understanding the influencers on PA behaviour change in general practice. It discussed the influence of clinician environments against macro, meso and micro levels of the health care system [435]. In the context of this dissertation, the findings offer evidence to inform gaps in PA research translation that utilise the position of the meso level health care stratum. Additionally, it suggests changes to the operational control within individual general practices and their teams, at the micro level of the health care system. Whilst not offering direct evidence to inform the macro health system, the finding herein imply the need to review national level policies for PA behaviour change to support implementation of strategies proposed from these studies, at meso and micro levels [435, 547-549].

6.2.1 Macro level implications

The macro level health care system in the context of PA behaviour change and general practice, relates to government schemes responsible for policy formation and implementation. The strategic intent of PA policy lies in the endorsement of population wide participation in PA, with the aim of enhanced health benefits. Despite the existence of PA policy, population levels of physical inactivity remain unsatisfactorily high, and continue to contribute to the burden of disease and injury both in Australian and most industrialised nations [48-53].

In Australia, there has been little change to policy in support of population levels of PA, with the exception of the revised National PA Guidelines in 2015 [229]. Whilst the revised Guidelines are welcomed, they are largely an independent policy, without links to other national strategies, demonstrating a need to initiate mechanisms to drive the policy for integration [25, 185, 221]. From a general practice perspective, PA policy responses have previously been limited to initiatives such as the now obsolete Lifescripts initiative [1]; and the type 2 Diabetes Risk Assessment [2].

6.2.1.1 Implications

The findings from this study imply the need to support existing policy initiatives to guide meso and micro level health care services in the delivery of PA behaviour change. Greater focus on existing policy will provide more definitive support for general practices. For example, enhancing standards established by SIGPAH which suggest the need for routine PA monitoring, in general practice along with access to tools/ resources to support the execution of interventions [229]. In particular, the standards established by SIGPAH would benefit from the following two enhancements:

1. Endorse robust instruments to support the variety of competency and confidence levels.
2. Expand the role of non-GP staff and patients to administer PA assessment.

These enhancements are discussed in detail below.

6.2.1.2 Endorse instruments to support clinician competency/confidence

The findings from the first study in this dissertation indicate a need to more explicitly acknowledge the variations in clinician competency/confidence in PA assessment. While this dissertation identified the GPPAQ and 3Q instruments (sequentially) as preferred instruments amongst participating clinicians, it also distinguished differences in clinician preferences that were linked to preferences. That is, clinicians who were less confident in PA behaviour change preferred the GPPAQ, whereas those more confident preferred the 3Q.

The distinction in competency/confidence was linked to a number of individual characteristics or circumstances such as the clinician's own involvement/participation in PA and/or the demography of the patient population. Previous research indicates that clinician attitudes, knowledge, beliefs and behaviour interact to influence their encounters with patient [35, 302]. Despite this research, little is known about the relationship between individual clinician characteristics and their impact on delivering PA assessment [35, 302]. This study identified a number of individual clinician characteristics that showed associations with instrument preferences, which in turn influenced their likelihood of implementing PA behaviour change. Consequently, a range of resources should be made available to meet the varying needs. This would likely include instruments such as the GPPAQ for clinicians less confident in administering PA assessment or the 3Q for clinicians more confident in PA behaviour change [548, 549].

Research efforts have focused on developing approaches to address time limitations of busy general practices, with the aim of increasing uptake of PA behaviour change interventions. In Australia, the 2Q and 3Q instruments have been developed as succinct responses to this issue and disseminated through both macro and meso levels of the health care sector. Despite widespread distribution across Australian general practices, evidence indicates that as few as one-third of all patient consultations involve PA behaviour change, indicating a potential treatment gap in the provision of preventive care of this nature [15].

Analysis of the instruments in this dissertation reinforced research from Smith et al validating the brief 2Q and 3Q instruments [18]. This research aimed to implement the 2Q and 3Q in Australian general practices to alleviate time constraints [18]. In contrast, the findings from the studies here suggest that clinicians with limited understanding in PA behaviour change may be reserved or reluctant to administer PA assessment using the 2Q and/or 3Q because of the complexity associated with these instruments. These studies found that brief instruments such as the 2Q and 3Q may be complex in content and/or their methods for calculating PA status. This can be perpetuated through the terms used in the instrument such as vigorous and moderate intensity. Ironically, the instruments that were designed to be brief and address time constraints (i.e. 2Q and 3Q) appear to have had the reverse effect in some clinicians, curbing the uptake of PA assessment amongst those less competent/confident in the area.

Whilst it is acknowledged that the 2Q and 3Q instruments are likely to meet the needs of some clinicians, this study suggests that those with less confidence or understanding on the topic may benefit from instruments that support their level of competency such as the GPPAQ [30, 32, 33]. Implications for future implementation of PA assessment instruments indicates a need to supply multiple instruments to suit the varying needs of clinicians such as the instruments included in the studies here.

6.2.1.3 Expand the role of non-GP staff and patients

Outcomes from the Lifescripts initiative recommended the need for meso level strategies to support the operation of lifestyle risk factor interventions in routine care [1]. Specifically, it suggested that general practices could benefits from education and training regarding the use of resources such as assessment/screening tools, and assistance with organisational strategy to enhance their capacity to administer interventions [1, 239]. This includes the role of administrators, practice managers and/or reception staff who can contribute to enhanced cross-team communication, the role of patients in terms of their responsibility for their own health-care decisions [281-283].

The studies here demonstrated the role members of the whole practice team have as a resource for addressing complex, multi-component tasks involved with executing a PA behaviour change intervention [280]. These findings support an enhanced role that spans the whole general practice team, in interventions targeting PA behaviour change. This includes the roles of non-GP staff to address GP time constraints, and generate functional efficiencies to balance the provision of acute versus preventive care, and ensure the delivery of whole-of-patient-care [266, 268, 275-279].

Current policy would benefit from definitively outlining the role of the whole general practice team in PA behaviour change including the potential to disperse interventions amongst non-GP members of team. Possible funding mechanisms may include the use of the chronic disease management initiative under the Medicare Benefits Schedule [240]. This initiative provides financial remuneration for GPs to manage patients with a chronic medical condition. For patients meeting these eligibility criteria, other members of the general practice team including PNs or patients via self-management tasks can assist the GP to administer by administering PA assessment. These tasks must occur under the guidance of the GP [240]. Other options include the delivery of health assessments such as the 45 year old health check and type 2 diabetes risk assessment can integrate PA assessment within the mandatory lifestyle risk factor elements of the initiative[2, 241]. Alternatively, the business case for dispersing the roles of non-clinical staff lies in the ability of the GP to generate efficiencies for the practice by reducing the burden of GP tasks by dispersing responsibilities amongst team members [314, 355].

6.2.2 Meso level implications

The findings from the studies here offer a pragmatic approach for meso level organisations to consider when supporting general practices to increase PA behaviour change. They suggest the need to consider the whole general practice team, including clinical and non-clinical staff when identifying individuals responsible for administering the assessment e.g. PNs, practice/reception staff and patients themselves. To ensure a unified approach to the care of patients, using multiple team members, comes the need to ensure comprehensive communication amongst the whole practice team, to ensure an awareness of roles and responsibilities and processes around how the intervention will occur. Additionally, the findings suggest the need for general practices to identify opportunities to exploit, or limitations to avoid, within each practice e.g. utilise waiting time to complete PA assessment, leverage interpersonal relationships or align the intervention to well-functioning systems such as health assessments already in place.

The meso level of the health care system in the context of general practice is responsible for supporting for clinicians to implement population and public health focused strategies. In Australia, this has been led by primary health networks (PHNs), previously known Medicare Locals and Divisions of General Practice [550, 551]. In addition, they include organisations that provide infrastructure for the sector, such as medical software companies or peak bodies. These organisations sit at the epicentre of the health care system, interfacing with both macro and micro levels. In terms of Cooksey's model, meso level health organisations have implications in addressing both first and second gaps in research translation [548, 549]. That is, they are responsible for diffusing policies relating to PA behaviour change relevant to the general practice setting, whilst at the same time delivering support to operationalise policy at the grass roots level.

Meso level organisations are those that stand most to gain, in terms of knowledge transfer, from the findings of the studies here. This includes how to use the meso level of the health care system to support PA behaviour change in general practice. The proceeding section outlines the implications of the studies in this dissertation for the future direction of the meso level support including the following:

1. Capacity building in general practice.
2. Resources to support the uptake of PA behaviour change interventions.
3. Information management.

6.2.2.1 Capacity building

Over the last ten years, meso level health care organisations have played a significant role in supporting general practices in quality improvement activities such as facilitating change to the delivery of care and/or administrative activities to generate efficiencies and improve patient care [447].

In terms of the findings from the studies here, these organisations could play a role to assist improving operational control within general practices, to implement systematic and comprehensive PA behaviour change interventions. Dispersing tasks associated with execution of PA behaviour change interventions amongst non-GP staff can enhance the capacity of practices to implement interventions routinely. The role of meso level organisations offer facilitation sessions with general practices to determine structure and resources available to implement intervention.

6.2.2.2 Resources

The findings from these studies suggest the need for meso level organisations such as primary health networks and peak industry bodies to collate and disseminate a catalogue of PA assessment instruments that cover the spectrum of competency, confidence and circumstances of general practices. Whilst many researchers would argue that limiting clinicians to one PA assessment instrument will offer direction and consistency in measurement, the findings here suggest that sustained dissemination of instruments containing technical measurement properties may limit uptake of PA assessment amongst clinicians less competent/confident in the topic. In contrast, it suggests that matching assessment instruments to the needs or circumstances of clinicians will enhance competency and confidence in the area.

The previous section of the discussion outlined the potential benefits to general practices by enhancing the roles of non-GP staff to implement PA behaviour change interventions. In terms of resourcing the broader group of individuals responsible for administering PA behaviour change, the need of appropriate resources to support their level of competency in the topic is required. This suggestion further supports the need for a spectrum of instruments to cater for the range of possible methods of administering the assessment.

Additionally, the findings here reinforce previous research regarding the need for resources to support lifestyle behaviour change such as patient education material and access to referral networks. Organisations such as PHNs have a pivotal role in the identification and capture of local information about services/providers to support PA behaviour change. This information can be disseminated amongst general practice to accompany the PA behaviour change interventions. Additional peak bodies such as the Exercise and Sport Science Association (ESSA) have a role in developing and promoting resources around patient and provider education. Similarly, these resources can be disseminated via PHNs to general practices.

Providing general practices with access to resources that can be applied in a variety of ways, and by different users, may increase capacity for general practices to implement an intervention, whereas if they are to continue to rely on already overburdened clinicians there is much less chance of this occurring [233, 290, 313, 552]. For example, the GPPAQ enabled administration by GPs, PNs and patients whereas other more technical instruments may not have. Moreover, directories of local PA service providers met a gap in identifying and accessing referral pathways for PA behaviour change.

6.2.2.3 Information management

The findings from the studies here indicate that resources for use in PA behaviour change interventions require compatibility with general practice information management systems. From a pragmatic perspective, the studies here suggest that resources should be compatible with medical software requirements to ensure easy access for conducting PA assessments, referring to external providers/services and/or reviewing records of previous interventions. Additionally, advances in clinical audits can enable the use of data stored from PA behaviour change to be used in quality improvement activities.

These outcomes have implications for medical software companies offering packages for general practices including the need for flexible applications such as the ability to customise what PA assessment instruments are available within the software package, rather than limit access to default instruments provided in most packages [440]. Enabling clinicians to upload their instrument of choice will support implementation of PA behaviour change whilst also offer the benefits associated with electronic medical records e.g. electronic referrals, medical summaries and other outputs derived from the patient medical record such as clinical audit and quality improvement activities. Having access to patient records, relative to PA behaviour change will enable GPs to compare PA behaviour over time, and offer a mechanism for monitoring patient compliance against PA advice provided during consultations. Currently, there are no mechanisms for extracting and monitoring patient PA behaviour within electronic medical records [440]. Clinical audits, such as the one described in this dissertation (Chapter 5) rely on secondary indicators of PA behaviour change as a measure for change between baseline and following audit points. However, ensuring PA behaviour is an accessible data item via audit tools, will facilitate quality improvement activities similar to those offered through the Australian Primary Care Collaboratives (APCC) [518, 553].

6.2.3 Micro level implications

Micro level health care in the context of this study relates to those organisations or individuals responsible for the delivery or receipt of PA behaviour change interventions. The degree to which PA policy is implemented at this level of the health care system is dependent on how they translate their understanding of the policy. In terms of Australian general practice, stakeholders at a micro level include general practices and their personnel, PA service providers such as exercise physiologists and patients. Micro level stakeholders interface with meso level organisations via policy directives initiated at the macro level.

6.2.3.1 Interpretation of PA policy

Limited attention to National level PA policy over the last ten years was discussed earlier in this chapter, specifically direction relating to PA in general practice. Current policy is limited to the National PA guidelines which offer benchmarks for population levels of PA. These evidence based guidelines demonstrate minimum requirements for PA, with variations for vigorous, moderate and resistance based exercises. For individuals without technical knowledge of PA behaviour change, reference to these guidelines does offer guidance in terms of conducting an assessment or quizzing a patient to determining sufficient or insufficient PA [25]. This finding was particularly evident amongst clinicians who expressed difficulty understanding terminology associated with PA assessment and prescription such as ‘vigorous’ and ‘moderate’ intensity. These findings imply the need for support for thorough training and resources to support the use PA behaviour change interventions, including the use of assessments instruments and in identifying opportunities to implement an intervention that align with the individual requirements of each general practice.

The findings from the studies presented here provide insight for researchers and policy makers around grass roots application of PA behaviour change and the need for flexible approaches to interventions to cater for variations in clinicians, need for capacity building and individual circumstances of general practices.

6.2.3.2 Patient experience

Whilst this dissertation did not evaluate patient experience, the student acknowledges the actions resulting from PA behaviour change interventions impact directly on patient experience. Where a GP does not implement PA behaviour change, for circumstances where it is clinically relevant, consumer experience is impacted. A systematic review of the core dimensions of primary health care suggests that the process of delivering good care includes efficient and equitable delivery of services [554]. In addition to this the RACGP Guidelines for Preventive Activities in General Practice (Red Book) recommend that GPs assess the PA status for patient considered at increased risk of chronic disease, at every opportunity [231]. This being the case, all patients with a clinical need to improve PA have a right to receive PA behaviour change interventions. Despite this, patients in these situations often miss this opportunity for many of the reasons outlined in this dissertation.

Patient self-management is an emerging area of chronic disease management involving the role that patients play in actively progressing the care of their condition [271, 315]. This entails the role patient's themselves play as an active participant in their health care, rather than a passive recipient [271, 315]. The introduction of wearable technology has served to enhance opportunities for patient self-management, specifically for PA through the availability of individual, real time feedback to patients about PA, sedentary time, standing and walking [555-558]. These innovations have potential to support PA assessment activities under the guidance and monitoring of GPs.

The findings of the studies presented in this dissertation indicate the role patients care play in assessing PA status, in partnership with their GP. It found that when patients were provided a PA assessment instrument that contained lay-language, limited jargon or technical terminology and offered examples, such as the content of the GPPAQ, patients can self-administer the PA assessment prior to their consultation with the GP. Not only do these findings support previous findings around capacity building in general practices to enhance the uptake of PA behaviour change, however they imply the use of strategies derived from self-efficacy theories rather than of stages of change [289, 316, 317]. This is a significant finding in terms of PA behaviour change as previous findings have limited self-efficacy theory to alcohol and smoking cessation strategies [289, 316, 317].

6.2.3.3 Clinician acceptability

There has been little research undertaken to understand the philosophical, cultural and personal perspectives of clinicians responsible for PA behaviour change. Steptoe et al.[434] suggested these elements are crucial considerations in developing interventions to ensure influencers, reinforcing factors and enablers are identified and addressed. Much like environmental scans do for companies developing or revising a strategic plan, there is a parallel need to understand potential risks, threats and opportunities in their own environment [559, 560].

The findings in this dissertation highlight new barriers and influencers to PA behaviour change, not previously considered. It found that clinicians were happy to implement PA assessment when they had an instrument they considered simple and easy to use, even if it was longer in length [18]. The findings challenge time as a barrier to PA behaviour change and suggest that while brief instruments may support some clinicians, they are unlikely to support all clinicians because of variations in their previous experience and/or understanding of PA behaviour change. It indicates that clinicians should be supported via their individual needs using strategies outlined in the macro and meso level structures. Aside from external support, clinicians themselves need to acknowledge their own level of competency in this area and select an instrument to support their needs accordingly.

6.3 Recommendations for research

National PA guidelines recommend that Australian adults undertake at least 150 minutes of moderate or 75 minutes of vigorous intensity PA, each week or combined equivalent. Levels of PA below these guidelines are indicative of increased mortality and morbidity amongst the Australian population [48, 53, 100, 101]. Despite the widespread awareness of the link between physical inactivity and disease burden, population levels of PA remain low. Worldwide, it is estimated that least 60% of the adult population are insufficiently active [417]. In Australia, this figure is higher with approximately 67% of the Australian population insufficiently active [41, 186, 187, 208].

Responses to physical inactivity have identified general practices as an integral part of wider public health efforts [14, 49, 258, 261]. However, despite multiple approaches to support general practice address PA, as few as 30% of all general practice encounters involve PA behaviour change interventions [15]. Moreover, there is a lack of contemporary and pertinent evidence regarding support for PA assessment in Australian general practice [186, 221, 461, 561, 562]. The studies presented here provide some insight into considerations to enhance the uptake of PA assessment in this setting, yet additional research is required using larger sample sizes to better represent a heterogeneous population. This research would aim to reinforce the findings herein, whilst offer insight into barriers, enablers and influencers for the broader Australian population.

Additional research is required to determine the feasibility of the interventions presented here, in terms of patient outcomes and patient experience both short and long term, including how practices follow-up beyond the initial assessment. The role of consumer health literacy is an additional area of research that has links with the work presented in this dissertation. Quantifying changes in patient literacy, following advice/assistance from general practice is an untapped area. This has implications for future administration of PA assessment and behaviour change interventions in general practice. Additionally, research should be directed towards the acceptability of PA assessment including patient perspectives around methods of administration, other than GPs e.g. PNs, practice/reception staff and patient self-administration. This is based on evidence that indicates patients consider GPs a credible source of advice. There is little known about the relative effectiveness of other individuals from the general practice setting (e.g. PNs, practice personnel or patients) administering PA assessment, in terms of PA behaviour change [49, 541-543].

