University of Cape Town

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Targeting Uptake of Exercise-Promoting Structured Patient Education Intervention

Foundational Research and Process Description of a Discrete Choice Experiment to Understand Perceived Intervention Utility and Design Preferences for Men with Prostate Cancer

By

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DECLARATION

I, Elochukwu Fortune Ezenwankwo, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor part of it has been, is being, or is to be submitted for another degree in this or any other university.

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- Study design and conceptualisation
- Search strategy and database searches
- Article screening and selection
- Data abstraction, analysis and interpretation
- Original manuscript draft and revision
- Journal submission

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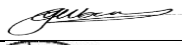
Yumna Albertus		01/08/2023
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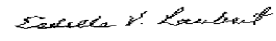
Estelle Vicki Lambert		02/08/20233

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GLOSSARY OF ABBREVIATIONS

AMED	Allied and Complementary Medicine Database
CINAHL	Cumulative Index to Nursing and Allied Health Literature
C-M-O configuration	Context Mechanism Outcome configuration
DCE	Discrete Choice Experiment
MEDILNE	Medical Literature Analysis and Retrieval System Online
PCa	Prostate Cancer
PEI	Patient Education Intervention
PICO	Population Intervention Comparator Outcome
PRISMA	Preferred Reporting Items for Systematic Review and Meta-Analysis
PROSPERO	International Prospective Register of Systematic Reviews
WHO	World Health Organization

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Thesis Abstract

Beyond effectiveness, critical aspects of the design process for complex healthcare interventions, including the organisation of the various independent components and features of the interventions or how they are presented to the users, can influence their overall uptake and long-term sustainability. The discrete choice experiment offers a pragmatic consumer-oriented approach to exploring and understanding individual preferences and perceived utility when planning complex interventions, ensuring that even without real-life observational data, only intervention attributes most valued by the intended users are prioritised in the design phase. This thesis presents foundational research and process description of a discrete choice experiment designed to understand perceived intervention utility and design preferences among men with prostate cancer for an exercise-promoting structured patient education intervention. The overarching goal is to clarify critical issues about effective components and delivery procedures for developing/implementing patient education intervention to increase daily/weekly exercise among prostate cancer survivors.

This project began with foundational research to examine and identify key attributes (or variables) and attribute levels (i.e., different functionalities of the attributes) for the discrete choice experiment using two key research approaches, (a) systematic literature reviews and (b) qualitative research. At the end of the foundational research, issues and challenges raised by men along with the opportunities and mechanisms identified in the literature and the qualitative interviews was resolved into four conditions central to the success (or failure) of promoting and increasing exercise engagement among survivors of prostate cancer in Cape Town, South Africa, using structured patient education interventions. These conditions, 1) program/service [Levels: Counselling/Education; b) Unsupervised exercise PLUS counselling; c) Supervised exercise program PLUS education/counselling], 2) delivery structure [Levels: a) Alone; b) Group-based; c) Individual and group-based], 3) setting [Levels: a) Community centre (or Local Gym); b) Home; c) Hospital (in-/outpatient rehab setting)], and 4) service personnel [levels: a) Physiotherapists (other cancer exercise specialists); b) Technology-assisted (mHealth); c) Former PCa patient now cancer exercise couch], comprised attributes of the discrete choice experiment.

This research aimed for five attributes and three attribute levels for the experiment. A fifth attribute, service operation [levels: a) 12 weeks; 1x/wk; 2hr/session; operates Weekends only; b) 8 weeks; 2x/wk; 2hr/session; operates Mon-Thurs; c) 12 weeks; 2x/wk; 1hr/session; operates Mon-Thurs], was further introduced, bringing the total number of attributes to five. Qualitative research played a crucial role in establishing the attribute levels.

An unlabelled fractional-factorial design with 27 choice tasks was developed using Ngene software (v.1.3). The 27 choice tasks were further blocked into 3 separate surveys of 9 choice sets each. An 'opt-out' was included in the experiment to allow respondents to reject the two alternatives in a given choice scenario where such alternatives have not reflected their preferred choice. The Multinomial Logit Regression was chosen to determine the main effect of the five attributes (the independent variables) on the choice alternatives (the dependent variables) upon when the discrete choice experiment is implemented. Overall, nine choice tasks were deemed sufficient per survey to fit a regression model while minimising time and cognitive burden on the participants.

Targeting the uptake of exercise-promoting structured patient education intervention can be particularly challenging among men with prostate cancer, especially in care contexts like Cape Town, South Africa, such intervention does not yet form part of patients' core management suite. This thesis recognises the place of discrete choice experiments in designing and implementing effective complex interventions like structured patient education interventions. It is thus hoped that this thesis and, ultimately, the implementation of the discrete choice experiment amount to well-invested efforts in the quest for effective strategies to increase daily/weekly exercise among prostate cancer survivors and mainstream exercise oncology in standard cancer care practice in Cape Town, South Africa.