Evaluation of the PA levels of those receiving an assessment should also be undertaken, to determine the effectiveness of the GPPAQ instrument. In this instance, research completed in the United Kingdom may inform Australian research, given they have comprehensively promoted the role of general practice, within PA behaviour change, using the GPPAQ [461]. Researchers from the National Institute for Clinical Excellence (NICE) have developed ‘fluid’ care pathways for identifying, assessing, advising and following-up PA behaviour change. Furthermore, they have committed significant resources to the evaluation and continuous improvement of the initiative, including a recent expansion of the instrument to cater for the National Health Service (NHS) Hypertension quality outcomes framework and NHS Employers initiative. The extension of the instrument in these circumstances demonstrates its versatility and scope in terms of target audience [431, 461, 563].

In Australia, the majority of general practices are resourced with electronic clinical information management systems (estimated 97.8% general practices) [338]. The research outlined in this dissertation highlights the importance of aligning PA assessment resources to the information management systems in general practices. However, current medical software companies offer little flexibility in terms of the PA assessment instruments they provide [440]. In most cases, the 3Q has been provided as a standard resource within software, with functions that facilitate access to electronic records of the assessment. For clinicians with a preference for instruments other than the 3Q, there is little option for including within their software. Research is firstly required to determine the efficacy of aligning preferred instruments to medical software, and then advocacy with software companies to ensure translation of findings.

Since the completion of the data collection and analysis phases of the studies presented in this dissertation, the Australian Government has released new National PA and Sedentary Behaviour Guidelines [25]. These guidelines have built on the previous evidence that specify the need to address sedentary time, and incorporate strength and/or resistance training. The release of these guidelines is an important step in describing more definitively the requirements of adult populations in meeting minimum PA requirements. As well, they reflect advancements in research identifying the link between physical inactivity, sedentary behaviour and functional capacity and the burden of disease and injury in Australia [58]. The GPPAQ does not currently include consideration for resistance training, outlined in the new guidelines, however continues to address the principles of cardiovascular fitness quantified through the following parameters: frequency, intensity, time and type of PA [25, 185, 186, 212, 213]. Whilst these new guidelines provide great definition, they have the potential to contribute an additional level of complexity to PA assessment, especially for GPs who may be limited in understanding and/or knowledge of PA behaviour change. The release of these guidelines should be considered in light of the findings from this study, specifically for high risk patients such as overweight/obese, patients with known sedentary behaviour, and those at risk of falls. New research is suggested to determine the implications, if any, the new guidelines have in the context of the findings herein, specifically in light of the consideration of sedentary behaviour.

6.4 Conclusion

Whilst this dissertation presents three independent studies, they collectively determine the acceptability and feasibility of a selection of existing PA assessment instruments, and provide suggestions to improve the uptake of PA assessment in routine general practice. The boundaries between each study form a link, with the findings from the prior study informing the next, in each case building on the findings to inform each research question.

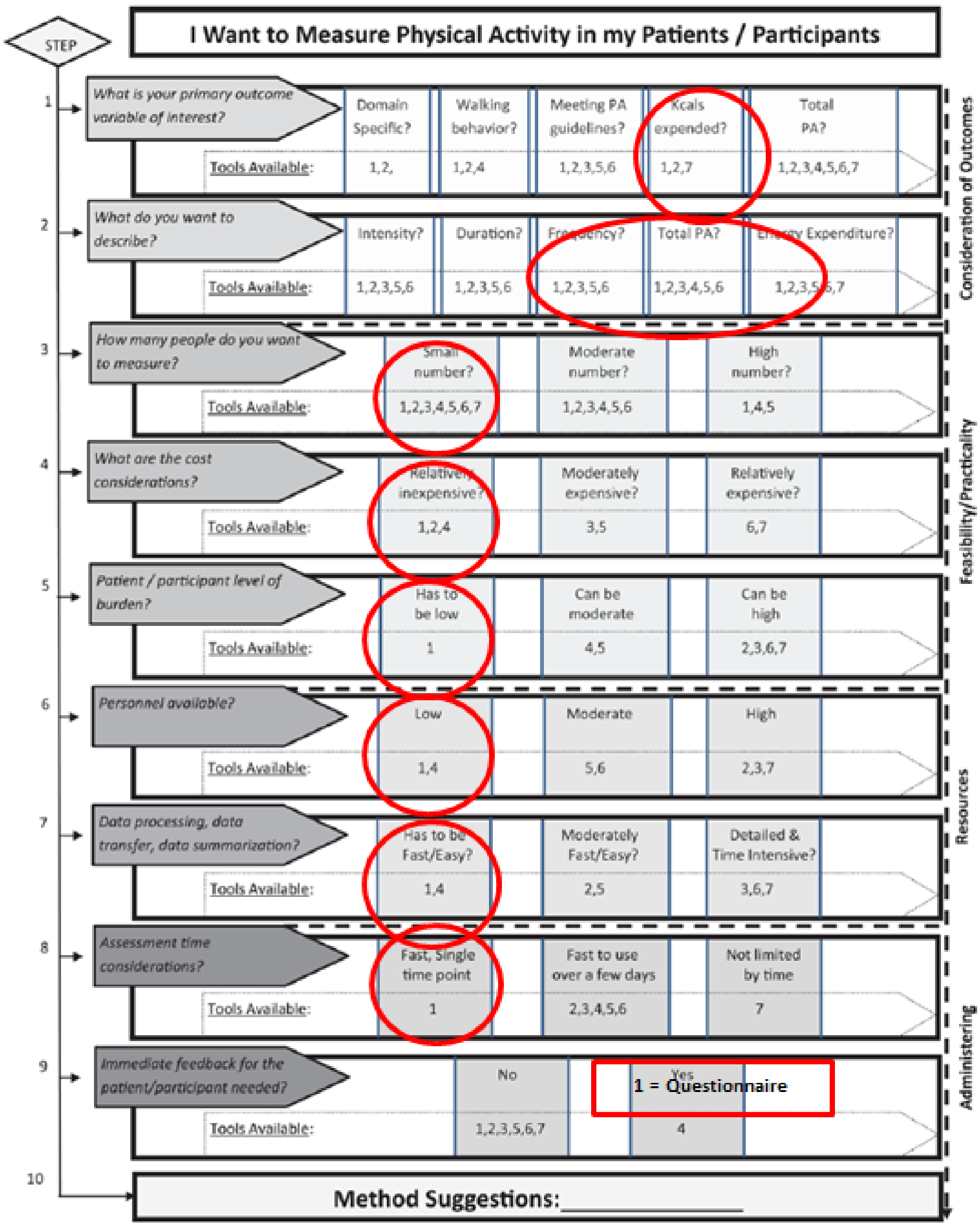
Key messages include the need to consider individual variations amongst clinicians in terms of knowledge, confidence, preferences and application of PA behaviour change. Additionally, the findings specify a broader selection of individuals may be capable of administering PA behaviour change outside of the traditional GP role. This can include clinicians and non-clinicians, such as practice/reception staff and patients. Finally, outcomes suggest that identifying opportunities to exploit PA behaviour change or avoid barriers to uptake can be useful for increasing assessment and referral. This includes ensuring resources are available to support the varying levels of confidence and are available in suitable formats, compatible to the setting. E.g. ensuring PA assessments instruments are compatible to medical software to align to existing systems and allow access to previous PA assessment.

The findings from this dissertation are an important step in improving the knowledge of barriers and enablers to PA behaviour change in the general practice setting, particularly the acceptability of PA assessment instruments amongst clinicians, and methods of implementing behaviour change into routine care without forgoing the need for additional capacity requirements.

GPs are widely acknowledged as a key to improving population levels of physical inactivity, particularly those considered at high risk of chronic disease, these findings are an important component of public and primary care research by facilitating PA assessment in general practice patients. Macro, meso and micro levels of the primary health care system can play a collective role for facilitating the uptake of PA assessment in this sector, and act as a cue for general practice to address this risk factor more regularly as part of disease prevention and management.

7 Appendices

Appendix 1 Decision Matrix



Note: 1=Physical activity questionnaires; 2=Physical activity logs/diaries; 3=Heart Rate Monitoring; 4=Pedometers; 5=Accelerometer; 6=Multi-unit Sensors; 7=Doubly Labeled Water

Appendix 2 **Publication 1:** Feasibility and acceptability of two instruments for measuring physical activity in primary care

Dutton S, Dennis S, Harris M, Zwar N, Bauman A, Van Der Ploeg H (2012) Feasibility and acceptability of two instruments for measuring physical activity (PA) in primary care. Journal of Science and Medicine in Sport 15, S295

Declaration

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Shona Dutton

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Accelerometer determined physical activity and body composition in community-dwelling older adults

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Introduction: Several studies have demonstrated a positive effect of physical activity (PA) on body composition; however, few have assessed this relationship in older community–dwelling adults using accelerometer measures of PA. The aim of this study was to examine the association between accelerometer determined PA and body fat composition in a large community-dwelling sample of older adults.

Methods: A total of 636 community-dwelling older adults aged 53–84 (mean age 66, 49% male) were randomly recruited to participate in this study. Body composition, including total body fat and trunk fat, was measured using dual-energy x-ray absorptiometry. PA was measured using Actigraph GT1 M accelerometers worn for 7 consecutive days. We measured counts/day and minutes/day spent in sedentary (< 1.5 METs), low intensity (1.5–2.9 METs), moderate intensity (3–5.9 METs) and vigorous intensity (> =6 METs) activity, using existing accelerometer count thresholds for each level of intensity. The association between accelerometer measures and body fat measures was determined using multiple linear regression models adjusted for age and sex.

Results: Sedentary minutes were positively associated with total body fat and trunk fat. For every 10 minute increase in sedentary minutes, trunk fat increased by 84 g (95% CI 44 to 124) and total body fat increased by 147 g (95% CI 79 to 214). There was a dose-response negative relationship between activity intensity and total body fat and trunk fat. For every 10 minute increase in activity, total body fat decreased by 261 g (95% CI −350 to −172), 1099 g (95% CI −1355 to -843), and 2593 g (95% CI −429 to −90) for light, moderate and vigorous minutes, respectively. Similarly, for every 10 minute increase in activity, trunk fat decreased by 156 g (95% CI −209 to −103), 676 g (95% CI −827 to −525), and 1611 g (95% CI −2618 to −604). We found a significant interaction between age and activity on body composition. As age increased, the magnitude of the effects of sedentary, light, and moderate activity on body fat measures all decreased (interactions all $p < 0.05$).

Discussion: Both body and trunk fat are independently associated with both intensity of physical activity and amount of sedentary time. The magnitude of these associations decreases with age but is still clinically relevant. Thus, PA programs should aim at both minimising sedentary time and promoting activity and may need to be altered to take into account the effect of increasing age.

http://dx.doi.org/10.1016/j.jsams.2012.11.717

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Feasibility and acceptability of two instruments for measuring physical activity (PA) in primary care

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Introduction: General practice has an important role in improving population levels of PA. However, measurement of PA remains challenging. There is a need to identify a usable, transferable and easily interpreted instrument for all members of the general practice team.

The aims of this study were to:

- Evaluate the validity and reliability of two instruments for measuring PA, administered by practice nurses (PNs) and self-administered by patients.
- Qualitatively explore general practitioner (GP), PN and patient perceptions of the two instruments

Methodology: Sample of 10 PNs and 100 patients, were invited to participate. Participating patients were allocated to PN (n = 41) or patient groups (n = 43). An additional, six GPs were invited to participate in semi-structured interviews to determine their opinions of the instruments.

Two instruments were examined:

- General-Practice Physical Activity Questionnaire (GPPAQ)
- Three-Question Physical Activity Questionnaire (3Q)

PN-group: Participants wore an accelerometer for 7-days then attended an appointment with their PN to complete questionnaires. Analysis determined criterion validity, comparing accelerometer counts against questionnaire responses. PNs (n = 9) participated in a semi-structured interview to determine opinions of the instruments.

Patient-group: Participants self-completed both questionnaires twice, 7-days apart. Analysis determined test-retest reliability using intra-class correlation coefficients (ICCs), comparing questionnaire responses from Time-1 and Time-2. A sample of patients (n = 21) participated in semi-structured interviews to determine opinions of the instruments.

Results: Criterion Validity was low to moderate for GPPAQ (rho = 0.26) and 3Q (rho = 0.45). For meeting PA recommendations there was moderate agreement for GPPAQ (k = 70.3%, 95% CI = 0.56–0.85) and fair agreement for 3Q (k = 62.2%, 95% CI = 0.47–0.78). The test-retest reliability ICC for the GPPAQ ranged from (0.82–0.95), the 3Q ranged from (0.94–0.98). This study found 89% Nurses and 67% patients preferred the GPPAQ. Health professionals indicated their reasons for preference were influenced by questionnaire characteristics (100%) and instrument comprehensiveness (100%) and simplicity of the instrument questions (43%)

Conclusions: The 3Q demonstrated moderate validity compared against accelerometer measures, substantially higher than the GPPAQ. Both instruments had excellent test-retest reliability. The GPPAQ demonstrated higher agreement with the accelerometer for meeting PA recommendations than the 3Q. This study raises important considerations for researchers regarding the design and implementation of PA assessment. Previous research has focused on time barriers however, this study comprehensiveness and simplicity are equally important. The GPPAQ may contain features useful for enhancing the established 3Q instrument for PA assessment, especially for PNs and patient self-management strategies.

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Agreement between the IPAQ-long weekday sitting item and the activPAL™ activity monitor in Scottish adults

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Introduction: Recent epidemiological evidence of the importance of sedentary time and health suggests that an accurate

Feasibility and acceptability of two instruments for measuring physical activity (PA) in primary care

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Never Stand Still | Medicine | Centre for Primary Health Care and Equity

Introduction

- Physical activity (PA) is as an important health enhancing behaviour [1].
- Research has highlighted integral position general practice has for improving population rates of PA to achieve health benefits [2-4].
- Attempts to measure physical activity in routine general practice remain limited due;
  - *Time constraints*
  - *Inadequate assessments instruments*
  - *Limited skills of health professionals in PA assessment and interpretation [3, 5, 6].*
- Studies of effectiveness of PA interventions often rely on third parties, such as researchers to conduct assessments
- Need to identify a usable, transferable and easily interpreted instrument for all members of the general practice team.
- Limited analysis of internal validity such as PN and patient role in assessment and monitoring of PA in routine practice [3, 7-10]

Aims

The aims of this study were to;

1. Evaluate the validity and reliability of two instruments for measuring PA, administered by practice nurses (PNs) and self-administered by patients.
2. Qualitatively explore general practitioner (GP), PN and patient perceptions of the two instruments

Methods

This study was conducted in 3 phases;

Phase 1: Validation Study

A sample of 10 practice nurses and 41 patients participated in a validation study of two instruments designed to assess physical activity. Patients were recruited based on their prior participation in an exercise referral scheme in the Sutherland Shire region of Sydney. Participants wore an accelerometer for 7-days then attended an appointment with their PN to complete questionnaires. Analysis determined criterion validity, comparing accelerometer counts against questionnaire responses.

Phase 2: Reliability Study

An additional sample of 43 patients was recruited to participate in a reliability study of two instruments designed to assess physical activity. Patients were recruited from participants in the same regional local exercise referral scheme in Sydney. Participants self-completed both questionnaires twice, 7-days apart. Analysis determined test-retest reliability using intra-class correlation coefficients (ICCs), comparing questionnaire responses from Time-1 and Time-2. A sample of patients (n=21) participated in semi-structured interviews to determine opinions of the instruments.

Phase 3: Qualitative Study

Semi-structured interviews were conducted with GPs (n=8), Practice Nurses (n=9) and a sample of patients that participated in the Phase 1 and 2 studies (n=21). Participants were asked questions regarding their opinions and preferences between two instruments.

Instruments:

- General Practice Physical Activity Questionnaire (GPPAQ)
- Three-Question Physical Activity Questionnaire (3Q)
- Actigraph Accelerometer

References

[illegible]

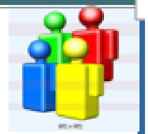
Acknowledgements

[illegible]

Results

Demographics

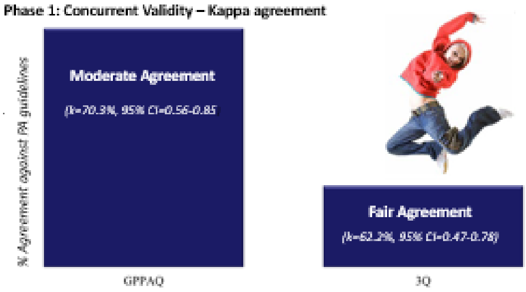
9 GPs, 10 PNs and 103 patients, were recruited to participate.
Participants were allocated to the GP (n=16), PN (n=41) or patient groups (n=43)



Phase 1: Criterion Validity – Spearmans Rho

- Criteria validity was measured using Spearman's Rho correlation co-efficient
- Measures showed low to moderate correlations for GPPAQ (rho=0.26, CI 0.12-0.39) and 3Q (rho=0.45, CI 0.30-0.61).

Phase 1: Concurrent Validity – Kappa agreement



Phase 2: Reliability - *Intra class correlation co-efficient (ICC)*

Instrument	Baseline *(Median)*	Retest - Post 7-days *(Median)*	ICC	Classification
GPPAQ	2.5	1.0	0.90 (0.82-0.95)	Excellent
3Q	5.75	6.0	0.97 (0.94-0.98)	Excellent

Phase 3: Questionnaire Preferences

- The majority of PNs referred the GPPAQ instrument (89%) compared with the 3Q
- Patients showed a clear preference for the GPPAQ instrument (71%) compared with 29% for the 3Q
- GP preferences were comparable with equal proportions preferring the GPPAQ and 3Q instruments (50:50)

Reasons for Preference

Reason	*Supporting Quotes*
Questionnaire characteristics	*GP quote: "… [Referring to GPPAQ] it means that you get more of an idea of what they're actually doing rather than them just saying I do regular exercise. I think the [GPPAQ] was more specific highlights exactly how much they're doing…"*
Ability to motivate & health literacy	*GP quote: "The GPPAQ seems thorough as it gets people to give a bit of a depiction of how their work is … it breaks down the PA outside of work fairly accurately too … it was somewhat easier for the patient to interpret"*
Time taken to complete	*Patient quote: "I think it helped me to reinforce that I need to do more exercise. It reminded me, as my GP often does. I think it's a good idea to take the burden off the GP to ask all the time."*

Conclusions

- 3Q demonstrated moderate validity compared against accelerometer measures, higher than the GPPAQ
- Both instruments had excellent test-retest reliability.
- The GPPAQ demonstrated higher agreement with the accelerometer for meeting PA recommendations than the 3Q
- The GPPAQ was the preferred instrument amongst GPs, PNs and Patients

Future considerations

The GPPAQ may contain features useful for enhancing the established 3Q instrument for PA assessment, especially for PNs and patient self-management strategies.

Appendix 3 **Publication 2**: An explorative qualitative study on acceptability of physical activity assessment instruments among primary care professionals in southern Sydney

Submitted to BMC Family Practice (May, 2016)

Accepted: 15 September 2016

Declaration

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BMC Family Practice

RESEARCH ARTICLE Open Access

An explorative qualitative study on acceptability of physical activity assessment instruments among primary care professionals in southern Sydney

Shona Nicole Dutton[1], Sarah May Dennis[2*], Nicholas Zwar[3] and Mark Fort Harris[1]

Abstract

Background: There are a substantial number of instruments for primary-care clinicians to assess physical-activity (PA). However, there are few studies that have explored the views of clinicians regarding comparative acceptability and ease of use. A better understanding of how clinicians perceive instruments could help overcome barriers, and inform future interventions. This study explored the acceptability of five PA-assessment instruments amongst a sample of Australian primary-care clinicians, including family-physicians (FP) and practice-nurses (PN).

Methods: A purposive sample of FPs ($N = 9$) and PNs ($N = 10$) from eight family-practices in southern Sydney consented to participate. Stage-1 involved semi-structured interviews with participants to select preferred instruments. An analysis of the two preferred instruments was conducted as Stage-2, to identify differences in instrument purpose and content. Stage-3 involved participants using the two instruments, selected from Stage-1, for 12-weeks. At the end of this period, semi-structured interviews were repeated to explore clinician experience.

Results: Clinicians indicated preferences for the GP-Physical-Activity-Questionnaire and 3-Questionnaire Physical-Activity-Questionnaire. These instruments demonstrated distinct variations in content, theoretical orientation, and outcome measures. Reasons for preference included; variations in individual clinician PA levels, knowledge in PA-assessment and instrument features.

Conclusion: Findings demonstrated two instruments as preferred. Reasons for preference related to internal characteristics of clinicians such as variations in the level of individual PA and external circumstances, such as instrument features.

Keywords: Acceptability, Family practice, General practitioner, Practice nurse, Physical activity, Physical activity assessment, Questionnaire

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Background

Evidence-based guidelines have been developed to support Australian primary care clinicians to address physical activity (PA) behaviour change in their patients [1, 2]. Despite evidence demonstrating the importance of implementing brief interventions, uptake is less than satisfactory with as few as 30 % of primary care encounters involving PA assessment [3, 4]. These data highlight the need for routine and consistent assessment of PA within clinical settings to improve identification of insufficient PA, and instigate behavior change. Understandably, there are many challenges to routine PA assessment within clinical settings and subsequently, a range of tools have been developed. Physical activity questionnaires are used to determine PA status, by providing self-report responses to questions regarding a selection of PA domains [5, 6]. Despite some evidence indicating limitations of self-report, they remain the most cost effective and pragmatic option for assessing patient PA behaviour, within primary care settings [7–9]. However, research indicates a degree of analytical rigour when using self-report PA assessment instruments, [5, 6, 10, 11]. Evidence has demonstrating strong correlations and agreement with other construct criteria measures for vigorous-intensity PA. Discriminant validation studies have also shown that questionnaires have usefully classified patients in rank order according to activity level [5, 6, 10, 11]. This reinforces the value of PA assessment instruments in primary care settings, specifically for risk factor identification and behaviour change interventions.

In Australia, a range of policy initiatives have led public health approaches to reduce the prevalence of physical inactivity. These include the introduction of inaugural PA guidelines (1995), which were updated in 2015, and introduction of national surveillance activities [12]. Inter-government and inter-sectoral approaches have been implemented through the Active Australia and Strategic Inter-Government forum on PA and Health (SIGPAH) [13]. More recently, the Australian Government committed $932 million between 2009 and 2018, for strategies to prevent disease through the National Partnership Agreement for Preventive Health (NPAPH) [14–16].This work will encourage the adoption of healthy behaviours, including PA [14–16]. The Royal Australian College of General Practitioners (RACGP) responded to the need for PA policy in the primary care setting by establishing guidelines for prevention of chronic disease [17] and, guidelines for preventive activities in general practice, Both resources have been designed to support primary care clinicians to implement preventive activities [17, 18].

There are several barriers identified as limiting the uptake of preventive activities, including PA assessment within primary care settings [8, 19, 20]. In response, researchers have focused on ways to support clinicians to apply the National PA Guidelines through interventions assessing patient PA [9, 21, 22]. Since the introduction of the Australian PA Guidelines in 1999 [23], a number of PA assessment questionnaires have been developed for use in primary care [22, 24–27]. However uptake has been suboptimal with evidence indicating a number of barriers experienced by clinicians including; time constraints; knowledge about PA; inadequate skills with interpretation of PA assessment; and capacity limitations of the practice [24, 28–30].

Other than identification of general barriers to uptake of PA assessment, little is known about the acceptability of these instruments for meeting the needs of the Australian primary care setting. One study by Smith et.al [24] determined the validity and reliability of the 2Q and 3Q instruments in an empirical design; but did not determine uptake in routine practice. Further research has focused on the population wide monitoring and reporting of PA, rather than application in primary care, whilst others have not been investigated in an Australian context [25, 31, 32].

Identifying interventions that help primary care clinicians to conduct PA assessment, whilst taking into consideration limitations on their capacity, has been identified as a key success factor in the uptake of guidelines [33]. To date, researchers have placed emphasis on overcoming limitations in family physicians (FP) time such as providing new instruments that are briefer in length and content [24]. Auxiliary approaches have included providing questionnaires in alternative formats such as electronic templates which are compatible with medical software and linking the assessment to (clinician) incentive funding such as Medicare Health Assessments and care plans [34]. However, there has been little noteworthy change in the uptake of PA assessment in family practice [24, 28].

This study sought a better understanding of how clinicians perceive assessment instruments and how these were influenced by clinician factors and their experience using the instruments in practice in order to inform future PA interventions.

Aims

This study aimed to determine the following;

- Identify instruments preferred by family practice clinicians, to administer amongst patients in routine practice.
- Ascertain reasons for clinician preferences before and after using the instrument.
- Identify intrinsic and extrinsic variables that influence clinician uptake of physical assessment amongst patients.

Methods

A purposive sample of FPs ($n = 9$) and practice nurses (PNs) ($n = 10$) from eight family practices from one primary care organization (PCO) in southern Sydney were identified. FPs had referred a patient to the PCO's GP Exercise Referral Scheme (GPERS) in the previous six months were eligible to participate in the study. PNs from practices with a FP, who had previously referred to the GPERS program in the six months prior to the study, were also eligible to participate. The GPERS Scheme was a local initiative where FPs could refer physically inactive patients for PA assessment and exercise prescription, with an exercise physiologist. Although PNs were not eligible to directly refer to the GPERS Scheme, they were included with the scope of this study because of their potential role in lifestyle risk factor management within the primary care setting. Of the 214 FPs and 46 PNs practicing in the region, 123 FPs and 32 nurses were eligible to participate.

FPs and PNs were sent an invitation letter and information sheet explaining the purpose of the study. This was followed up with a visit from the investigator (SND) who explained the project in detail and obtained their written, informed consent.

The study was conducted in three stages. Stage-1 involved semi-structured interviews to identify two PA assessment instruments, preferred by the clinicians. Stage-2 involved conducting a detailed analysis of the two preferred instruments (from stage 1) relative to the features of each instrument. Stage- 3 was the implementation of the two preferred instruments over a period of 12-weeks. At the end of the implementation period, semi-structured interviews were conducted to explore clinician experience and identify the two highest ranked preferences.

Stage-1

The FPs ($n = 9$) and PNs ($n = 10$) took part in semi-structured interviews with the investigator (SND). Demographic data were collected for each participant including; age, gender, profession and practice location. Clinician PA behaviour was assessed by the chief investigator; a tertiary trained Exercise Physiologist who determined the frequency and intensity of PA undertaken, over the previous or usual week. The responses provided by clinicians were used to determine whether they were sufficiently physically active, against the Australian National PA Guidelines [23].

Following collection of demographic data, participants were provided with copies of five commonly used PA questionnaires to review, and were asked a series of questions about their preferences. The following five instruments were selected based on their potential for use in Australian family-practice;

- Active Australia (AA) [35]
- Occupational Sitting and PA Questionnaire (OSPAQ) [25]
- 2-Question PA Questionnaire (2Q) [24]
- 3-Question PA Questionnaire (3Q) [24]
- General-practice PA Questionnaire (GPPAQ) [32]

This study aimed to determine clinician preferences for a range of PA assessment instruments. It called for clinicians to draw on insight into their patient population, and practice systems to determine which instrument would be the best fit for their individual situation. Clinicians were considered as having experience in assessing patient PA behaviour, determined by previous referrals to the GPERS program. Former methods used to assess PA, or the frequency at which this occurred was not determined because of potential recall bias. Clinician knowledge of PA assessment was determined by their PA status. The process for determining PA status is outlined in the methods for Stage-1 of this study.

The interviews were guided by a schedule (Appendix) of open-ended questions to explore the participants';

- Instrument preferences,
- Understanding and confidence in PA assessment, and
- Perceptions of barriers to assessing PA.

Stage-2

An analysis of the two preferred instruments identified from Stage-1 was conducted to identify differences in instrument purpose and content. Variables considered in this analysis included; theoretical orientation, length of the instrument including the number of questions and estimated time taken to complete, scoring or outcome measures, terminology and/or language used within the content of the instrument, types of PA considered (e.g. planned, incidental, work and leisure) and the use of explanatory text such as examples and scenarios.

Stage-3

The two instruments ranked highest from Stage-1 were implemented by clinicians in routine practice, over a 12-week period. At the end of the 12-week period, there was a second round of semi-structured interviews to determine participants' satisfaction and experiences of using the selected instruments. There was one FP and one PN that were unavailable to participate in the follow-up interviews leaving eight FPs and nine PNs who took part. The interviews were guided by a schedule (Appendix) and the questions covered;

- Preferences between the two (selected) instruments.
- Understanding and confidence in PA assessment using the two (selected) instruments.
- Exploration of their perceptions of barriers to assessing PA using the selected instruments.

All interviews were conducted in 2011 and were audio recorded and field notes made. The interviews were transcribed verbatim. Ethical approval was granted by the University of New South Wales Human Research Ethics Committee (HREC 11068).

Analysis

Content analysis was conducted following the framework analysis approach [36]. FP and PN interviews were analysed together. SND read and re-read all transcripts and coded emergent themes and subthemes using the 18 theoretical domains and 112 constructs from the Theoretical-Domains-Framework (TDF) [24, 37–39]. The TDF was selected because of its capacity to integrate 33 constructs, across 18 domains of behavioural determinants, covering the full range of current scientific explanations for human behaviour (i.e., 'Knowledge', 'Skills' and 'Social/professional role and identity'). The coding was discussed with members of the research team and modified following discussions.

To ensure analytical rigour, a second iteration of this process was performed, with re-review of transcripts to identify any important quotes or subthemes missed or misallocated. It was noted whether subthemes arose solely by FPs, PNs or both. The final synthesis and interpretation involved considering each theme/domain and subtheme, in the context of the whole set of interviews. The strongest domains were those mentioned by most practitioners; were discussed at greatest length; and/or judged by the investigators to be invested with considerable intensity, passion, or sentiment by clinicians.

Results

Health Professional characteristics

A total of nine FPs and ten PNs took part in the interviews in Stage-1 and eight FPs and nine PNs in Stage-3. There was one FP and one PN that were unavailable to participate in follow-up interviews, due to leave. Participants represented eight group practices and with an equal proportion of small (four or less FPs) and large (five or more FPs) practices. The characteristics of the participants are detailed in Table 1.

Table 1 Clinician characteristics

Characteristic	FP ($n = 9$)	PN ($n = 10$)
% female	45 %	100 %
% working in small (≤4 FPs) practice	4	6
Practice size – Large (≥5 FPs)	5	4
% physically active *(i.e. meets PA guidelines)*	100 %	40 %

Clinicians were classified as either meeting or not meeting the Australian PA Guidelines of 30-minutes or more moderate intensity PA on most days of the week. A total of 68.4 % (13/19) of clinicians indicated that they were currently physical active, 100 % of males and 57.1 % (8/14) of females.

Stage-1 – Questionnaire Preferences

The majority of clinicians (88 % FPs and 100 % PNs) interviewed in Stage-1 preferred the GPPAQ [32]. A ranking process determined the GPPAQ and 3Q [24] as most preferred, from the original selection of five instruments and they were used in the second stage (Table 2).

Stage 2 – Preferred instrument analysis

The instruments selected in Stage-1 were (1) GPPAQ [40] and (2) 3Q [24] and were different across a range of variables. The GPPAQ was longer in length than the 3Q, and used explicit examples of incidental and planned PA. This included specific reference to PA undertaken in an occupational setting. Whereas the 3Q was briefer in length, it contained technical terminology, typically used by exercise professionals. A comparison of selected variables for the two preferred instruments is provided in Table 3.

Stage 3 – Questionnaire Preferences

After implementing the instruments in Stage-3, preferences changed amongst some clinicians, particularly amongst those clinicians (FP and PNs) who were more physically active. In Stage-1, 89 % ($n = 9$) FPs preferred the GPPAQ instrument. In Stage-3 this proportion changed (for FPs) to an even preference for GPPAQ and 3Q.

Key themes derived from the Theoretical Domains Framework

Not all domains from the TDF were found to be relevant to the context of the interviews. Relevant domains and themes were grouped into (1) Intrinsic or (2) Extrinsic variables. Intrinsic variables are those inherent to the clinician. Extrinsic are fundamentally, external influencers. Data has been presented according to the themes identified from the TDF below;

Intrinsic variables

TDF Domain: Knowledge

In the context of this study, the domain "knowledge' refers to clinician knowledge and perceived competency about PA assessment/advice [37]. Clinician feedback demonstrated a link between the following three themes;

Table 2 Questionnaire preferences for clinicians at Phase 1 and Phase 2 of semi-structured interviews.

	FP			PN		
	Phase 1		Phase 2	Phase 1		Phase 2
	1st Preference ($n = 9$)	2nd Preference ($n = 2$)	Aggregate preference ($n = 8$)	1st Preference ($n = 10$)	2nd Preference ($n = 4$)	Aggregate preference ($n = 9$)
AA	0	1		0	0	
OSPAQ	0	0		0	0	
2Q	1	0		0	0	
3Q	0	1	4	0	4	1
GPPAQ	8	0	4	10	0	8

Theme 1: Clinician knowledge/competency
Theme 2: Clinician individual characteristics
Theme 3: Instrument design/content

Theme 1: Clinician knowledge/competency

Clinician knowledge and understanding of PA was determined based on their current PA status, and their awareness of Australian PA guidelines, including their understanding of terminology associated with PA assessment e.g. differentiating between vigorous and moderate PA. A participating PN who was considered as having less knowledge and/or understanding of PA domains indicated that the 2Q and 3Q instruments were limited in the information they provided, whereas the GPPAQ provided more detail to conduct the assessment *"...there's just not enough information in there and these are a bit more detailed ..."* (PN6). An FP, also considered to be less knowledgeable of PA suggested that the same instruments [2Q and 3Q] *"...took more concentration to work out; I had to go back over the questions..."* (FP5)

The analysis of the two preferred instruments carried out during Stage-2 of the study found the GPPAQ to offer rudimentary support for clinicians less knowledgeable of PA, whereas the 3Q instrument suited those more familiar with the mechanisms of PA assessment.

Clinician knowledge/competency regarding PA appeared to influence their preference for instruments. Clinicians with less knowledge about PA preferences were more likely associated with the GPPAQ, the reverse was the case for 3Q. For example, several clinicians highlighted that the GPPAQ instrument provided terminology or wording that was *"... more specific with asking exactly what exercise"* and *comments that the GPPAQ instrument "... was more specific."* (PN5).

Table 3 Preferred instrument analysis, across selected variables.

	Preference 1: GPPAQ	Preference 2: 3Q
Theoretical orientation	• Validated instrument designed to produce a short measure of PA in primary care patients aged 16–74 years. • Administration of the instrument: ◦ FP ◦ PN ◦ Patient ◦ Other health care professionals [32]	• Designed for epidemiological surveillance purposes and adapted for use in family-practice. • Administration of the instrument: ◦ FP ◦ PN ◦ Other health care professionals [18]
Length (number of questions)	• 7 questions. • Additional sub-questions. • Estimated completion time between ≤1 minute [32].	• 3 questions. • Estimated completion time between ≤1 minute.
Outcome measures	• Provides a simple, 4 level PA index (PAI); Inactive, Moderately Inactive, Moderately Active or Active.	• Assigns patients based on outcome score to one of four categories; Minimal, Low, Adequate or High.
Terminology and/or language	• Simple language. • Terminology typically used amongst lay-people.	• Technical used by exercise professionals. • Terms used obtain unique definitions specific to PA assessment e.g. Vigorous and Moderate Intensity.
Range of PA settings considered	• 5 Occupational settings. • 3 Planned exercise settings. • 2 Home-based incidental settings.	• Discrete suggestions of incidental and planned exercise. • No reference to specific environments or situations.
Use of explanatory text such as examples and scenarios	• 28 explicit examples, within scenarios.	• 9 single-term examples of types of exercise e.g. jogging, walking or digging. • Discrete definition for vigorous and moderate activity.
Use of explanatory text such as examples and scenarios	• 28 explicit examples within scenarios	• 9 single-term examples of types of exercise Discrete definition for vigorous/moderate PA

Theme 2: Clinician individual characteristics
Clinicians meeting national PA guidelines showed greater understanding of PA, and had a preference for the 3Q rather than the GPPAQ, in Stage-3, whereas those less physically active preferred the GPPAQ, linked to its ability to guide the assessment process.