CHAPTER 1— Introduction

1.1 Introduction

Chapter 1 sets the scene for the entire thesis. It provides the basis for the research and highlights how issues and questions evolved to ultimately address the overarching purpose of the research. This chapter begins by considering the research focus and underpinning literature. It went further to outline the research aims and objectives, and key approaches and methodological considerations that anchored this thesis. It concludes by outlining the thesis structure, focusing primarily on the contributions of each chapter to the overall research purpose.

1.2 Research Focus

This thesis details how evidence synthesis and qualitative research were deployed in designing a discrete choice experiment intended to inform the development of a complex intervention, a structured patient education intervention (PEI), for increasing exercise uptake/maintenance in men with prostate cancer (PCa). Specifically, the discrete choice experiment will explore the perceived intervention utility and design preferences among PCa survivors in relation to promoting exercise engagement. This research focused on:

- using two key research approaches, (a) systematic literature reviews and (b) qualitative research, to identify key attributes (or variables) and attribute levels (i.e., different functionalities of the attributes) for the discrete choice experiment; and
- adopting a D-efficient design to develop the discrete choice experiment based on the established attributes and their levels.

This thesis is based on works conducted in Cape Town, South Africa (Fig. 1.1). South Africa represents the largest economy in Southern Africa and the second largest economy in the sub-Saharan region with a population of 69.6 million, a current per capita health expenditure of about $546.69, and real gross domestic product of nearly R1, 170 billion ("60,6 million people in South Africa | Statistics South Africa", n.d.; "Global Health Expenditure Database", n.d.; "Mid-year population estimates 2022", n.d.). Cape Town's 2023 population is estimated at over 4,890,000, making the city the second largest city in South Africa after Johannesburg ("Mid-year population estimates 2022", n.d.). Even with significant diversity, wealth distribution remains uneven in South Africa, with high inflation and a record-high unemployment rate of 2.9% in the first quarter of 2023 ("Beyond unemployment – Time-Related Underemployment in the SA labour market | Statistics South Africa", n.d.). Currently, a vast proportion of the population, even in major cities and the adjoining suburbs, are experiencing a disproportionate burden of social and economic deprivations (Oskam et

al., 2021; Alaba et al., 2022; Nglazi & Ataguba, 2022). Access to healthcare is further lower in most rural communities, with the Black population experiencing a significantly higher incidence of delayed PCa diagnosis and incurable disease at presentation (Tindall et al., 2014; Finestone & Wishnia, 2022). These factors have a major influence on the severity and spread of the PCa burden in South Africa (Finestone & Wishnia, 2022).

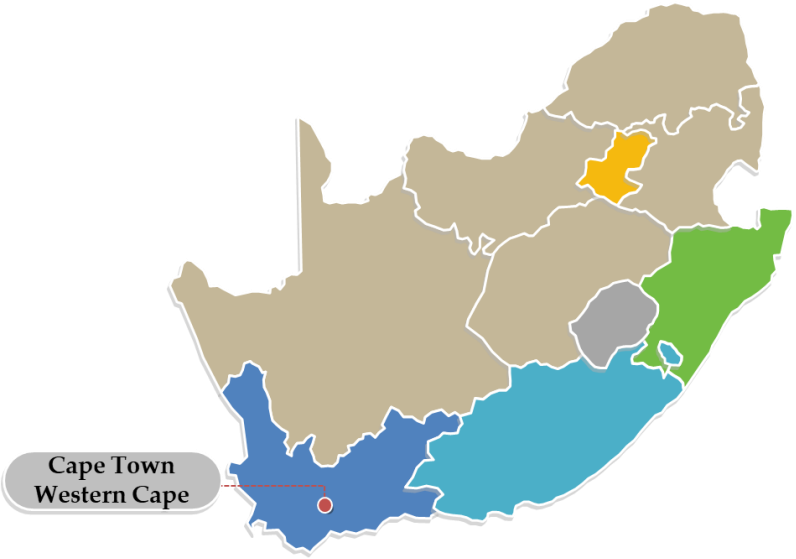

Figure 1.1: *Map of South Africa, highlighting the city of Cape Town where this research was conducted (from https://yourfreetemplates.com/).*

1.3 Rationale and Literature Review

This section presents an overview of PCa burden, the challenges and complications associated with PCa treatment, and the broader implication of PA and exercise for PCa survivorship. It further elucidates the issues and challenges associated with engaging in regular exercise and the superior role of structured PEIs in promoting regular exercise in this population.

1.3.1 Background

The increasing number of cases of PCa worldwide and the associated deaths continues to raise deep concerns over the comparative magnitude of the disease impact among men on the global burden from cancer and other chronic, non-communicable disease (Tran et al., 2022). With over 1.4 million new cases and 375 000 associated deaths, PCa became the second most-diagnosed cancer and the fifth leading cause of cancer death among men, in 2020 (Siegel et al., 2022). In southern Africa, almost 66 men were diagnosed with PCa out of every 100 000 men in 2020, with 22 men per 100 000 dying from the disease (Siegel et al., 2022). While the exact figure for South Africa remains contestable, the incident rate is estimated as 1 out of every 1,470 men, having increased annually between 1998 and 2017 by an average of 9.2% (Ramaliba et al., 2022).