Theme 3: Instrument design/content
Participant responses provided insight into the knowledge and confidence of clinicians, regarding PA assessment. This was closely linked with the design, and content of instruments. The GPPAQ featured elementary style language, typically used in lay language. It was longer in length and used explicit examples for incidental and planned PA including reference to occupational activity (see Table 3).

Participant's referred to how their preferred instrument supported inadequacies, or limitations faced in conducting PA assessments. Specifically, PNs referred to the absence of technical terminology such as "vigorous" and "moderate" intensity in the GPPAQ. Several clinicians highlighted that the GPPAQ provided terminology that was "*... more specific with asking exactly what exercise*" and comments that the GPPAQ "*... was more specific.*" (PN5)

Just over half of all clinicians reported using the instrument as a prompt/guide during the assessment, indicating that the "... [GPPAQ] *examples helped explain what was meant*" and were "*... clearly written [with]... good examples of what they would expect each types of activity to include.*" (FP5)

The GPPAQ content used limited technical (PA) terminology and used examples for the subject to consider, such as work, leisure and planned PA. For example, one clinician said that the GPPAQ '*...gets people to give a bit of a depiction of how their work is and exactly how intense their work is ... it also breaks down the PA outside of work fairly accurately too.... somewhat easier for the patient to interpret than some of the other ones... [gives]...more of an idea of what they're actually doing rather than them just saying I do regular exercise.*" (FP4)

Comments regarding the content and design of each instrument included "*...examples helped explain what was meant*" (FP5) and were "*... clearly written [with]... good examples of what they would expect each types of activity to include.*" (PN4). In addition, the scope of the instruments and types of patients that were considered also influenced preferences. An important distinction made in relation the GPPAQ included the assertion that the "*... GPPAQ was broader based, so it covers the employment side of things as well as the things that you do for leisure as opposed to the other one seems to be more just what you do for leisure, really.*" (PN4).

TDF Domain: Beliefs about capabilities
The intrinsic beliefs and capabilities of clinicians, about their ability to execute PA assessment was linked to instrument preferences. There were two themes associated with this domain;

Theme 1: Ability to motivate patients
Theme 2: Confidence and familiarity

Theme 1: Ability to motivate patients
There was reference regarding clinician's ability to motivate the patient for successful behaviour change and the role the instrument played in supporting this. Some clinicians thought the instruments "*...helped motivate these patients to exercise if they weren't already*". The questionnaires prompted patients to think about their activity. A participating PN recalled a patient saying "*You know, I think I should be doing more, I should be doing more*". (PN5)

Theme 2: Confidence and familiarity
Clinicians discussed how they would link the use of the instrument to existing procedures or activities within their practice. They reflected on current processes/systems in place, and how the questionnaire would fit within this framework so that it could conform to existing processes.

One of the FPs referred to the similarities between the 3Q instrument and current practice. She highlighted that "*This is similar to the way I'm already approaching patients... I suppose I'm biased because it's something that I'm familiar with and that's the way I do it, um and it can lead on to some advice I guess...*" (FP6)

Extrinsic variables
TDF Domain: Social/professional and role and identity
The analysis indicated that clinicians maintained a professional responsibility to facilitate PA assessment. Professional training, knowledge and competencies provided clinical knowledge of the benefits associated with PA. There were two themes that emerged from clinician feedback that related to this domain;

Theme 1: Patient selection
Theme 2: Leveraging external factors during consultations

Theme 1: Patient selection
Extrinsic variables included the professional responsibilities of the clinicians and how the instrument supported this role. Clinicians referred to patients within a strata

or a demographic classification e.g. patients with established chronic conditions, gender, age or social mediums, such as unemployed, mothers and elderly.

There were differences between clinician roles and responsibilities and how they referred to implementing their preferred instrument. Both FPs and PNs indicated that PA assessment was undertaken with select patients, however for FPs, selection was undertaken on an incidental basis rather than pre-emptive planning. That is, as patients presented for consultations, the clinicians elected to conduct an assessment if they felt there was a specific clinical need. In essence, this stratified patients, albeit incidentally for assessment rather than assessing the practice population, in an all-encompassing approach. One FP, mentioned that *"...whenever I go through blood test results and there's something that's a little bit abnormal... high cholesterol, borderline sugar, it usually does prompt a discussion on exercise....middle aged patients who are slightly overweight..."* (FP4)

Dissimilar to FPs, PNs used the preferred instrument(s) within formal practice-based initiatives such as health assessments. This was evident when discussing the type of consultations or patients they would likely initiate PA assessment. A nurse whose primary role was to conduct 75 year old health assessments for her practice selected the GPPAQ instrument because it *"... would incorporate the retired people"* (PN3). Another nurse mentioned that her role focused on women's health. This nurse preferred the GPPAQ instrument because *"It covers traditional women's activities like housework better than Questionnaire 3* [3Q]..." (PN2)

Theme 2: Leveraging external factors during consultations

The use of specific situations where the clinician could introduce or initiate PA assessment, were highlighted during interviews. Clinicians referred to the use of the preferred questionnaire(s) during consultations where they could initiate a discussion about PA under the guise of something else such as health assessments, poor pathology results, diabetes cycle of care activities and care planning. One FP commented that *"... whenever you go through blood test results there's often something that's a little bit abnormal, you know high cholesterol, boarder line sugar, it usually does prompt a discussion on exercise. ... it would be very useful for that situation."* (FP4)

TDF Domain: Innovation

Innovation referred to the use of the PA assessment instrument as a tool to discourage/encourage the development of PA assessment skills or behaviour. There were two themes that emerged from the data that related to this domain;

Theme 1: Support tool for conducting/initiating PA assessment
Theme 2: Adaptive behaviour to support improved competency

Theme 1: Support tool for conducting/initiating PA assessment

Clinicians referred to using the instrument as a mechanism for starting a conversation with the patient about PA, rather than raising with topic independently. In one case, the GPPAQ was used as "... *a springboard ...It kind of led on to other things.*" (PN10). In addition, there was reference to the questionnaires acting as a prompt during their consultation with patients, initiating thought about activity. A participating PN referred to a consultation with a patient where PA behaviour was discussed. The PN recalled that the conducting the PA assessment using the GPPAQ enabled patients to independently realise they were insufficiently physically active. This PN recalled patient responses "*...you know I think I should be doing more, I should be doing more*" that kind of think came up. (PN10)

Theme 2: Adaptive behaviour to support improved competency

After using the instruments in Stage-3, preferences changed amongst some clinicians from the GPPAQ to the 3Q. This was particularly evident amongst clinicians with higher knowledge/perceived confidence of PA assessment. This indicated a period of adaptation and heightened understanding of the concepts of PA assessment. Supporting the premise that a degree of adaptation occurred between the two study points (Stage-1 and 3), amplifying clinician competency. For example, a clinician referred to their interaction with a patient during the assessment and how they "*... found the 3Q one a little harder to understand at first, but we just read it through a few times and then it was no problem.*" Another clinician referred to the use of examples in the GPPAQ "*...were good, because that way they [the patients] realised what vigorous was.* " (PN4)

TDF Domain: Innovation strategy

Innovation strategy refers to how the PA instruments encouraged or discouraged the execution of PA assessment for each clinician. Clinicians indicated that the brevity of the instrument was not indicative of the time taken to complete the questionnaire, and inconsequential in deciding their preferences. Whilst time was raised as a consideration, it was associated with how quickly or efficiently they could complete it the assessment. This was linked to clinician knowledge and confidence and how this would impact the time taken to complete an assessment. This was linked to their ability to their understanding of the content of each instrument. Almost half (47.4 %, 9/19) of all clinicians referred to the support the instrument(s) provided them using phases such as "...it took a little bit longer but I'd still prefer this one

[GPPAQ]." (PN6) and "... I'd rather do [GPPAQ] and get that much more info " (FP2).

TDF Domain: Social influences

In the context of this study, social influences referred to interpersonal variables that influenced clinician knowledge/competency of PA assessment.

Analysis identified associations between clinicians who were physically-active and their preference for the 3Q instrument. This was particularly evident in Stage-3, when clinicians had used both instruments for the period of the intervention (12-weeks). These differences indicated a variation in the competency of clinicians administering the instruments. Administration of the 3Q necessitated a proficiency in PA assessment variables. The link between preference and PA status possibly relates to prior knowledge, perceived confidence, and/or personal experience with PA.

The study did not determine the number of PA assessments undertaken by clinicians during the intervention period. The primary purpose of the study was to determine clinician preferences following a period of 'testing' the preferred instruments (between Stages 1 and 3). This process was to validate initial preferences stated in Stage-1 interviews. Initially, the frequency of PA assessments undertaken during the testing phase was not considered when designing the study. Some clinicians changed their preferences between Stage 1 and Stage 3. This is indicative that a period of adaption or learning occurred after using the instruments, following their initial impressions of each instruments. This study did not focus on variations in exposure to each instrument. Further research is required to investigate the educational requirements or variations that occur to increase clinician knowledge on this topic. This has been added to the further research section in the conclusion section.

Discussion

This study determined FP and PN preferences amongst a selection of five PA assessment instruments. Preference for two instruments were identified; (1) GPPAQ and (2) 3Q. Reasons for preference were linked to a range of variables including; individual clinician PA status, knowledge/perceived competency in PA assessment, and features contained within each instrument.

Triangulation of data identified links between; (1) clinician PA status, (2) knowledge and perceived competency in PA assessment and (3) preference for PA instruments. Practice nurses maintained consistent preference for the GPPAQ instrument, had a lower proportion of personal PA (40 %) than FPs, and demonstrated limited knowledge/perceived competency and confidence in PA assessment. The reverse was the case for FPs and PNs who were recorded as physically active.

Intrinsic variables

The relationship between the individual characteristics of clinicians and patient encounters is well documented [41–43]. Yet, little is known about the relationship between individual clinician characteristics and their impact on delivering PA assessment. This study identified a number of intrinsic demographic characteristics of clinicians that showed associations with instrument preferences including; clinician PA status and their level of competency regarding PA assessment.

Findings indicate that clinicians fit on a spectrum of high knowledge/competency through to limited knowledge/competency in terms of their ability to perform PA assessment. Clinicians categorised as physically inactive were associated with lower knowledge/competency of PA behaviour change, the reverse was the case for physically active clinicians. The GPPAQ demonstrated rudimentary support for clinicians, whereas the 3Q instrument suited those more familiar with the mechanisms of PA assessment. This study suggests that consideration of clinician knowledge/perceived competency and confidence of PA behaviour change could be addressed by simplifying terminology, and including relevant examples to guide the assessment process. A recent study conducted in the United Kingdom determined the usability of the GPPAQ amongst British GPs and nurses, specifically regarding its application within socio-economically disadvantaged populations [44]. Health professionals found the GPPAQ easy-to-use, particularly amongst patients with complex conditions who could benefit from PA behaviour change, however it suggested further enquiry around optimal methods of integration within routine practice [44].

For less knowledgeable clinicians, the time taken to complete an assessment is likely to be longer, particularly if the instrument does not support limited knowledge/competency. This finding is contrary to previous research [30, 45–47]. Whilst time is a limiting factor, this study suggests that it might be addressed if clinician knowledge and competency in PA assessment is augmented by the assessment instrument [30, 45–47].

Extrinsic variables

There were differences observed between the GPPAQ and 3Q instrument variables (Table 3) determined in the preferred instrument analysis. These included theoretical orientation, terminology, number of questions, outcome measures, types of PA such as planned and/or incidental exercise, and inclusion of examples/

scenarios to aid interpretation [24, 40]. Given the theoretical orientation of the GPPAQ lies within the context of family practice, it is not surprising there was a high preference for this instrument [40]. Interpretation of technical terminology, such as 'vigorous' and 'moderate' in the context of PA assessment proved difficult for some clinicians, specifically those linked with lower levels of individual PA

The patient population within each practice influenced clinician preferences, with clinicians ensuring the questions met the needs of current patients and/or encounters e.g. women with children, men and retired patients. Complex adaptive theory can be used to describe how clinicians considered the dynamic network of interacting agents presented during routine care such as balancing the need for acute care, with that of preventive care [48, 49]. This is compounded by variations in routine encounters according to patient demography e.g. patient gender, reason for visit or the complexity of conditions [50, 51].

The notion of a blanket approach to PA assessment, incorporating the entire patient population was not evident in this study. Consistent with complex adaptive practice, clinicians were selective, or decentralised in their approach, leveraging or drawing on a range of methods or situations to incorporate PA assessment into routine practice [52]. Examples of methods include clinicians initiating PA assessment following the delivery of poor pathology results or, during health assessments. Clinicians indicated that by using their preferred instrument, they would be able to integrate PA assessment into a given situation such as those outlined above. Theories of behaviour change and complexity for health promotion provide the best explanation for these findings, with clinicians using selective approaches to adapt to change by shifting one variable, such as the PA assessment instrument discussed here [4, 50, 51, 53].

Strengths and limitations

Limitations of this study include the small sample size and potential generalizability beyond that of the geographical region in which the study was conducted. Despite this, there was equal representation of FPs and PNs. All clinicians had prior experience in referring patients for PA behaviour change via the local GPERS. As a result, it is recognised that this sample describes clinicians who may be more interested in PA assessment and preventative care, than the general population [29, 54, 55]. However, these health professionals are more likely to offer meaningful input regarding their application of PA assessment instruments, than those without prior involvement as they have an established commitment to preventative care. The geographical region where the study was conducted offers relative homogeneity with respect to other large, industrialised cities both in Australia and internationally. This extends beyond population profiles to rates of physical inactivity, rates of chronic disease and primary care systems [56–60].

Use of the TDF offers both strengths, and limitations. The strengths of this framework include the ability to draw on a range of relevant behaviour change and implementation research theories in one synthesised and accessible framework [39]. It is acknowledged that potential limitations may have impacted on the findings of this study; however the following efforts have been made to reduce any outliers [39]. The TDF was used as a structural framework for analysis only. Secondly, the investigators aimed to reduce associated limitations with data analysis by co-opting investigators skilled in behaviour change and implementation research skills.

Conclusion

This study demonstrated preferences for two instruments, preferred for use in routine family-practice encounters. The GPPAQ was most preferred, followed by the 3Q for both FPs, and PNs. However, as experience in PA assessment increased both FPs and PNs reported increased satisfaction with the 3Q.

The GPPAQ has not previously been implemented in Australia, despite widespread application in the United Kingdom, whilst the 3Q has had an established position in Australian family practice through use in existing resources [24, 32].

Instrument preferences were influenced by a range of intrinsic and extrinsic variables. Intrinsic variables related to clinician knowledge/perceived competency of PA and/or individual PA levels. Extrinsic variables related to the content of instruments facilitating support for clinicians throughout the assessment process and limiting time taken to complete the assessment.

The outcomes of this study suggest that limited uptake of PA assessment in family practice may not be directly linked to clinician time restrictions, but associated with a range of intrinsic and extrinsic variables. It suggests that PA assessment may be related to variations in personal PA levels of clinicians, and that identification and integration of assessment instruments should be matched to their individual needs, acknowledging differences in physician knowledge/competency levels, and patient population.

Further research is required to quantify clinician knowledge of PA assessment to ensure instruments are appropriately graded to meet the needs for assessment.

Appendix

Table 4 Time 1 and 2 interview schedule

Time 1: Interview schedule	Time 2: Interview schedule
Health professionals will be asked for their opinions about the following five instruments and their impression as a potential instrument for use by patients in their practice: 1. Active Australia. 2. Occupational Sitting and Physical Activity Questionnaire (OSPAQ). 3. 2-Question Physical Activity Questionnaire (2Q). 4. 3-Question Physical Activity Questionnaire (3Q). 5. General Practice Physical Activity Questionnaire (GPPAQ). A copy of each questionnaire provided to interviewee and given 10 minutes to review the content and format Investigator 1. From the selection of questionnaires provided, do you have any preferences on which ones you would rather use for patients in your practice? If so, why? 2. From the selection of questionnaires provided, are there any that you find difficult to understand? If yes, which ones and why? 3. From the selection of questionnaires provided, are there any specific questions that you would find difficult to explain to patients? If so, which ones and why? 4. Which of the 5 questionnaires would you feel most confident to use amongst patients in your practice and why? 5. Are there any questionnaires that you would be interested in finding out more about and possibly implement in routine practice? If so which ones and why? 6. If your most preferred questionnaire was provided to you by the method of your choice (e.g. Medical software), how often would you use this? 7. What sort of patients would you use this for?	1. How easy did you find the two questionnaires were to administer with patients? (Consider time taken and ease of use in completing the form) Questionnaire #1 Questionnaire #2 2. Did you have to explain, prompt or provide more information to patients about any of the questions? If so, which questionnaire and specific questions? 3. Did you have a preferred questionnaire and if so, which one and why? 4. How useful did you find the preferred questionnaire was in giving you an accurate picture of a patient's current physical activity level 5. Would you use the preferred questionnaire again, if so what would you recommend to assist you in doing this?

Abbreviations

2Q: 2-question PA questionnaire; 3Q: 3-question physical activity questionnaire; AA: Active Australia; FP: Family physician; GP: General practitioner; GPERS: GP Exercise Referral Scheme; GPPAQ: General practice physical activity questionnaire; HREC: Human Research Ethics Committee; OSPAQ: Occupational sitting and physical activity questionnaire; PA: Physical activity; PCO: Primary care organization; PN: Practice nurse; TDF: Theoretical domains framework

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Availability of data and materials

The dataset(s) supporting the conclusions of this article is (are) available on request from the primary author Shona Dutton E shona_dutton@hotmail.com. The availability of data adheres to the constraints set out under HREC 11068 of the University of NSW Human Research Ethics Committee.

Authors' contributions

All authors of this manuscript have contributed to its execution of in the following ways: Made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data. Involvement in drafting the enclosed manuscript or revising for intellectual content. Provided final approval of the version to be published. Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Competing interests

All authors declare that they have no competing interests.

Consent for publication

All participants provided informed written consent prior to participation in the study within the requirements of the University of NSW HREC 11068. Participants were aged 18 years and over and therefore did not require parental or guardian consent.

Ethics approval and consent to participate

Ethical approval was granted by the University of New South Wales Human Research Ethics Committee (HREC 11068).

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Appendix 4 Information statement, consent and revocation of consent

THE UNIVERSITY OF NEW SOUTH WALES Centre of Primary Health Care & Equity

Approval No HREC 11068

GP AND PRACTICE NURSE INFORMATION STATEMENT AND CONSENT FORM

Quantifying physical activity behaviour through the general practice team

Investigators: Dr Sarah Dennis, Ms Shona Dutton, Professor Mark Harris and Professor Nicholas Zwar

You are invited to participate in a study that aims to examine the feasibility of up to five (5) physical activity assessment questionnaires for use in general practice. In addition, the investigators hope to determine the reliability of two (2) of these questionnaires, when administered by different members of the general practice team such as; GP, Practice Nurse and patient self-report.

If you decide to participate in this study, researchers will identify your patients who have participated in the GP Exercise Referral Scheme in the previous six months, and invite them to participate in the study. In addition, you will be asked to undertake the following:

Step 1

A sample of GPs and Practice Nurses will be selected to participate in an interview to provide feedback regarding the feasibility of up to five (5). Two questionnaires will be selected based on feedback from the interviews for step two of the study which will involve testing the questionnaires for reliability and feasibility. The Practice Nurse group will also test the questionnaires against accelerometer data for each patient. Accelerometers are similar to pedometers and provide researchers with information regarding physical activity undertake in the past 7 days.

Step 2

Participating patients will attend a maximum of two (2) appointments with one week between. An outline of what will occur during the appointments is provided below:

Appointment 1
- Accelerometer assigned to patient for proceeding 7 days (for Practice Nurse Group only).
- Appointment 2 scheduled for 7 days in advance with GP, Practice Nurse or advised if the questionnaire will be mailed to patient directly for completion.

Appointment 2
- Questionnaire administered via assigned methods i.e. GP, Practice Nurse or mailed directly to patient.
- Accelerometer collected (for Practice Nurse group only).

Step 3

A sample of GPs and Practice Nurses will be selected to participate in an interview conducted by the Researcher to obtain feedback regarding the use and acceptability of the questionnaire.

It is estimated that a total of 35-40 minutes of your time will be required to complete the assigned questionnaire in the 'Appointment 2' section of the study, and complete an interview before and after the study.

All GPs and Practice Nurses participating in the study will receive a feedback report for each patient based on the outcomes from the physical activity measures obtained through by the questionnaires and accelerometer. This report will be provided electronically to enable direct upload to medical software and patient records and will act as an up-to-date record of your patient's physical activity behaviour. We cannot and do not guarantee or promise that you will receive any benefits from this study.

Your involvement in this study will be strictly confidential and will be disclosed only with your permission or except as required by law. If you give us your permission by signing this document, we plan to publish the results in reports and journals. In any publication, information will be provided in such a way that you cannot be identified. A summary of results will be sent to you via a letter at completion of the study.

If you would like more information, feel free to contact the Research Officer, Ms Shona Dutton, Ph: 9545 3533 or email sdutton@shiregps.org.au

Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

Complaints may be directed to the Ethics Secretariat, The University of New South Wales, SYDNEY 2052

AUSTRALIA (phone 9385 4234, fax 9385 6648, email ethics.sec@unsw.edu.au). Any complaint you make will be investigated promptly and you will be informed out the outcome. You will be given a copy of this form to keep.

If you have any questions, please feel free to ask us. If you have any additional questions later, Ms Shona Dutton Ph: 9545 3533 or email sdutton@shiregps.org.au will be happy to answer them. You will be given a copy of this form to keep.

THE UNIVERSITY OF NEW SOUTH WALES Centre of Primary Health Care & Equity

PARTICIPANT INFORMATION STATEMENT AND CONSENT FORM (continued)

Quantifying physical activity behaviour through the general practice team

You are making a decision whether or not to participate. Your signature indicates that, having read the information provided above, you have decided to participate.

……………………………….	…………………………………….
Signature of Research Participant	Signature of Witness
………………………………….	………………………………….
(Please PRINT name)	(Please PRINT name)
………………………………….	………………………………….
Date	Nature of Witness

REVOCATION OF CONSENT

Quantifying physical activity behaviour through the general practice team

I hereby wish to **WITHDRAW** my consent to participate in the research proposal described above and understand that such withdrawal **WILL NOT** jeopardise any treatment or my relationship with The University of New South Wales, Centre of Primary Health Care & Equity.

……………………………………	………………………………………
Signature	Date
……………………………………	
Please PRINT Name	

The section for Revocation of Consent should be forwarded to Dr Sarah Dennis Senior Research Fellow - Centre for Primary Health Care and Equity, UNSW General Practice Unit Fairfield Hospital, P.O. Box 5, Fairfield NSW 1860

Appendix 5 Active Australia Survey

Active Australia survey

1. a. In the last week, how many times have you walked continuously, for at least 10 minutes, for recreation, exercise or to get to or from places?

   ______________ times

   b. What do you estimate was the total time that you spent walking in this way in the last week?

   ______________ hours _____________ minutes

2. a. In the last week, how many times did you do any vigorous physical activity which made you breathe harder or puff and pant? (e.g. jogging, cycling, aerobics, competitive tennis)

   _______________ times

   b. What do you estimate was the total time that you spent doing this vigorous physical activity in the last week?

   ______________ hours ______________ minutes

3. a. In the last week, how many times did you do any other more moderate physical activities that you have not already mentioned? (e.g. gentle swimming, social tennis, golf)

   _______________ times

   b. What do you estimate was the total time that you spent doing these activities in the last week?

   ______________ hours ______________ minutes

Appendix 6 Occupational Sitting and Physical Activity Questionnaire

Occupational Sitting and Physical Activity Questionnaire

1. How many hours did you work in the last 7 days? ______________ hours

2. During the last 7 days, how many days were you at work? _____________ days

3. How would you describe your typical work day in a usual week? (This involves only your work day, and does not include travel to and from work, or what you did in your leisure time)

a	Sitting (including driving)	%
b	Standing	%
c	Walking	%
d	Heavy labour or physically demanding tasks	%
	Total	% *(Must equal 100%)*

Appendix 7 Two-Question Physical Activity Questionnaire

Two-Question Assessment

1. How many times in a usual week do you usually do 20 minutes or more of vigorous-intensity physical activity that makes you sweat or puff and pant? (e.g., heavy lifting, digging, jogging, aerobics, or fast bicycling).

   ☐ 3 or more times a week
   ☐ 1 to 2 times a week
   ☐ None

2. How many times in a usual week do you usually do 30 minutes or more of moderate-intensity physical activity or walking that increases your heart rate or makes you breathe harder than normal? (e.g., carrying light loads, bicycling at a regular pace, or doubles tennis).

   ☐ 5 or more times a week 3–4 times a week
   ☐ 1–2 times a week
   ☐ None

<u>Appendix 8</u> Three-Question Physical Activity Questionnaire

Three-Question Assessment

1. How many times in a usual week do you usually do 20 minutes or more of vigorous-intensity physical activity that makes you sweat or puff and pant? (e.g., heavy lifting, digging, jogging, aerobics, or fast bicycling)?

   ☐ 3 or more times a week
   ☐ 1 to 2 times a week
   ☐ None

2. How many times in a usual week do you usually do 30 minutes or more walking? (e.g., walking from place to place for exercise, leisure or recreation)

   ☐ 5 or more times a week
   ☐ 3–4 times a week
   ☐ 1–2 times a week
   ☐ None

3. How many times in a usual week do you usually do 30 minutes or more of moderate-intensity physical activity that increases your heart rate or makes you breathe harder than normal? (e.g., carrying light loads, bicycling at a regular pace, or doubles tennis)

   ☐ 5 or more times a week
   ☐ 3–4 times a week
   ☐ 1–2 times a week
   ☐ none

Appendix 9 GP Physical Activity Questionnaire

General Practice Physical Activity Questionnaire

Date: …………………………… Name: ……………………………………………………………

1. Please tell us the type and amount of physical activity involved in your work

		Please mark 1 box only
a	I am not in employment (e.g. retired, retired for health reasons, unemployed, full-time carer, etc…)	
b	I spend most of my time at work sitting (such as in an office)	
c	I spend most of my time at work standing or walking. However, my work does not require much intense physical effort (e.g. shop assistant, hairdresser, security guard, child carer, etc…)	
d	My work involves definite physical effort including handling of heavy objects and use of tools (e.g. plumber, electrician, carpenter, cleaner, hospital nurse, gardener, postal delivery workers, etc…	
e	My work involves vigorous physical activity including handling of very heavy objects (e.g. scaffolder, construction worker, removalist, etc…)	

2. During a usual week, how many hours did you spend on each of the following activities?

		None	Some but less than 1 hour	1 hour by less than 3 hours	3 hours or more
a	Physical exercise such as swimming, jogging, aerobics, football, tennis, gym workout, etc…				
b	Cycling, including cycling to work and during leisure time				
c	Walking, including walking to work, shopping, for pleasure, etc…				
d	Housework/Childcare				
e	Gardening/Housework				

3. How would you describe your usual walking pace? Please mark one box only

Slow pace (i.e. less than 2-3 km/hr)		Steady average pace (i.e. between 3-4 km/hr)	
Brisk pace (i.e. between 4-5 km/hr)		Fast pace (i.e. more than 5 km/hr)	

Appendix 10 Time 1 and 2 interview schedule

Time 1: Interview schedule (Acceptability study)

Health professionals will be asked for their opinions about each instrument and their impression as a potential instrument for use by patients in their practice. The following 5 instruments have been selected for qualitative analysis:

1. *Active Australia.*
2. *Occupational Sitting and Physical Activity Questionnaire (OSPAQ).*
3. *2-Question Physical Activity Questionnaire (2Q).*
4. *3-Question Physical Activity Questionnaire (3Q).*
5. *General Practice Physical Activity Questionnaire (GPPAQ).*

A copy of each questionnaire provided to interviewee and given 10 minutes to review the content and format

Investigator

1. From the selection of questionnaires provided, do you have any preferences on which ones you would rather use for patients in your practice? If so, why?
2. From the selection of questionnaires provided, are there any that you find difficult to understand? If yes, which ones and why?
3. From the selection of questionnaires provided, are there any specific questions that you would find difficult to explain to patients? If so, which ones and why?
4. Which of the 5 questionnaires would you feel most confident to use amongst patients in your practice and why?
5. Are there any questionnaires that you would be interested in finding out more about and possibly implement in routine practice? If so which ones and why?
6. If your most preferred questionnaire was provided to you by the method of your choice (e.g. Medical software), how often would you use this?
7. What sort of patients would you use this for?

Time 2: Interview schedule

1. How easy did you find the two questionnaires were to administer with patients? (Consider time taken and ease of use in completing the form)

   Questionnaire #1

   Questionnaire #2

2. Did you have to explain, prompt or provide more information to patients about any of the questions? If so, which questionnaire and specific questions?

3. Did you have a preferred questionnaire and if so, which one and why?

4. How useful did you find the preferred questionnaire was in giving you an accurate picture of a patient's current physical activity level

5. Would you use the preferred questionnaire again, if so what would you recommend to assist you in doing this?

<u>Appendix 11</u> Publication 3: Resourcing an evolution of roles in general-practice: a study to determine the validity and reliability of tools to assist nurses and patients to assess physical activity

Dutton Shona N., Bauman Adrian, Dennis Sarah M., Zwar Nicholas, Harris Mark F. (2016) Resourcing an evolution of roles in general-practice: a study to determine the validity and reliability of tools to assist nurses and patients to assess physical activity. Australian Journal of Primary Health

Declaration

I certify that this publication was a direct result of my research towards this PhD, and that reproduction in this thesis does not breach copyright regulations.

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Shona Dutton

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Research

Resourcing an evolution of roles in general-practice: a study to determine the validity and reliability of tools to assist nurses and patients to assess physical activity

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Abstract. Traditionally, GPs have been responsible for physical activity (PA) assessment within the general practice setting. Multiple questionnaires are available to support uptake of PA assessment but less than 30% of patients are assessed. A range of barriers hamper uptake. Evidence indicates that practice nurses (PNs) and patients are resourceful members of the general practice team but have been underutilised. This study assessed the validity and reliability of two instruments for assessing PA, administered by PNs and patients. The study aimed to identify robust tool(s) to support the evolving role of PNs and patients in prevention and management strategies in general practice. A purposive sample of PNs and patients from general practices in Sydney was invited to participate. The results of the PN- or patient-administered general practice physical activity questionnaire (GPPAQ) and the three-question physical activity questionnaire (3Q) were compared against accelerometer activity. The study examined agreement in classification of PA levels according to Australian PA recommendations. Validity showed low–moderate correlations between accelerometer and GPPAQ (rho = 0.26), 3Q (rho = 0.45). Seven-day test-retest reliability intraclass correlation coefficients (ICCs) were 0.82–0.95 for GGPAQ and 0.94–0.98 for 3Q. Agreement with PA recommendations was moderate for GPPAQ (kappa 0.73, 95% CI, 0.56–0.85) and fair for 3Q (kappa 0.62, 95% CI, 0.47–0.78). Although 3Q demonstrated higher correlation with accelerometry, GPPAQ demonstrated higher agreement with PA guidelines. Given GPPAQ showed reasonable rigour, it may prove useful for PN and patient use.

Additional keywords: general practice, measurement, physical activity, practice nurse, primary health care.

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Background

Research highlights the role of general practice in improving population levels of physical activity (PA) (Blair *et al.* 1989). There are many questionnaires available to support implementation of PA assessment in the general practice setting (Bauman *et al.* 2006; Bull and Bauman 2008; Le Grande *et al.* 2008; Fitzgerald *et al.* 2015). However, it is estimated that less than 30% of general practice patients are asked about their PA (Britt *et al.* 2010). PA is assessed less often than smoking and obesity (Hinrichs *et al.* 2011; Orrow *et al.* 2012; National Institute for Health and Clinical Excellence 2013; Fitzgerald *et al.* 2015).Routine assessment is constrained by a range of barriers, such as organisational capacity, personal and/or professional attributes of clinicians/patients and resource provision.

The three-question physical activity questionnaire (3Q) has been validated previously in the Australian context and disseminated widely through medical software and Smoking, Nutrition, Alcohol and Physical Activity initiatives. Despite this, it has not been validated when administered by practice nurses (PNs) or patients (Smith *et al.* 2005). The general practice physical activity questionnaire (GPPAQ) has been adopted in the United Kingdom as a robust option for PA assessment but has not been validated for use in Australian general practice (National Health Service 2006). A recent qualitative study identified these two instruments (GPPAQ and 3Q) as preferred and accepted by general practice clinicians (Dutton *et al.* 2012).

Non-GP members of the general practice team can play a significant role in lifestyle risk-factor management (Proudfoot *et al.* 2007*b*; Taggart *et al.* 2009). The emerging roles of PNs and patient self-management have been highlighted as options for increasing the capacity of general practice to systematically manage prevention strategies (Zwar *et al.* 2006; Orrow *et al.* 2012). This study asked the following two questions;

What is known about the topic?

- The three-question physical activity questionnaire (3Q) was developed as a brief measure of physical activity (PA) to help time-poor GPs, however PA assessment in general practice remains suboptimal.

What does this paper add?

- Prior to this study, the GPPAQ had not been validated for use in the Australian context. This study provides potential strategies for a new PA assessment instrument to be used alongside the established 3Q tool.

1. What is the validity of the GPPAQ (National Health Service 2006) and 3Q (Smith *et al.* 2005) instruments for assessing PA when administered by PNs?
2. What is the reliability of the GPPAQ and 3Q instruments when self-administered by patients?

Methods

The GPPAQ was selected for this study following an earlier consultation process with GPs and PNs, during which they were presented with five PA assessment tools and asked to select their preferred two.

Participants

A purposive sample of 10 PNs from the Sutherland Division of General Practice in Sydney's south was invited to participate. Patients over 18 years who were proficient in English and who had participated in a local GP exercise referral scheme (GPERS) in the previous 6 months were also invited to participate. A list of patients previously referred to the GPERS was used to recruit to the study. Patients were recruited into two groups;

Group 1: validation study

Consenting patients were allocated to the validation study if the PN from their usual general practice had consented to participate in the study (Fig. 1). 'Usual' general practice referred to a practice on whose referral records the patient was listed.

Group 2: reliability study

Consenting patients whose usual PN was not participating in the study were allocated to the reliability study (Fig. 1).

Procedures

Validity study

The investigator (SND) trained the PNs in the procedures for administering questionnaires, including delivering questions without prompts. The patients received training from the investigator regarding accelerometer use and the recording started at midnight the next day. Participants wore an Actigraph GT1M accelerometer (Actigraph Corporation, Pensacola, FL, USA) on their right hip for the 7-day measurement period, removing it only for water-based activities and sleeping. They were instructed to return to their PN to complete the two questionnaires within 2 days of the end of the wearing period.

Reliability study

Participants were forwarded a copy of the two questionnaires (GPPAQ and 3Q) with instructions to complete and return to the investigators (Time 1). This procedure was repeated 7 days later (Time 2) to examine test-retest reliability.

Instruments

The GPPAQ (National Health Service 2006) is a short measure of PA for adult patients (aged 16–74 years), developed and validated in the United Kingdom. PA status is determined using a four-level physical activity index (PAI) that categorises patients as active, moderately active, moderately inactive or inactive according to National Physical Activity Guidelines (Appendix 1) (Commonwealth Department of Health and Aged Care 1999).

The three-question physical activity questionnaire (3Q) (Smith *et al.* 2005) is another short measure of PA developed for use during routine medical consultations. It measures the number of occasions of vigorous intensity activity of >20 min duration, and walking or moderate-intensity activity of >30 min duration, reported in a usual week. The 3Q assesses participation in walking and moderate-intensity activity separately (Appendix 2). The instrument classifies patients as sufficiently or insufficiently active against the National Physical Activity Guidelines (Commonwealth Department of Health and Aged Care 1999).