Men with PCa are bound to experience several adverse effects with far-reaching consequences on their general well-being (Henry et al., 2008a; Woźniak & Izycki, 2014). Regardless of the disease stage or treatment regimen, most patients will experience chronic inflammation, fatigue and weakness, pain, sleep disturbance, cardiopulmonary changes (i.e., physical deconditioning, loss of function, increased sedentary behaviour, etc.), gastrointestinal complications (i.e., bowel alterations, nausea, vomiting, etc.), psychological distress (i.e., anxiety, depression, fear, etc.), neurological issues (i.e., impaired cognition, poor coordination, and balance, etc.), altered body composition (i.e., loss of muscle mass, increase in fat mass, etc.), loss of bladder and bowel control, sexual dysfunctions, skin complications (i.e., hot flashes, constant sweating, hair loss/appearance, etc.), musculoskeletal issues (i.e., frailty, osteoporosis, increased risk of falling and fracture) and oedema (Henry et al., 2008a; Brearley et al., 2011a; Reilly et al., 2013a). These sequelae stem not only from the disease itself but considerably from the multisystemic impacts of PCa treatment (Stout, Santa Mina, et al., 2021).

For example, common among men receiving pelvic radiotherapy is exacerbating genitourinary toxicities (Olsson et al., 2013, 2015; Pettersson et al., 2013; Lehto et al., 2017; Meissner et al., 2017; Catucci et al., 2021; Nolsøe et al., 2021). Throughout treatment, men are likely to experience urinary and faecal incontinence and compromised sexual function (Olsson et al., 2013, 2015; Pettersson et al., 2013; Catucci et al., 2021). Even though complications may generally resolve in 6 to 24 months, severity is usually peaked immediately after treatment (Evans et al., 2020). Treatment-related toxicities may also linger over an extended period among the older and advanced populations or in the presence of lifestyle-related comorbidities, such as obesity and overweight (Evans et al., 2020). For men receiving androgen deprivation therapy (ADT), loss of muscle mass, increase in body fat deposition, declining bone health, and an increased risk of osteoporosis are commonplace (Choi & Kam, 2015; Rhee et al., 2015). These are physiological markers of metabolic syndrome. A build-up of these markers commonly results in adverse skeletal events, with an increased risk of fall, frailty, and fracture (Choi & Kam, 2015; Rhee et al., 2015; Evans et al., 2020).

These complications are far-reaching, with both physical, social and economic losses, and can persist throughout the balance of life (Carlotto et al., 2013a; Paltrinieri et al., 2018; Granström et al., 2020; Lee et al., 2020).

1.3.2 Exercise and prostate cancer

Exercise plays a major role in the different stages of PCa management, from the time of diagnosis to active treatment and throughout the entire care continuum (S. C. Hayes et al., 2019; Schmitz, Campbell, Stuiver, Pinto, Schwartz, Morris, Ligibel, Cheville, Galvão, Alfano, Patel, Hue, Gerber, Sallis, Gusani, Stout, Chan, Flowers, Doyle, Helmrich, Bain, Sokolof, Winters-Stone, et al., 2019; Stout, Brown, et al., 2020; Stout, Silver, et al., 2020). At different points on the illness trajectory, men benefit from exercise tumour suppression, anti-inflammatory, and disease symptom modulatory effects (Hayes et al., 2016a; KIM et al., 2022). The improved well-being associated with these effects has had demonstrable impacts on

treatment recovery and long-term hospitalization (Champ et al., 2016; Schmitz, Campbell, Stuiver, Pinto, Schwartz, Morris, Ligibel, Cheville, Galvão, Alfano, Patel, Hue, Gerber, Sallis, Gusani, Stout, Chan, Flowers, Doyle, Helmrich, Bain, Sokolof, Winters-Stone, et al., 2019; Stout, Silver, et al., 2020). Patients also benefit from the mitigatory effects of long-term exercise engagement on post-treatment complications and the associated improved quality of life (QoL) and early return to work and daily routine (Burgio et al., 2006; Thijs et al., 2012; Stout, Mina, et al., 2021). This section considers a broad range of benefits (Fig. 1.2) and plausible mechanisms in detail.

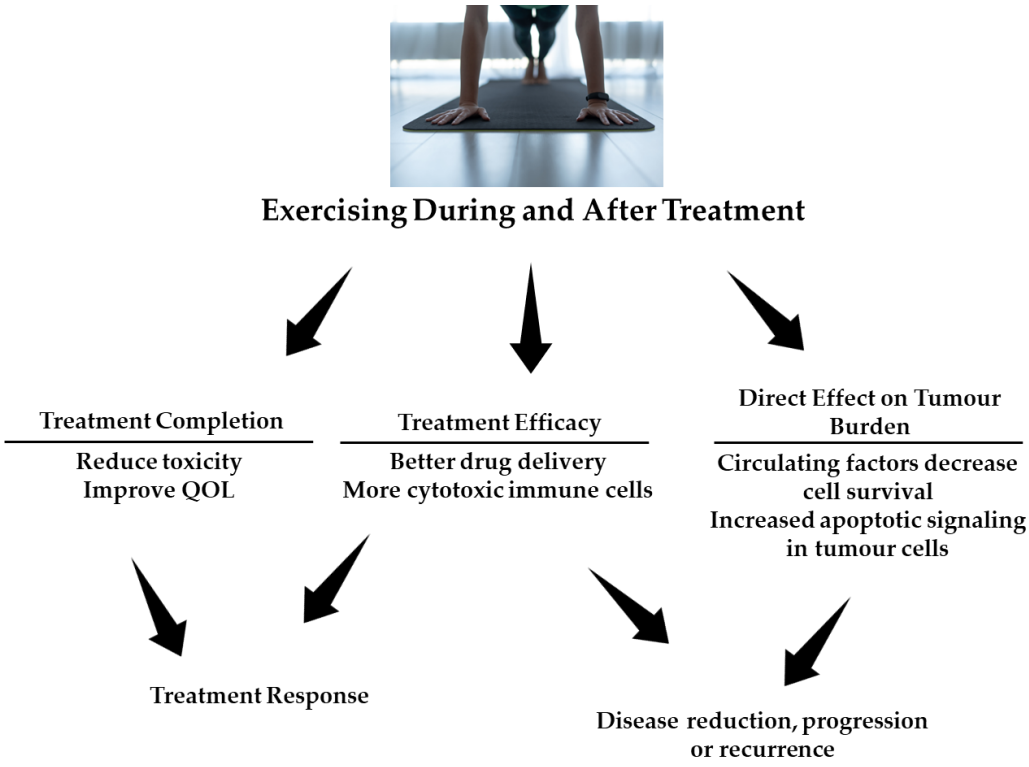

Figure 1.2: *Plausible direct and indirect exercise impacts on treatment course, disease outcome and quality of life (QoL). Image is adapted from* https://doi.org/10.3322/caac.21773 (Do et al., 2023)

1.3.2.1 Tumour suppression

Exercise effects on muscle hypertrophy, adipose tissue oxidation, osteogenesis, chronic inflammation, insulin sensitivity, and antitumour activity are key pathways proposed to demonstrate the tumour-suppressive effects of physical exercises in men with PCa (Dawson et al., n.d.; Kiwata et al., 2016; Bressi et al., 2021; Leitão et al., 2022; Lopez et al., 2022). One key mechanism is via the direct suppression of PCa (LNCaP) cell line (Hayes et al., 2016a; Zhang et al., 2021). For instance, previous studies have reported a 27% to 31% direct reduction of PCa cell line viability after exercise interventions (Hojman et al., 2011; Rundqvist et al., 2013). Another plausible mechanism is the suppressive effects of serum myokines. Analyses of serum OSM, SPARC, and decorin secreted by skeletal tissues have shown a marked increase in serum OSM and a trend towards an increase in serum SPARC in men on ADT following a 12-week exercise intervention (KIM et al., 2022). When applied to PCa cell line DU145, a

significant reduction in Cell indices and growth rates was further observed compared to a pre-intervention serum (KIM et al., 2022).

Previous studies have also shown increased blood circulation at the tumour site and a direct reduction in tumour volume (B. D. Hayes et al., 2016a; McCullough et al., 2014a; Zhang et al., 2021). Cancer cells are generally anaerobic, thriving optimally in hypoxic environments (McCullough et al., 2014a). An increase in tumour perfusion is often reported with an increase in acute exercise bouts by increasing vasodilation of surrounding vessels (B. D. Hayes et al., 2016a; McCullough et al., 2014a; Zhang et al., 2021). The likely increase in oxygen circulation at the tumour site may attenuate tumour growth and aggressiveness by altering the tissue milieu to a less hypoxic microenvironment (McCullough et al., 2014a). Another likely pathway is via epigenetic effects of physical exercises and the demonstrated ability to modulate skeletal muscle-secreted extracellular vesicle proteins, including miRNAs, messenger RNAs (mRNAs), DNA, piwi-interacting RNAs (piRNAs), transfer RNAs (tRNAs), and myokines (Zhang et al., 2021).