The Actigraph GT1M accelerometer (Fitzgerald *et al.* 2015) objectively measures PA by detecting vertical accelerations. It also measures steps taken. To eliminate bias, the accelerometer was encased in durable plastic, offering no indication to the wearer that the device was active. The accelerometers were calibrated, the epoch interval used was set at 1 min and output was expressed as mean counts per minute. Seven

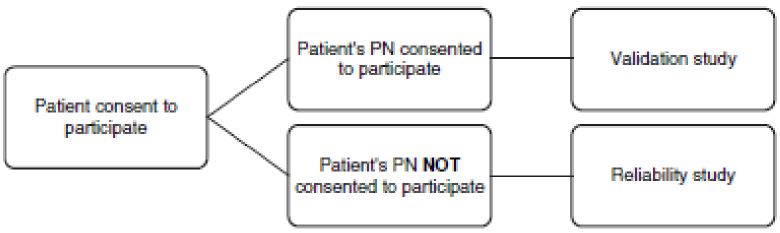

Fig. 1. Distribution of consenting patients to the validation or reliability studies.

consecutive days of physical activity data were monitored, measuring mean counts per day, steps per day and time spent in sedentary (<1.5 metabolic equivalents [MET]), low intensity (1.5–2.9 MET), moderate intensity (3.0–5.9 MET) and vigorous intensity (>6 MET) activity. Accelerometer activity counts were used to compute time spent in activity intensities using existing cut points. Rules for determining usable data, non-wear time and interrupted wear time for the accelerometer were used to filter out non-usable data periods. Agreement between the two instruments (GPPAQ and 3Q) was determined by comparing the proportion of sufficient/insufficient PA with matching accelerometer outcome data.

Statistical analysis

Data were analysed using IBM SPSS Statistics 19 (IMB Corp., Armonk, NY, USA) to determine criterion validity and inter-rater reliability between the PN-administered questionnaires (GPPAQ and 3Q) and accelerometer counts. Criterion validity was indicated by Spearman's rho correlations, classified as low (<0.30), moderate (0.30–0.59) and high (≥ 0.60). Inter-rater reliability was indicated by kappa statistics to assess agreement between the PN-administered questionnaires and the accelerometer data in the classification of participants undertaking sufficient or insufficient activity against national PA recommendations (Commonwealth Department of Health and Aged Care 1999). Agreement was categorised as fair (0.21–0.40), moderate (0.41–0.60) or substantial (0.61–0.80). Participants were categorised according to questionnaire responses. For the GPPAQ, participants were classified as 'active' and for the 3Q, those ranked in the 'adequate' or 'high' (total PA) categories were classified as 'sufficiently active' (National Health Service 2006).

Test-retest reliability was determined by comparing participant responses from Time 1 and Time 2, 7-day test-retest. The reliability analyses calculated intraclass correlation coefficients (ICCs) using a two-way mixed model based on absolute agreement. The ICC was interpreted as poor (<0.4), fair to good (0.4–0.75) or excellent (>0.75) repeatability.

Ethics approval

Ethics approval was obtained from the University of NSW Human Research Ethics Committee (approval number HC11068).

Results

Ten PNs from eight general practices in Sydney took part in the study. A convenience sample of $n=77$ patients was recruited during a 12-week period. Of those recruited, 40 (37 complete) were allocated to the validity study and 37 (36 complete) to the reliability study. There were three patients with unusable accelerometer data in the validity study, and seven patients were excluded from reliability data because of incomplete questionnaires.

Criterion validity

Criterion validity analysis demonstrated moderate correlation between GPPAQ scores and accelerometer counts (70.3% CI, 0.56–0.85), and fair to moderate correlation between 3Q scores and accelerometer scores (62.2% CI, 0.47–0.78) (Table 1).

Test–retest reliability

The 7-day test-retest reliability measures for both instruments demonstrated excellent repeatability, with ICCs ranging from 0.82 to 2.92 for GPPAQ and 0.94 to 0.98 for the 3Q. Results are shown in Table 1.

Discussion

The validation study showed that both instruments demonstrated moderate rank order correlations for agreement against Actigraph accelerometers, typical of PA validation studies (Smith *et al.* 2005). The 3Q demonstrated strong measurement properties in terms of validity and reliability. The GPPAQ showed fair rank order correlations, and higher agreement when compared against national PA guidelines in identifying participants as adequately or inadequately physically active, compared with the 3Q. PNs demonstrated that they could effectively measure PA using both instruments. The percentage agreement for both instruments was similar to that found in other studies using self-reported PA measures against accelerometers (Freedson *et al.* 2012; Fitzgerald *et al.* 2015). This level of agreement is considered acceptable for self-reported PA assessment (Smith *et al.* 2005).

Caution is required when comparing measures of agreement between studies with different sample sizes and study populations (Warren *et al.* 2010). The results of this study suggest that the criterion validity of the GPPAQ and 3Q instruments may be as good as longer self-report measures (for classifying people as sufficiently/insufficiently physically active; Freedson *et al.* 2012; Fitzgerald *et al.* 2015).

A limitation of this study was the small sample size. This has implications for the generalisability of outcomes (Warren *et al.* 2010). For some time, the scientific properties of the 3Q have influenced policy makers attempting to increase the uptake of PA interventions (Smith *et al.* 2005). There have been significant attempts to implement the 3Q instrument across general practice in Australia but PA assessment remains suboptimal. A key issue for adoption is the acceptability of the

Table 1. Results summary including criterion validity, and inter-rater and test-retest reliability for the general practice physical activity questionnaire (GPPAQ) and three-question physical activity questionnaire (3Q) instruments
*Correlation is significant at the 0.01 level (2-tailed). ICC, intraclass correlation coefficient

Instrument	Spearman's rho (95% CI)	Inter-rater reliability – kappa for meeting/not meeting PA guidelines (95% CI)	Test-retest reliability ICC participant responses for Time 1 to Time 2
GPPAQ	0.26 (0.12–0.39)	70.3 (0.56–0.85)	0.90 (0.82–0.95)
3Q	0.45* (0.30–0.61)	62.2 (0.47–0.78)	0.97 (0.94–0.98)

instrument to PNs, who demonstrated a higher preference for the GPPAQ than the 3Q (Dutton *et al.* 2012). Lessons learned from this study indicate a need for further investigation regarding factors influencing widespread adoption and acceptability of PA assessment instruments in primary health care in Australia.

Conclusion

The measurement properties of two instruments for measuring PA when administered by PNs and patients (self-completion) were evaluated. Both the GPPAQ and 3Q showed reasonable validity and reliability when administered by PNs and patients. The GPPAQ may offer a better balance between user preference and measurement rigour to support PA promotion in general practice. This study highlights the need for rigorous and acceptable tools to support PA assessment by non-GP staff. Further research should investigate factors influencing adoption of PA assessment instruments, by PNs and/or patients, beyond measurement properties.

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Appendix 1. Classification of physical activity (PA) based on the general practice physical activity questionnaire (GPPAQ)

Category	Physical activity index (PAI)	Criteria	1 = Does not meet PA recommendations 2 = Meets PA recommendations
0	Inactive	No PA	1
	Inactive	Sedentary job	
1	Moderately inactive	<1 h/week PA sedentary job	
2	Moderately inactive	No PA standing job	
3	Moderately active	Between 1 and 2.9 h/week PA sedentary job	2
4	Moderately active	<1 h/week PA standing job	
5	Moderately active	No PA physical job	
6	Active	3 h/week PA sedentary job	
7	Active	Between 1 and 2.9 h/week PA standing job	
8	Active	<1 h/week PA physical job	
9	Active	Heavy manual job	

Appendix 2. Classification of physical activity (PA) based on the three-question physical activity questionnaire (3Q)

For calculation of the number of sessions, the midpoint in the response category was used (e.g. 1.5 for a response of 1–2 sessions/week). Total activity sessions/week = moderate session/week + (2 × vigorous sessions/week)

Category	Level of PA	Criteria	1 = Does not meet PA recommendations 2 = Meets PA recommendations
0–2	Minimal	0 sessions/week plus ≤ 1–2 sessions/week walking Or 0 sessions/week plus ≤ 1–2 sessions/week moderate activity	1
3–4	Low	1–2 sessions/week vigorous plus ≤ 1–2 sessions/week walking Or 1–2 sessions/week vigorous plus ≤ 1–2 sessions/week Or 0 sessions/week vigorous plus 3–4 sessions/week walking Or 0 sessions/week vigorous plus 3–4 sessions/week moderate activity	2
5–7	Adequate	≥3 sessions/week vigorous ≥5 sessions/week walking Or ≥5 sessions/week moderate activity Or 1–2 sessions/week vigorous plus 3–4 sessions/week walking Or 1–2 sessions/week vigorous plus 3–4 sessions/week moderate activity	
≥8	High	≥3 sessions/week vigorous plus ≥3–4 sessions/week walking Or ≥3 sessions/week vigorous plus ≥3–4 sessions/week moderate activity	

Appendix 12 GP Exercise Referral Scheme information sheet

Sutherland Division of General Practice – GP Exercise Referral Scheme

The Sutherland Shire GP Exercise Referral Scheme was started in February 2004, as a joint initiative between Sutherland Division of General Practice and the Sutherland Shire Leisure Centre (Sutherland Shire Council). The program is conducted in the Sutherland Shire of Sydney which is one of the largest local government areas in Australia, with an estimated 214,030 residents [66]. The population is relatively homogenous with 78% Australian born and only 14.4% speaking a language other than English at home [66].

All GPs in the region were provided the opportunity to refer eligible patients to the program, promoted through the local Division of General Practice (Sutherland). At the time this research project started, 131 GPs (n=216, 61%) has referred to the program between the time the program started (2004). General Practitioners were able to refer any adult patient aged 18 years and over, meeting the referral criteria. The referral criteria included the following:

- Pre-diabetes (IFG/IGT).
- Type one diabetes.
- Type two diabetes.
- Back pain (non-acute) Hypertension.
- Obesity.
- Current and ex-smokers.
- Sedentary lifestyle.
- Osteoarthritis.
- Osteoporosis (asymptomatic).
- Polycystic ovarian syndrome.
- Stress or anxiety.

Completed the **Sutherland Hospital Cardiac Rehabilitation or Heart and Lung Team** or completed an exercise rehabilitation program with the following criteria:

- ***Stable heart disease or other stable chronic disease including:***
  - At least three months following hospital discharge for an acute coronary syndrome.
  - At least three months following coronary bypass surgery, heart valve surgery or other cardiac surgery.
  - At least 3 months following coronary angioplasty/stenting for stable coronary artery disease (CAD).
  - With two of major risk factors for heart disease who were previously sedentary.
  - Heart failure or cardiomyopathy with New York Heart Association (NYHA).
  - Class 1 or 2 (non-symptoms during exercise or reduced physical capacity during moderate activity).
  - BMI Mass Index greater 30 .
- ***Previous cardiac history with little or no rehabilitation and;***
  - Assessed as medically stable and suitable to exercise by GP.
  - Able to walk 300-400 metres in six minutes.

All patients participating in the GP Exercise Referral Scheme participated in an initial one-to-one assessment between patient and exercise physiologist, ten supervised exercise sessions and a re-assessment with the exercise physiologist. Contraindications to the exercise program included acute, complicated and unstable heart conditions or hypertension.

Appendix 13 Letter of support from ESML

medicare
local
EASTERN SYDNEY
Connecting health to meet local n

27 May 2013

Annamarie D'souza
Ethics Officer
Ethics Secretariat
UNSW Grants Management Office
High Street
KENSINGTON NSW 2052

Email: anna.dsouza@unsw.edu.au

Dear Ms D'souza

Re: ***What mechanisms and processes support the uptake of physical activity assessment and advice in primary health care?***

The Eastern Sydney Medicare Local (ESML) would like to offer their support to the UNSW Centre for Primary Health Care and Equity in implementation of the abovementioned study. The ESML will provide support for the implementation of this study including recruitment, data collection and dissemination of findings via established provider networks.

The study will be integrated within the activities of the (ESML) population health stream to assist in addressing the prevention and management of chronic disease and associated lifestyle risk factors. The study aligns well with health priorities recently identified through the ESML comprehensive community needs assessment. This assessment highlighted the need to address lifestyle risk factor including physical activity.

The ESML welcomes the opportunity to integrate this study within the strategic and operational frameworks and the subsequent benefits the opportunity offers in terms of collaboration with the University of NSW. We look forward to jointly disseminating the outcomes of the study and translation of findings, with our stakeholders.

If you require any further information, please contact me on the details listed below.

Yours sincerely,

Darrell Williams
Chief Executive Officer

www.esml.org.au
L2, 6-8 Crewe Place Rosebery NSW 2018
t 02 9663 5958 f 02 9663 5817
ABN 49 158 486 670

Appendix 14 Information statement, consent and revocation of consent

THE UNIVERSITY OF NEW SOUTH WALES Centre of Primary Health Care & Equity

Approval No13127

PRACTICE INFORMATION STATEMENT AND CONSENT FORM

What mechanisms and processes support the uptake of physical activity assessment in general practice?

Investigators: Dr Sarah Dennis, Ms Shona Dutton and Professor Mark Harris

You are invited to participate in a study that aims to investigate processes and mechanisms needed to support the increases in physical activity assessment and advice, in primary care patients. The purpose of the study is to support providers to prevent and manage chronic disease through efficient and effective physical activity assessment and advice.

This study support the continued implementation of the RACGP Red Book for preventative activities in general practice. Participation offers a comprehensive clinical audit with a focus on lifestyle risk factor indicators. Category 1 CPD points through the RACGP are available for consenting practices completing the study.

If you decide to participate in this study, you will be asked to undertake the following:

Step 1 – Planning

Clinical audit

The researchers will conduct a clinical audit of your practice to identify the following measures indicative of physical inactivity; weight, height, waist circumference, blood pressure, lipids and referrals to physical activity program. UNSW will provide a feedback report with outcomes of audit and key indicators of physical inactivity

Questionnaire

Relevant practice staff will be asked to complete a questionnaire to determine knowledge, skills, confidence regarding the physical activity assessment and advice

Step 2 – Intervention

UNSW will provide training to the practice regarding the intervention and associate resources including orientation to the assessment questionnaire, fact sheets and directories. Additional assistance is available regarding uploading electronic resources to clinical software.

Implementation – the practice will implement the intervention which includes administering the physical activity assessment questionnaire, calculating the physical activity score, providing the appropriate fact sheet(s) and referring eligible patients for physical activity support using the directory provided.

Step 3 – Follow-up

Clinical audit

A following audit will be completed with an accompanying report and discussion regarding the results

Questionnaire

Practice staff will be asked to complete a follow-up questionnaire to determine changes in knowledge, skills and confidence regarding physical activity assessment and advice

Interview

A sample of staff will be invited to participate in an interview for a qualitative sub−study asking questions relating to processes and mechanisms used for implementation, the usefulness of the instruments provided or the intervention, literacy around physical activity assessment and advice and barriers and enablers to implementation

Feedback report

Practices will be provided a feedback report regarding the outcomes of their clinical audit, a review of the processes implemented and outcomes from qualitative data collected, including advice regarding further education or links for additional support for additional capacity building within the practice.

The investigators of this study cannot and do not guarantee or promise that you will receive any benefits from this study.

Your involvement in this study will be strictly confidential and will be disclosed only with your permission or except as required by law. If you give us your permission by signing this document, we plan to publish the results in reports and journals. In any publication, information will be provided in such a way that you cannot be identified. A summary of results will be sent to you via a letter at completion of the study.

Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

Complaints may be directed to the Ethics Secretariat, The University of New South Wales, SYDNEY 2052 AUSTRALIA (phone 9385 4234, fax 9385 6648, email ethics.sec@unsw.edu.au). Any complaint you make will be investigated promptly and you will be informed out the outcome. You will be given a copy of this form to keep.

If you have any additional questions, contact Shona Dutton, Ph: 9662 0755 or email sdutton@esml.org.au will be happy to answer them.

You will be given a copy of this form to keep.

THE UNIVERSITY OF NEW SOUTH WALES Centre of Primary Health Care & Equity

PARTICIPANT INFORMATION STATEMENT AND CONSENT FORM (continued)

Quantifying physical activity behaviour through the general practice team

You are making a decision whether or not to participate. Your signature indicates that, having read the information provided above, you have decided to participate.

……………………………………….	……………………………………….
Signature of Research Participant	Signature of Witness
……………………………………….	……………………………………….
(Please PRINT name)	(Please PRINT name)
……………………………………….	……………………………………….
Date	Nature of Witness

REVOCATION OF CONSENT

Quantifying physical activity behaviour through the general practice team

I hereby wish to **WITHDRAW** my consent to participate in the research proposal described above and understand that such withdrawal **WILL NOT** jeopardise any treatment or my relationship with The University of New South Wales, Centre of Primary Health Care & Equity.

……………………………………….	……………………………………….
Signature	Date

……………………………………….

Please PRINT Name

The section for Revocation of Consent should be forwarded to Dr Sarah Dennis Senior Research Fellow - Centre for Primary Health Care and Equity, UNSW General Practice Unit Fairfield Hospital, P.O. Box 5, Fairfield NSW 1860

Appendix 15 Information statement, consent and revocation of consent

THE UNIVERSITY OF NEW SOUTH WALES Centre of Primary Health Care & Equity

Approval No13127

PRACTICE INFORMATION STATEMENT AND CONSENT FORM

What mechanisms and processes support the uptake of physical activity assessment and advice in primary health care?

Investigators: Dr Sarah Dennis, Ms Shona Dutton and Professor Mark Harris

Thank you for your participation in the abovementioned study. Outcomes have been analysed and provided to you in the form of a report to you outlining changes in clinical markers and data completeness related to lifestyle risk.

You are invited to participate in a follow-up investigation to determine how you and your staff have integrated the intervention into everyday practice, since taking part in the study. We seek to implement follow-up interviews with you and other staff from your practice, involved with implementing lifestyle risk factor assessment and management. This may include; other GP, practice nurses or reception staff. It is anticipated that each interview will take approximately 10-15 minutes and will be scheduled at a mutually agreeable time for your practice.

The findings of this study will contribute to the continued implementation of the RACGP Red Book for preventative activities in general practice. Participation offers a one off payment of $200 to your practice.

If you decide to participate in this investigation, you will be asked to undertake the following;

Identify staff from your practice, to participate in an interview. Suitable staff include those previously or currently involved with any aspect of implementing lifestyle risk factor management in your practice, including yourself e.g. GPs, Practice Nurses or Reception Staff

Nominated staff will be asked participate in an 10-5 minutes interview with staff relating to their experience with the intervention, sustained activities and changes implemented in response to the intervention

Participating practices and individuals will receive a feedback report regarding the aggregated outcomes of the clinical audit abovementioned investigation outcomes

Participants will receive additional support in the form of best practice resources to sustain the implementation of lifestyle risk factor management in their practice

The investigators of this study cannot and do not guarantee or promise that you will receive any benefits from this study.

Your involvement in this study will be strictly confidential and will be disclosed only with your permission or except as required by law. If you give us your permission by signing this document, we plan to publish the results in reports and journals. In any publication, information will be provided in such a way that you cannot be identified. A summary of results will be sent to you via a letter at completion of the study.

Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

Complaints may be directed to the HREC Coordinator, The University of New South Wales, Sydney NSW, Australia 2052 (phone +61 2 9385 6222 or email humanethics@unsw.edu.au . Any complaint you make will be investigated promptly and you will be informed out the outcome. You will be given a copy of this form to keep. If you have any additional questions, contact Shona Dutton, Ph: 9663 5958 or email sdutton@esml.org.au will be happy to answer them. You will be given a copy of this form to keep.

THE UNIVERSITY OF NEW SOUTH WALES Centre of Primary Health Care & Equity

PARTICIPANT INFORMATION STATEMENT AND CONSENT FORM (continued)

What mechanisms and processes support the uptake of physical activity assessment and advice in primary health care?

You are making a decision whether or not to participate. Your signature indicates that, having read the information provided above, you have decided to participate.

……………………………………………	……………………………………………
Signature of Research Participant	Signature of Witness
……………………………………………	……………………………………………
(Please PRINT name)	(Please PRINT name)
……………………………………………	……………………………………………
Date	Nature of Witness

REVOCATION OF CONSENT

What mechanisms and processes support the uptake of physical activity assessment and advice in primary health care?

I hereby wish to WITHDRAW my consent to participate in the research proposal described above and understand that such withdrawal WILL NOT jeopardise any treatment or my relationship with The University of New South Wales, Centre of Primary Health Care & Equity.

…………………………………………	………………………………………
Signature	Date

……………………………………………

Please PRINT Name

The section for Revocation of Consent should be forwarded to Dr Sarah Dennis, Conjoint Senior Lecturer, Centre for Primary Health Care and Equity, THE UNIVERSITY OF NEW SOUTH WALES, UNSW SYDNEY NSW 2052 AUSTRALIA

Appendix 16 Clinical audit data collection form

CLINICAL AUDIT						
Practice ID:	**GP ID:**					
First Audit Date:	**Second Audit Date:**					
	First Data Collection			**Second Data Collection**		
	Total	**Males**	**Females**	**Total**	**Males**	**Females**
Number of patients seen in the last 12 Months						
RISK ASSESSMENT AND RECORDING – all patients						
Proportion of patients for which following measures were recorded:						
PA assessed within past 12 months:						
Waist measured within past 2 years						
BMI measured within past 2 years						
BP within past 2 years for patients without known HT						
BP within past 12 months for patients with known HT						
RISK ASSESSMENT AND RECORDING – all patients						
HDL - within past 12 months						
LDL - within past 12 months						
Triglycerides - within past 12 months						
Absolute cardiovascular risk - in last 2 years						
Fasting Blood Glucose - in last 3 years						

	First Data Collection			Second Data Collection		
RISK PROFILE OF PATIENTS	**Total**	**Males**	**Females**	**Total**	**Males**	**Females**
Proportion of patients with measurements within healthy target range						
BP <140/90						
Cholesterol < 4 mmol/L						
Triglycerides < 2 mmol/L						
HDL > 1.0 mmol/L						
LDL < 2.5 mmol/L						
Waist < 94cm male, < 80cm female						
BMI 18.5-24.9						
Fasting Blood Glucose <5.5 mmol/L						
Absolute cardiovascular risk <10%						
Proportion of patients with measurements within increased risk						
BP >140/90						
Cholesterol ≥ 4						
Triglycerides > 2 mmol/L						
LDL >=2.5						
Waist ≥ 94cm male, ≥ 80cm female						
BMI 25 to 29.9						
Fasting Blood Glucose 5.5 – 7 mmol/L						
Absolute Cardiovascular risk 10-15%						

	First Data Collection			Second Data Collection		
	Total	**Males**	**Females**	**Total**	**Males**	**Females**
Proportion of patients with high risk						
Waist ≥ 102cm male, ≥ 88cm female						
BMI ≥ 30						
Fasting Blood Glucose > 7.0 mmol/L						
Absolute Cardiovascular risk >15%						
Physical activity assessment						
Number of patients assessed for PA status						
Physical activity referral						
Number of patients referred for PA intervention						

Appendix 17 Clinical audit reflection form

Mechanisms and processes to support increased physical activity assessment and advice in general practice (HREC 13127)

General Practitioner name: ……………………………………………………………………….

RACGP QA&CPD reference number: ……………………………………...........................

Practice ID: …………………

GP Reflection on Clinical Audit Results and Activities for Change

The following questions are designed to assist you reflect on your Clinical Audit data: (please refer to your Clinical Audit Report)

1. Were the data in the Clinical Audit Report what you had expected?

   ……………………………………………………………………………………………………..…………

   ……

2. In the table below, indicate areas and specific areas where your practice performance could be improved.

Areas to improve (tick)	**What specific factors could you improve in your practice?**
☐ Knowledge of PA assessment and advice	
☐ Systems for identifying patients	
☐ Mechanisms for providing advice for increasing PA e.g. referrals, networks and links to providers	
☐ Patient safety e.g. areas in communication and recording, communication with AHPs and referrals, evaluating patients' understanding of PA and how it relates to their conditions	
☐ Information management and technology, e.g. recording of medical records, use of decision support tools, recall/reminder systems	

3. List the barriers that prevent you from improving your practice. How can these barriers be overcome?

Barriers	Possible solutions

Strategies and Activities for Change

4. Detail some strategies for change identified by you and your practice to improve performance

……

……

Further Learning

5. What learning needs do you have about implementation of physical activity assessment and advice for patients aged in your practice?

……

……

Process evaluation

6. Is the Clinical Audit report useful to you? Did it assist you identify areas that need improvement?

   ………

   ………

7. Is there other information that would be useful to your practice to assist it improve physical activity assessment and advice to patients?

   ………

   ………

   ………

8. What were the strengths and weaknesses of the Clinical Audit?

   ………

   ………

   ………

9. Do you have recommendations to improve the Clinical Audit in the future?

   ………

   ………

   ………

Please return this completed form to Shona Dutton at ESML on F: 9663 5817

<u>Appendix 18</u> Physical Activity and Advice (PAAA) in primary care

Physical Activity Assessment and Advice (PAAA) in primary health care General Practitioner & Practice Nurse

This survey takes approximately 15 minutes to complete
All information will be kept **confidential**

1. **Clinician and Practice Staff Details**

Gender:	❑ Female	❑ Male			
Age (years):	❑ 20-34	❑ 35-44	❑ 45-54	❑ 55-64	❑ 65+
Employment category	❑ General Practitioner	❑ Practice Nurse	❑ Practice Manager	❑ Practice Staff	❑ Practice Reception

2. **Assessment of Patients**

These questions are about your assessment of patient physical activity and support provided over the past 3 months

	Never	Rarely	Sometimes	Half the time	Often	Usually	Always
	0%	*1-20%*	*21-40%*	*41-60%*	*61-80%*	*81-99%*	*100%*
How often do you assess PA with the patients that you see?							
How often do you use or refer to PA guideline recommendations (e.g. Red Book)							
How often do you advise your patients about PA?							
How often do you refer your patients to PA services and providers?							
How often do you have difficulty finding other PA services and providers to refer your patients to?							

3. **Please rate your confidence in assessing physical activity with patients (✓Tick)**

Not at all confident	Minimally confident	Somewhat confident	Moderately confident	Very confident

4. **Please rate your understanding of the Physical Activity Guidelines & principles of PA assessment**

Not at all confident	Minimally confident	Somewhat confident	Moderately confident	Very confident

5. **In your practice, how important are the following barriers to assessing and providing PA support to patients?**

At the practice level	Very important	Moderately important	Somewhat important	Not very important
Lack of availability of staff who can offer health education				
Insufficient reimbursement for preventive services				
Lack of proper patient education materials				
Lack of reminder systems for tracking and prompting preventive care				
Difficulty with referral services				
Please name any other major barriers that are not included above.				
At the provider level	**Very Important**	**Moderately Important**	**Somewhat Important**	**Not very Important**
Lack of time				
Personal lack of interest in providing preventive care				
Uncertainty about what preventive care to provide				
Communication difficulties with patients				
Cultural differences between doctors and patients				
Please name any other major barriers that are not included above.				
At the patient level	**Very important**	**Moderately Important**	**Somewhat Important**	**Not very Important**
Lack of patient interest in prevention				
Patients level of health literacy				
The patient came for a different purpose				
Please name any other major barriers that are not included above.				

Thank you for completing the questionnaire, please fax/email the completed questionnaire to: <INSERT>

Office Use Only	GP code	PN code

**Adapted from PMAAQ questionnaire: Murphy K, Yeazel M, Center B. Validity of Residents' Self-Reported Cardiovascular Disease Prevention Activities: The Preventive Medicine Attitudes and Activities Questionnaire. Preventive Medicine. 2000;31:241–8.*

Appendix 19 Interview schedule

SCHOOL OF PUBLIC HEALTH
AND COMMUNITY MEDICINE

Interview schedule

Introduction: *This interview is to help us [investigators] to understand the practices approach to improving physical activity assessment and support for physically inactive*

Overview: Increasing uptake of physical activity guidelines in general practice
Description of processes for implementing intervention including the following;

- *Staff roles*
- *Identification of eligible patients*
- *Assessment process*
- *Follow-up process*
- *Referral process*
- Opinions and feedback regarding GPPAQ Questionnaire
- Identification of enablers to the process
- Identification of barriers within the process
- Networks identified for referral for physical activity support
- Suggestions for future implementation

Interview questions

1. How do you identify which patients to assess/advise for PA?
2. Which staff members are involved in this process and what is their role?
3. How have you used or introduced the PA Questionnaire in everyday consultations?
4. How do you use the outcomes of the questionnaire to advise and/or refer patients?
5. Where do you store data from the questionnaire and details regarding advice provided?
6. What processes do you use to follow-up on patient progress?
7. How have you utilised the ESSA Fact Sheets in everyday consultations?
8. How have you utilised the PA service directories in everyday consultations?
9. How has participating in this study impacted on day-to-day work within your practice e.g. staff roles, allocation of tasks and responsibilities.
10. What changes have you made to everyday practice since participating in this study?

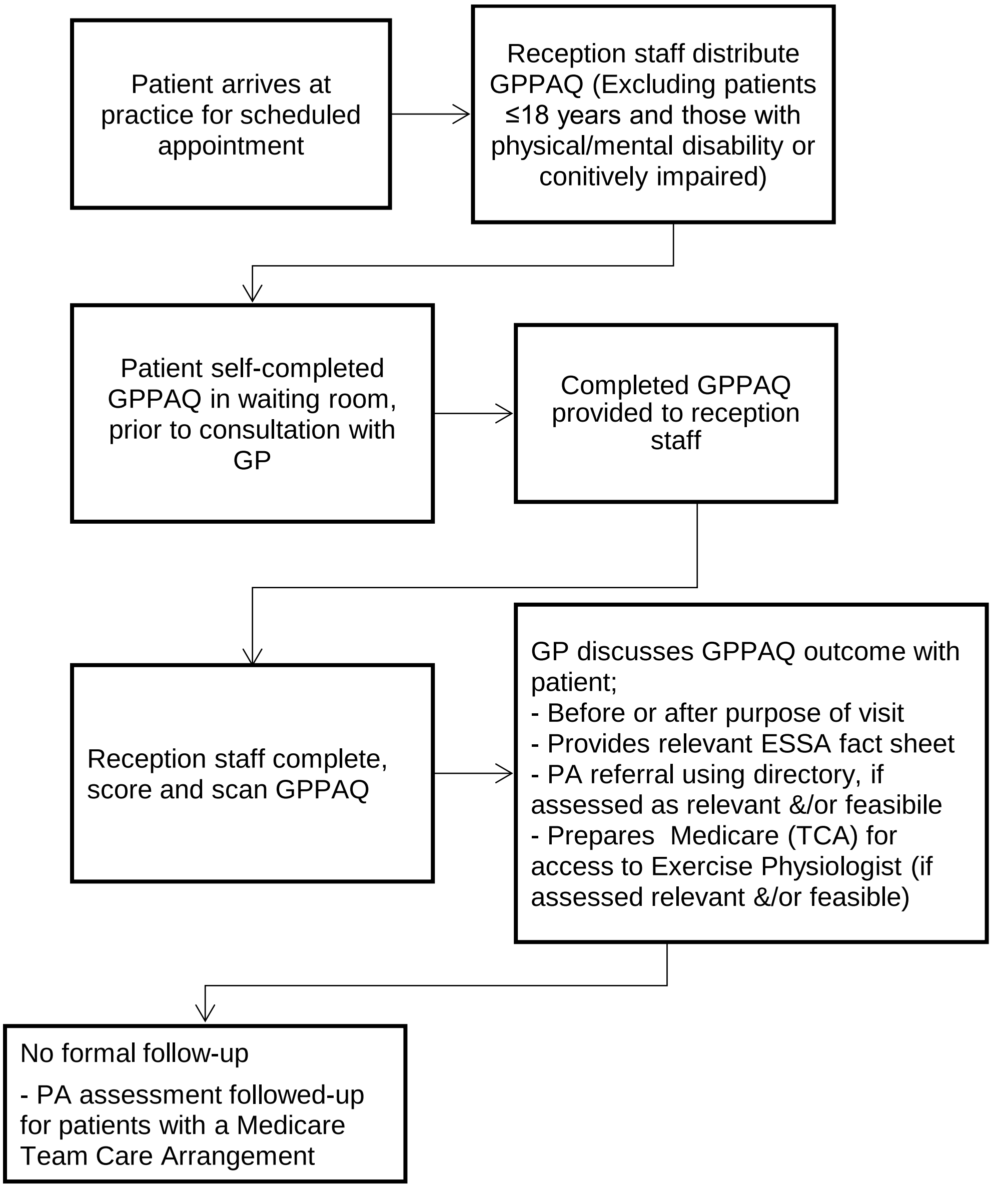
Appendix 20 Practice observation template

Practice 1			
Region		Randwick	
Facility		**Consultation rooms & Waiting area** ❑ Consult rooms ❑ Med-large ❑ N= chairs ❑ TV with preventive health film screening	
		Health promotion material displayed ❑ Waiting area ❑ Consult rooms ❑ Brochures ❑ Posters	
Practice personnel	GP	**FTE**	FTE
		Gender	
		Age	
	General Practitioners	**No. GPs**	
		FTE	FTE
		Gender	Female=n, Male=n
	Practice nurses	**No. PNs**	
		FTE	FTE
		Gender	
	Practice staff	**No. practice staff**	
		FTE	FTE
		Gender	F
Teamwork / intra-team interactions		**Whole team** ❑ Team meetings (all staff) ❑ Case conferencing ❑ Joint clinical activities e.g. GPMP, TCA, Health assessments ❑ Referrals to external providers ❑ Clear roles and responsibilities	**Intra-clinician interactions** ❑ Clinical conferencing or meetings ❑ Joint clinical activities e.g. GPMP, TCA, Health assessments ❑ Shared responsibilities in patient care ❑ Clear roles and responsibilities
Access		❑ Prior bookings required ❑ Waiting period for appointments Ranged from n= ❑ Walk-ins ❑ Recall and reminder system ❑ Disease register(s)	
Billing		❑ Bulk-billing all patients	
Patient demography		N= Males n= Females n=	
Initiatives/incentives		❑ GP Management Plans ❑ ECGs ❑ Aboriginal health assessments ❑ Spirometry	
Networks or links		Established links with local AHPs ❑ Yes ❑ No ❑ Intermittent	
GP interests and/or services		❑ Aboriginal health ❑ Women's Health ❑ Family planning ❑ Ante-natal care ❑ Paediatrics ❑ Immunisation ❑ Diabetes management	❑ ECG: heart check ❑ Preventive health ❑ Gynaecology ❑ Dermatology ❑ Mental health ❑ Orthopaedics

Appendix 21 Observational data collection results (Practice 1)

Practice 1			
Region		Randwick	
Facility		**Consultation rooms & Waiting area** ☑ Consult rooms = 5 ☑ Med-large ☑ 10 chairs ☑ TV with preventive health film screening	
		Health promotion material displayed ☑ Waiting area ☑ Consult rooms ☑ Brochures ☑ Posters	
Practice personnel	GP	**FTE**	1.0FTE
		Gender	M
		Age	20-34
	General Practitioners	**No. GPs**	4
		FTE	3.0 FTE
		Gender	Female=3, Male=2
	Practice nurses	**No. PNs**	2
		FTE	0.8 FTE
		Gender	F
	Practice staff	**No. practice staff**	5
		FTE	3.40FTE
		Gender	F
Teamwork / intra-team interactions		**Whole team e.g. Admin ↔ Clinicians** ☒ Team meetings (all staff) ☒ Case conferencing between clinicians ☒ Joint clinical activities e.g. GPMP, TCA, Health assessments ☑ Referrals to external providers ☑ Clear roles and responsibilities	**Intra-clinician interactions e.g. GP ↔ PN** ☒ Clinical conferencing or meetings ☒ Clinician conferencing/meetings ☒ Joint clinical activities e.g. GPMP, TCA, Health assessments ☑ Shared responsibilities in patient care ☑ Clear roles and responsibilities
Access		☑ Prior bookings required ☑ Waiting period for appointments Ranged from ~10 mins- 45 mins ☑ Walk-ins ☒ Recall and reminder system ☒ Disease register	
Billing		☑ Bulk-billing all patients	
Patient demography		N= 3222 Males n=1491 Females n=1702	
Initiatives/incentives		☑ GP Management Plans (not systematic) ☑ ECGs ☑ Aboriginal health assessments (not systematic) ☑ Spirometry	
Networks or links		Established links with local AHPs ☑ Yes (At follow-up, established referral link with local Exercise Physiologist) ❑ No ☑ Intermittent – changed following completion of the study **NB**: Clinical Psychologist on site 0.1FTE	
GP interests and/or services	☑ Aboriginal health ☑ Women's Health ☑ Family planning ☑ Ante-natal care ☑ Paediatrics ☑ Immunisation ☑ Diabetes management		☑ ECG: heart check ☑ Preventive health ☑ Gynaecology ☑ Dermatology ☑ Mental health ☑ Orthopaedics