1.3.2.2 Treatment tolerance, early recovery and length of hospital stay

A few mechanisms have been suggested to explain the role of PA and exercise in improving treatment tolerability and early recovery in cancer patients (Champ et al., 2016; Hayes et al., 2016a; Galvão, Taaffe, et al., 2018a). One pathway is via exercise effects on strength and functional status (Champ et al., 2016; Hayes et al., 2016a). A major complication of chemotherapy with or without hormone therapy with implications for treatment efficacy and adherence is physical deconditioning and the associated vicious circle of cancer-related fatigue (Stout, Silver, et al., 2020) (Fig. 1.3). In most patients with advanced disease, the multisystemic impacts of chemotherapy and hormone therapy, and energy demands of hospitalisation often result in increased sedentary behaviour (Kirby, Hirst & Crawford, 2011; Stark, Livas & Kyprianou, 2015; Faithfull et al., 2021). Physically inactive patients have poor prognoses, respond poorly to treatment and may take longer periods to recover after treatment (Gong et al., 2007; Kenfield et al., 2011a). Emerging evidence shows that moderate pre-treatment exercise levels may positively impact disease-specific endpoints like adherence to cancer treatment and improve surgical and functional outcomes after radical prostatectomy (Stout, Silver, et al., 2020). Patients who engage in daily exercise from the time point of diagnosis and before commencing treatment are often in a much healthier state with significant gains in pulmonary function, strength and endurance to enter and sustain treatment (Stout, Silver, et al., 2020).

1.3.2.3. Treatment toxicities, general well-being and quality of life

Cancer literature abounds with overwhelming evidence on the effects of regular exercise on the challenges and complications associated with PCa treatment. This evidence draws from multiple research designs and methodologies, including early preclinical studies, large

population-based observational studies, high-quality clinical exercise efficacy trials and behaviour change studies involving 'real world' scenarios (Kenfield et al., 2011b; Galvão et al., 2014a; Ashcraft et al., 2016; Lahart et al., 2018; Morishita et al., 2020; Brown, Morris & Akam, 2021). The supposed 'causal pathway' including the mechanisms of action, is generally characterised as complex and dynamic and has involved multiple interplays of both physiological and psycho-behavioural systems (Hayes et al., 2016a; Huri et al., 2016; Wang et al., 2017; Stout, Mina, et al., 2021). One plausible route has remained the modulating effects of PA and exercise on inflammatory processes. Exercise-based interventions may deliver acute exercise bouts as commonly seen in exercise efficacy trials, triggering a transient increase in serum anti-inflammatory biomarkers like the interleukin 10 (IL-10) and consequent cytokine deregulation (Galvão et al., 2010a; Parent-Roberge et al., 2020). Likewise, sufficient doses of a lifestyle PA accumulated over time following a sustained increase in exercise behaviour (often achieved using behaviour change interventions) have been found to consistently create a pro: anti-inflammatory balance in a direction that ultimately triggers a marked reduction in chronic inflammation (Thomas et al., 2021; Leitão et al., 2022).

One direct consequence of chronic inflammation in PCa survivors is cancer-related fatigue (Greenberg et al., 1993; Bower et al., 2009; Bower, 2014; Holliday et al., 2016; Randall et al., 2019; Nazha & Bilen, 2021). Cancer-related fatigue also results from neuromuscular involvements in radiation treatment, with two in every three PCa survivors experiencing cancer-related fatigue during and after treatment (Greenberg et al., 1993; Bower et al., 2009; Luo et al., 2021). Coupled with a reduced cardiopulmonary function that results from multi-system involvements during treatment, there is a significant increase in sedentary behaviour and concomitant reduction in the ability to perform daily tasks in PCa survivors experiencing cancer-related fatigue (Bower, 2014; Randall et al., 2019). Endurance training improves aerobic function and physical fitness by increasing the volume of serum and systemic oxygen available for muscle functions (Vashistha et al., 2016; Galvão, Taaffe, et al., 2018a; Scott et al., 2018). This is particularly critical during radiation treatment or long-term ADT use to prevent and reduce muscle atrophy, sarcopenia and fibrosis and break the vicious cycle of fatigue created following increased sedentary behaviour and physical deconditioning (Fig 1.3) (Schumacher et al., 2021; Tian, Ding & Sun, 2022). With improvement in aerobic function and chronic inflammation, the vicious cycle of cancer-related fatigue is mitigated using tailored exercise programs (Bower et al., 2009; Holliday et al., 2016; Vashistha et al., 2016).

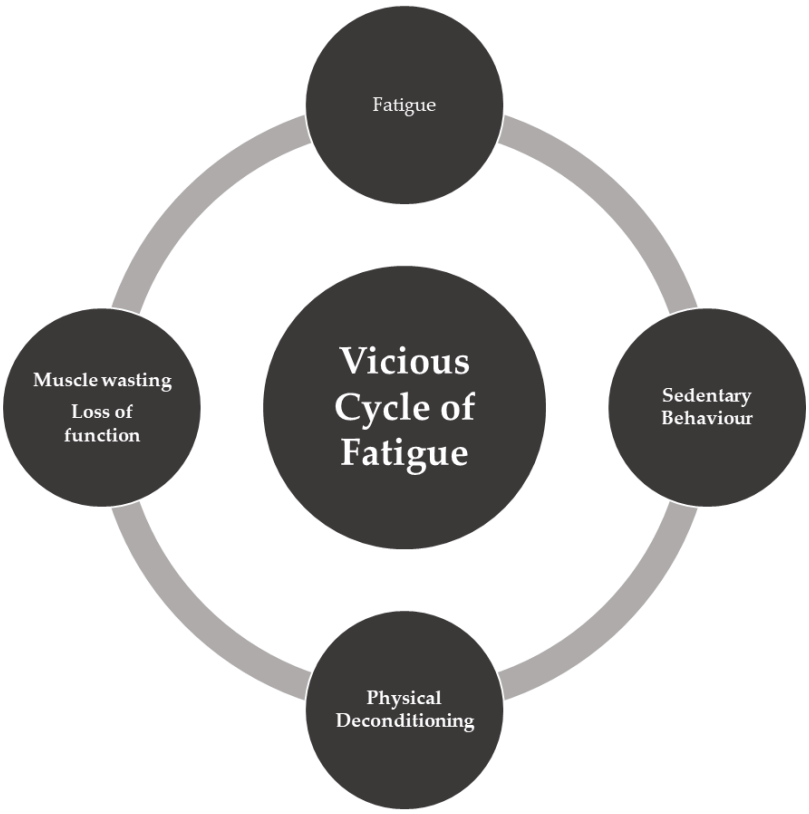

Fig. 1.3: Illustrating the vicious cycle of fatigue common in patients on chemotherapy, radiation therapy or hormone therapy.

Another plausible route is via the direct impacts of regular exercise, particularly resistance exercise and balance training, on body composition and musculoskeletal health (Dawson et al., n.d.; Kim et al., 2018a; Bressi et al., 2021; Newton et al., 2021a). Key direct complications of [long-term] use of radiation therapy, chemotherapy or ADT remain massive reduction in skeletal muscle mass and concomitant gain in fat mass (Kirby, Hirst & Crawford, 2011; Smith et al., 2012; Troeschel et al., 2020; Newton et al., 2021b). A direct consequence of hormone deprivation, the primary target in ADT use, is further evident in the marked reduction in bone density (A M El Badri, Salawu & Brown, 2019; Castañeda et al., 2022). Combined, patients and survivors experience frailty and balance problems and a consequent increase in the risks of falling, osteoporosis, and fractures (Kirby, Hirst & Crawford, 2011; Smith et al., 2012; A M El Badri, Salawu & Brown, 2019). Muscle mass loss, bone loss, and fat mass gain not only can be prevented or reduced during ADT but also reversed with combined resistance and aerobic exercise program (Segal et al., 2003; Galvão et al., 2010b; Tian, Ding & Sun, 2022). Exercise [and lifestyle changes] have also shown huge protective effects on obesity/weight gain during long-term ADT use (Mohamad et al., 2014; Faithfull et al., 2021; Tian, Ding & Sun, 2022). Exercise has also been found to improve hyperglycaemia, serum high-density lipoprotein, insulin uptake and hypertension, the risks of which are increased along with metabolic syndrome during long-term ADT use (Dawson et al., n.d.; Kiwata et al., 2016).

Exercise programs also form an integral part of pelvic floor rehabilitation following PCa treatment (Baumann et al., 2021). On average, between 10 and 15% of men report urinary incontinence as a major side effect after radical prostatectomy and the need to use absorbent pads even six months after treatment (Singla & Singla, 2014). Whereas the pathophysiology of post-prostatectomy incontinence is multifaceted, detrusor overactivity, nerve injury and compromise to the pelvic floor architecture have been implicated in as high as 74% of cases of incontinence post-surgery (Singla & Singla, 2014; Kadono et al., 2022a,b). A weakened pelvic floor is also implicated in most cases of erectile dysfunction following radiation therapy, the most long-term adverse effects of radiotherapy regardless of whether external bean therapy or radioactive seed implants are used (Olsson et al., 2015; Catucci et al., 2021). The testosterone-reducing effects of ADT further pose serious consequences to the muscles of the pelvic floor in long-term ADT use (Basaria et al., 2002). Most patients on ADT experience a significant reduction in their sexual function in as short as two weeks after commencing treatment (Gryzinski et al., 2022; Nguyen, Leonard & Hsieh, 2022). Pelvic floor muscle exercises [or Kegel exercises] have shown strong efficacy for managing damages to the pelvic floor, in addition to bladder neck contractures or urethral strictures secondary to bladder outlet obstruction after surgery (Baumann et al., 2021).

Regardless of disease stage or treatment type, physically inactive PCa survivors generally experience varying higher levels of psychological distress than those who are physically active, with several studies showing significant improvement in anxiety, depressive symptoms and sleep disturbance during and after treatment using exercise programs (Galvão et al., 2015a; Duarte et al., 2022). Among 135 PCa survivors on long-term ADT, Galvao and colleagues showed that not only anxiety and depression can be reduced using varying exercise modalities and intensities, including aerobic exercise, resistance training or impact loading, but also the overall severity index (Galvão et al., 2021). Even among PCa patients under active surveillance, sufficient evidence has shown significant reductions in anxiety and other critical psychological stressors like fear of disease progression, perceived stress, fatigue, hormonal symptoms and self-esteem using high-intensity interval exercise training (Kang et al., 2022).