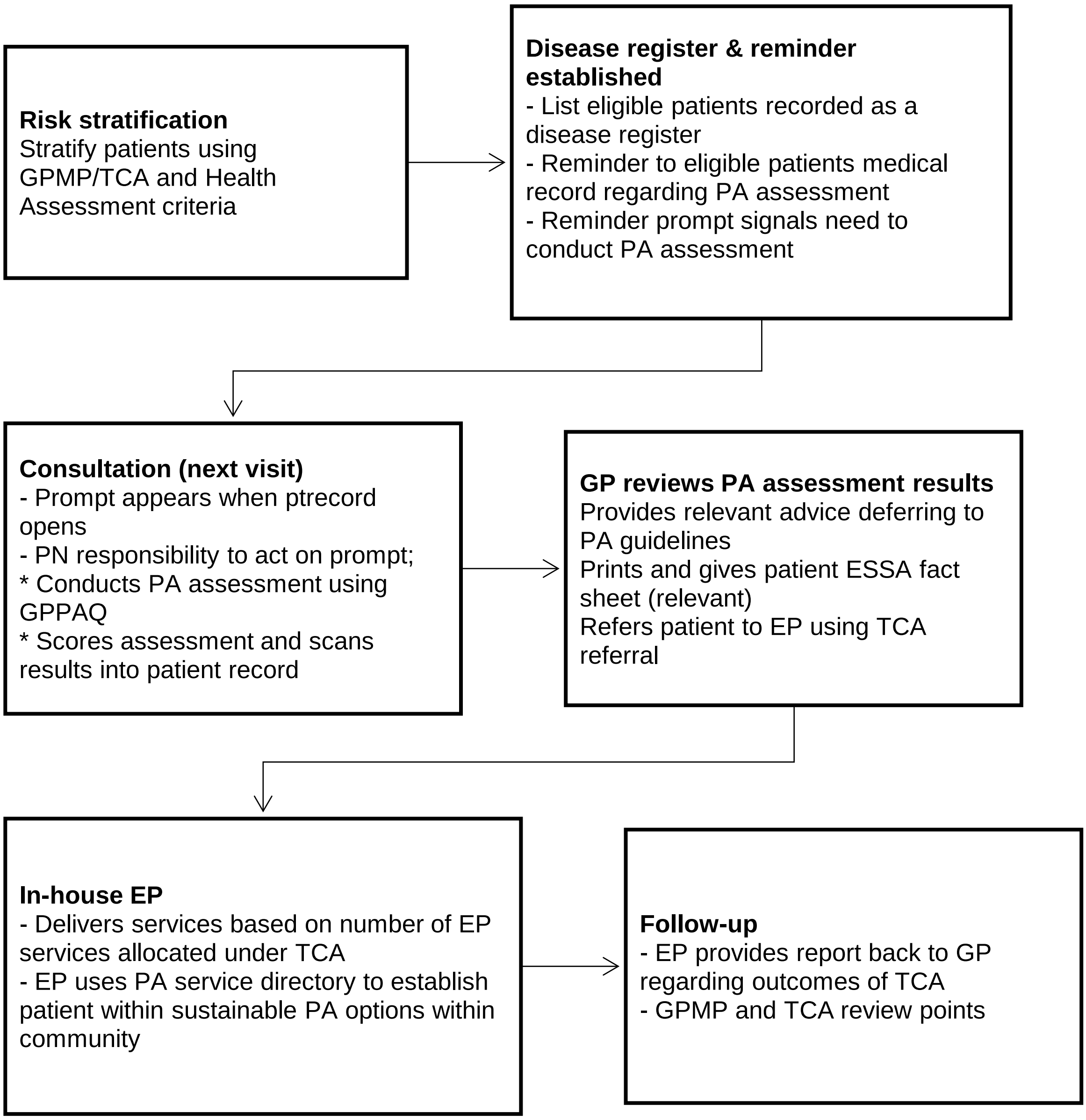
Appendix 22 Practice 1 Intervention roadmap



<u>**Appendix 23**</u> Observational data collection results (Practice 2)

Practice 2		**Waverley LGA**	
Facility		**Consultation rooms & Waiting area** ☑ 2 areas (1 Large, 1 Medium) ☑ 14 chairs (total, 8/6)	
		Health promotion material displayed ☑ Waiting area ☑ Consult rooms ☑ Brochures ☑ Posters	
Practice personnel	GP	**FTE**	1.0FTE
		Gender	F
		Age	55-64
	General Practitioners	**No. GPs**	8
		FTE	5.0
		Gender	Female=6, Male=2
	Practice Nurses	**No. PNs**	1
		FTE	0.5FTE
		Gender	F
	Practice Staff	**No. practice staff**	7
		FTE	5.0FTE
		Gender	F
Teamwork / intra-team interactions		**Whole team (Admin ↔ Clinicians)** ☑ Team meetings (all staff) ☒ Case conferencing between clinicians ☒ Joint clinical activities e.g. GPMP, TCA, Health assessments ☑ Referrals to external providers ☑ Clear roles and responsibilities	**Intra-clinician interactions (GP ↔ PN)** ☑ Clinical conferencing or meetings ☒ Joint clinical activities e.g. GPMP, TCA, Health assessments ☑ Shared responsibilities in patient care ☑ Clear roles and responsibilities
Access		☑ Prior bookings ☑ Waiting period for appointments Ranged from ~15 minutes- 1 hour ☑ Walk-ins ☑ Recall and reminder system ☑ Disease register	
Billing		☑ Discretional billing directed by consulting GP ☑ Bulk billing for concessional card holders ☑ Gap fees apply for all other patients/services	
Patient demography		N= 5874, Males n=1922, Females n=3952	
Initiatives/incentives		☑ Health assessments ☑ GP Management Plans & Team care arrangements ☑ Diabetes SIPs (not systematic) ☑ Cervical screening ☑ Childhood immunisation recall program ☑ Quality improvement activities with Medicare Local	
Networks or links		Established links with local AHPs - Yes ☑ Yes ❑ No ❑ Intermittent <u>NB</u>: Exercise Physiologist on site 0.2FTE	
GP interests and/or services		☑ Preventive health ☑ Diabetes management ☑ Women's health ☑ Family planning ☑ Immunisation & travel medicine	☑ Mental health ☑ Antenatal ☑ Men's health ☑ Palliative care ☑ Paediatrics

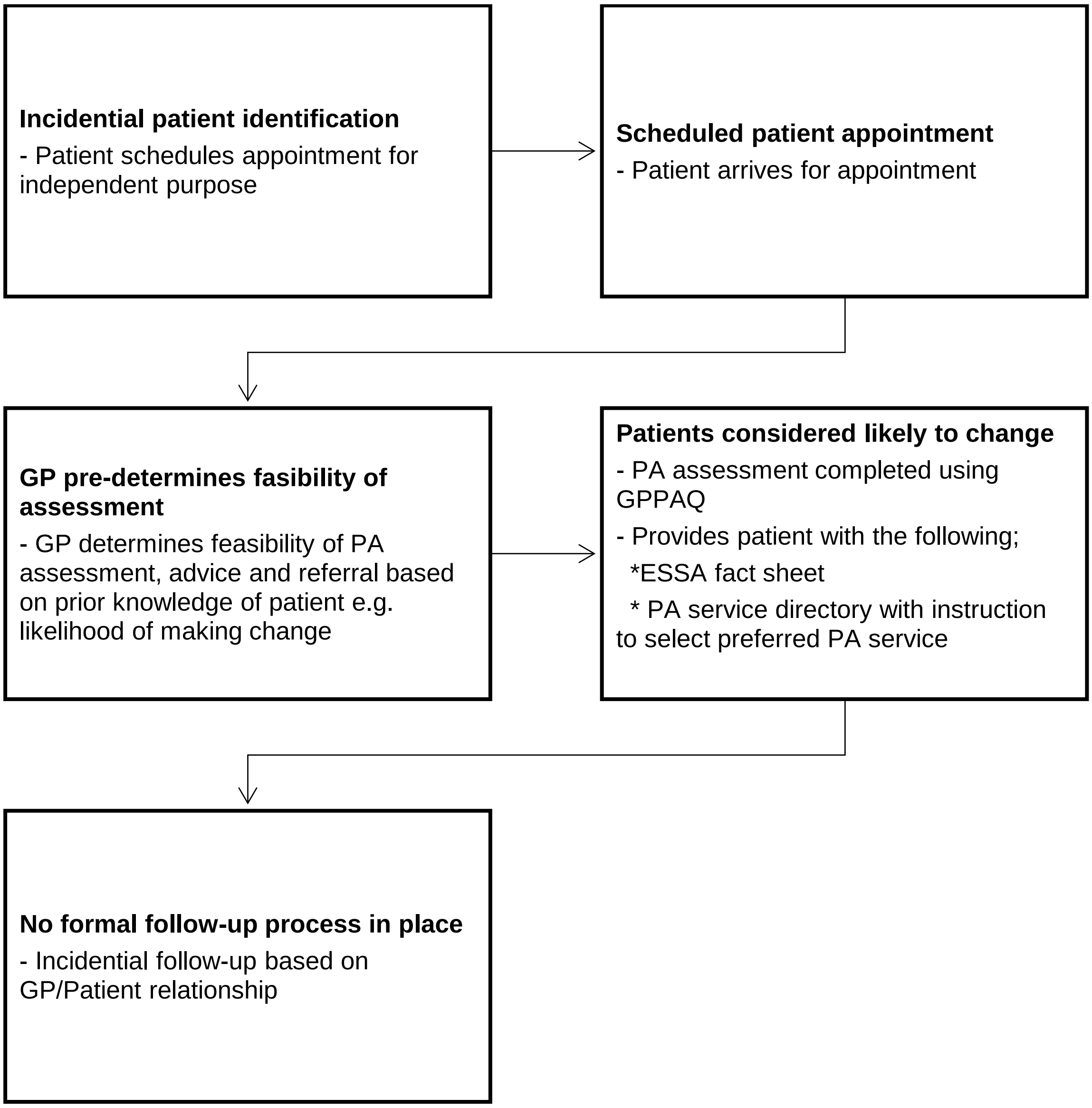
<u>Appendix 24</u> Practice 2 Intervention roadmap



Appendix 25 Observational data collection results (Practice 3)

Practice 3		**Randwick (LGA)**	
Facility		**Consultation rooms**	**Waiting area** ☑ Small ☑ 6 chairs ☑ No TV
		Treatment rooms	**Health promotion material displayed** ☑ Waiting area ☑ Consult rooms ☑ Brochures ☑ Posters
Practice personnel	GP	**FTE**	1.0FTE
		Gender	M
		Age	20-34
	Practice staff	**No. PNs**	2
		FTE	1.0FTE
		Gender	F
Teamwork / intra-team interactions		**Whole team e.g. Admin ↔ Clinicians** ☒ Team meetings (all staff) ☒ Case conferencing between clinicians ☒ Joint clinical activities e.g. GPMP, TCA, Health assessments ☑ Referrals to external providers ☑ Clear roles and responsibilities	**Intra-clinician interactions e.g. GP ↔ PN** ☒ Clinical conferencing or meetings ☒ Clinician conferencing/meetings ☒ Joint clinical activities e.g. GPMP, TCA, Health assessments ☒ Shared responsibilities in patient care ☒ Clear roles and responsibilities
Access		☑ Prior bookings ☑ Waiting period for appointments- range: 30 minutes - 1 hour ☒ Walk-ins (for existing patients) ☒ Recall and reminder system ☒ Disease register ☑ After hours visits ☑ RACF visits	
Billing		☑ Bulk-billing for patients with government concessional card ☑ Bulk bills on arrangement ☑ Gap fees for remaining patients	
Patient demography		N= 3260 Males n=1518 Females n=1742	
Initiatives/incentives		☑ GP Management Plans (not systematic) ☑ Team Care Arrangements (not systematic) ☑ Vaccination reminder for children & people aged 75 years and older (not systematic) ☒ Recall and reminder system ☒ Disease register	
Networks or links		☒ Established links with local AHPs ❑ Yes ☑ No ☑ Intermittent	
GP interests and/or services		☑ General family medical care ☑ Minor surgical procedures ☑ Women's health ☑ Diabetes management	☑ Podiatry ☑ Dermatology ☑ Immunisations ☑ Travel medicine

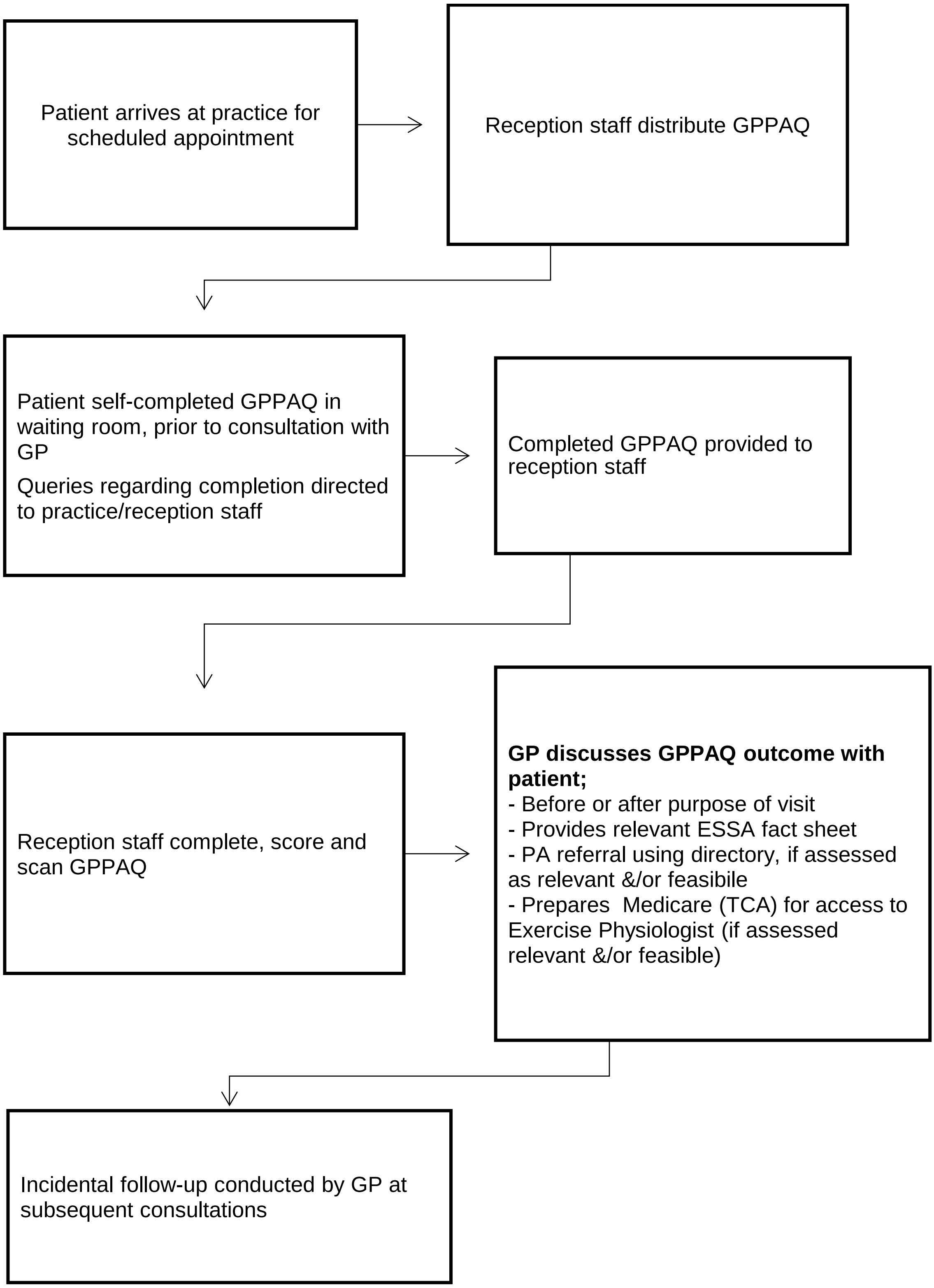
<u>Appendix 26</u> Practice 3 Intervention roadmap



Appendix 27 Observational data collection results (Practice 4)

Practice 4		**Randwick LGA**	
Facility		**Consultation rooms & waiting area** ☑ Large ☑ 12 chairs (waiting area) ☑ TV	
		Health promotion material displayed ☑ Waiting area ☒ Consult rooms ☑ Brochures ☒ Posters	
Practice personnel	GP	**FTE**	0.4 FTE
		Gender	F
		Age	45-54
	General Practitioners	**No. GPs**	7
		FTE	5.0FTE
		Gender	Female=4 Male=3
	Practice Nurses	**No. PNs**	N/A
		FTE	N/A
		Gender	N/A
	Practice Staff	**No. practice staff**	4
		FTE	3.0FTE
		Gender	F
Teamwork / intra-team interactions		**Whole team (Admin ↔ Clinicians)** ☑ Team meetings (admin) ☒ Case conferencing between clinicians ☒ Joint clinical activities e.g. GPMP, TCA, Health assessments ☑ Referrals to external providers ☑ Clear roles & responsibilities	**Intra-clinician interactions (GP ↔ PN)** ☑ Clinical conferencing or meetings ☑ Joint clinical activities e.g. GPMP, TCA, Health assessments (not systematic) ☑ Shared responsibilities in patient care ☑ Clear roles & responsibilities
Access		☑ Prior bookings ☑ Waiting period for appointments b/w 30 minutes-1.15 hours ☒ Walk-ins ☑ Recall system	
Billing		☑ Bulk-billing for patients with valid government concessional card ☑ Bulk bills on arrangement ❑ Gap fees for remaining patients	
Patient demography		N= 7456 Males n=2972, Females n=4434	
Initiatives/incentives		☑ GP Management Plans, & Team Care Arrangements *(intermittent)* ☑ Health Assessments *(Intermittent)* ☑ Recall and reminder system *(cervical screening & diabetes annual cycle of care)*	☑ Diabetes SIPs ☑ Cervical Screening ☑ Vaccination reminders ☑ Disease registers *(for cervical screening & diabetes annual cycle of care)*
Networks or links		☑ Established links with local AHPs *(post intervention)* ☑ Yes ❑ No ❑ Intermittent	
GP interests and/or services		☑ Mental health ☑ Women's Health ☑ Antenatal care ☑ Paediatrics ☑ Immunisation ☑ Diabetes management	☑ Skin Care & Ulcer Clinic ☑ Geriatrics ☑ Hypnotherapy / Counselling ☑ Sexual and relationship counselling ☑ Gynaecology ☑ Musculo-skeletal Medicine

Appendix 28 Practice 4 Intervention roadmap



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