Overall, exercise can improve patients' general well-being and QoL. Several studies have shown this by demonstrating reductive 'real world' effects on chronic inflammation and treatment complications (Dawson et al., n.d.; Galvão et al., 2010b; Scott et al., 2018; Parent-Roberge et al., 2020; Schumacher et al., 2021). To further confirm the direct exercise impacts on QoL, multiple clinical trials and meta-analyses have recorded both clinically and statistically significant results using varying outcome measures not only of QoL composites but also disease-specific and general QoL in men with PCa (Galvão et al., 2015a; Vashistha et al., 2016; Kang et al., 2022). Improvement in general well-being and QoL have further resulted in early return to work and other day-to-day activities (Thijs et al., 2012; Stout, Mina, et al., 2021).

1.3.2.4 Disease progression, recurrence, and mortality

The modulatory effects of PA and exercise, especially on chronic inflammatory processes, have beneficial impacts on PCa progression and recurrence (Leitão et al., 2022). In patients with advanced disease stages, several clinical investigations have recorded, for example, elevated levels of IL-6 and C-reactive protein (CRP) (Stark, Livas & Kyprianou, 2015; Hayes et al., 2016b; Archer, Dogra & Kyprianou, 2020). Elevated levels of CRP are also associated with negative prognosis, PCa recurrences, and significantly shorter survival (Stark, Livas & Kyprianou, 2015; Archer, Dogra & Kyprianou, 2020; Zhou et al., 2023). Studies have shown significant reductions in IL-6 levels in patients on radiation therapy or ADT using aerobic exercise and resistance training (Champ et al., 2016; Hayes et al., 2016c; Thomas et al., 2021). In a multivariate analysis involving 2, 705 men, both vigorous and non-vigorous exercise were associated with lower risk of both all-cause and PCa-specific mortality (Kenfield et al., 2011a). Specifically, men who continued to have over three hours of vigorous exercise per week four years after their post-diagnosis PA evaluation had a 49% lower risk of all-cause mortality and 61% lower risk of PCa-specific mortality(Kenfield et al., 2011a).

Evidence from multiple cohort studies and meta-analyses has further shown greater mortality risk in men with localized and advanced PCa presenting with significantly low levels of muscle mass and high visceral adipose tissue to subcutaneous adipose tissue ratio (Chiang et al., 2021; Lopez et al., 2021). Exercise can also lower the risk of death, consequently increasing overall survival in men with PCa, not only by sustaining balanced muscle-to-fat mass ratios regardless of disease stage; but also, by promoting weight loss in obese survivors (Mohamad et al., 2014; Kiwata et al., 2016; Lopez et al., 2022).

1.3.3 Issues and challenges associated with exercise uptake in prostate cancer survivors

The compelling evidence on exercise safety and effectiveness has not yet resulted in sufficient daily/weekly exercise engagement in men with PCa. Currently, less than 40% of men diagnosed with PCa are meeting global exercise recommendations (Cormie et al., 2013; Galvão et al., 2015b). Even where exercise programs are located in cancer treatment centres, annual enrollment can be as low as 10% of total patient referrals, with over 50% of the enrolled patients missing nearly half of the sessions (AM et al., 2017, 2021a; Dalzell et al., 2017; Kennedy et al., 2020). This section considers the individual, environment (including community), and health systems levels barriers to engaging in regular exercise among PCa survivors.

1.3.3.1 Individual (micro) level barriers

The greater proportion of PCa survivors is not only over the of age 60 years but also with pre-existing cardiovascular, neurological and musculoskeletal conditions that influence exercise safety and tolerance (Stout, Brown, et al., 2020). In addition to these conditions, the presence of age-associated functional limitations orchestrated by cognitive deficit, accelerated muscle

loss, sarcopenia, aerobic declining, frailty, and other hosts of geriatric syndrome may result in additional exercise barriers (Galvão et al., 2008; Kirby, Hirst & Crawford, 2011; Smith et al., 2012; Stout, Brown, et al., 2020; Xu et al., 2021). PCa treatment may further precipitate new cardiovascular and metabolic risks and events in most patients, like stroke, heart diseases, hypertension, diabetes, etc, along with confluence of treatment-related adverse effects with significant implications for exercise participation and maintenance (Keating, O'Malley & Smith, 2006; D'Amico et al., 2007; Saigal et al., 2007; Kenfield et al., 2011a; Ehdaie et al., 2012; Troeschel et al., 2020).

Lack of time, energy and motivation and presence of psychosocial stressors like fear of symptom exacerbation, and anxiety over dealing with a potentially fatal disease may further introduce limitations to exercise engagement (Fox et al., 2019). Most patients have a poor understanding of their condition and limited exercise experience and may face uncertainties regarding the role of exercise in managing their condition (Neil-Sztramko et al., 2019). These challenges have significant negative impacts on exercise self-efficacy and may affect exercise adoption and maintenance in this population.

1..3.3.2 Environmental level barriers

Living and workplace environment, socioeconomic status, access to healthcare and wellness facilities (including gyms), health insurance, the lack of family and social support and a host of other social and economic determinants of health fall under this category (Fox et al., 2019). Patients who live in unsafe neighbourhoods, work multiple and long-hour jobs and lack access to health insurance are at high risk of physical inactivity (Fox et al., 2019). Some patients may also experience challenges covering the cost of a gym membership or access to an exercise program after paying for PCa treatment (Fox et al., 2019).

1.3.3.2 Health systems (macro) level barriers

Very few oncology treatment facilities have exercise promotion and rehabilitation services embedded in them (Stout, Mina, et al., 2021). The lack of cancer care models with integrative exercise-cancer care units presents significant limitations to delivering access to timely, flexible, and high-quality exercise programs to PCa survivors (Schmitz, Campbell, Stuiver, Pinto, Schwartz, Morris, Ligibel, Cheville, Galvão, Alfano, Patel, Hue, Gerber, Sallis, Gusani, Stout, Chan, Flowers, Doyle, Helmrich, Bain, Sokolof, Winters-Stone, et al., 2019; Stout, Mina, et al., 2021). Most treatment facilities lack the resources to embed exercise programs in cancer care. Resources may include exercise specialists with sufficient experience with PCa patients, funding for hiring qualified staff or purchasing exercise equipment, screening algorithms for determining patient exercise needs and challenges, and the physical space to instal an exercise service unit (Kennedy et al., 2022). Where such models exist, many clinicians are not sufficiently informed about exercise and may lack the capacity and agency to counsel, prescribe or refer patients to exercise programs (Kennedy et al., 2022). There is often a lack of

robust guideline-concordant care with streamlined exercise referral pathways where such models exist (NL et al., 2020; Stout, Brown, et al., 2020). These issues pose significant barriers and challenges to exercise engagement among PCa survivors.

1.3.4 Structured patient education intervention

The concept of using structured patient education as an interventional approach for promoting health behaviours and behavioural changes has seen tremendous growth in the last two decades. Consistently, behavioural scientists, clinicians (including nurses), clinical investigators, and public and allied health practitioners are leveraging PEIs to support and encourage self-management practices and critical lifestyle changes in the routine management of chronic disease conditions (Deakin & Whitham, 2009; Abaraogu, Dall & Seenan, 2017; Howell et al., 2017; Yu et al., 2022). Central to PEIs is expanding patients' understanding of their condition, addressing uncertainties regarding, for example, the importance of exercise in managing patient conditions and empowering patients to take steps in overcoming even higher-order obstacles interfering with their goals (Deakin & Whitham, 2009; Abaraogu, Dall & Seenan, 2017). PEI serves primarily to deliver effective behavioural change techniques crucial to developing self-agency and behavioural control among patients, improving patient ownership of their conditions and care efforts, and promoting patient-centred self-management efforts (Deakin & Whitham, 2009; Adams, 2010; Howell et al., 2017). The overarching purpose of this thesis anchors on the demonstrable role of PEIs in promoting PA behaviour in patients with varying chronic conditions to propose its application for increasing daily/weekly exercise among men with PCa (*Structured Patient Education in Diabetes Report from the Patient Education Working Group*, n.d.). With persisting individual, community and health systems challenges and roadblocks to achieving sufficient exercise behaviour in PCa survivors, patients can be sufficiently empowered using PEI to develop the right attitude and exercise self-efficacy and play major roles in the efforts that are critical to not only increase exercise capacity but also free-living exercise behaviour (Bandura, 1977).

Consistent with international best practice for designing every complex intervention (Levati et al., 2016), an important step in developing and implementing PEIs for increasing daily/weekly exercise is first to elucidate critical intervention composites and understand how they can be combined and feasibly delivered among men with PCa. This is particularly critical as there is currently no consensus on the effective components and delivery procedures for PEIs in the context of increasing exercise behaviour or managing cancer conditions. This thesis proposes a discrete choice experiment and elaborates on a design experiment to clarify these issues and ultimately address an important gap in the literature concerning applying PEIs to promote self-managed free-living exercise behaviour in PCa survivors (Wang et al., 2021).

1.4 Research Purpose

Building on the established role of PEIs in facilitating behaviour change and self-management practices, the overarching purpose of this research was to design a discrete choice experiment to clarify key issues pertaining to effective components and delivery procedures for developing and implementing a PEI to increase daily/weekly exercise in men with PCa. Specifically, the following objectives were covered in this thesis to address the overarching purpose:

1. Identify attributes (or characteristics [also variables]) and attribute levels (i.e., different functionalities of each attribute) for developing the discrete choice experiment;
2. Design a discrete choice experiment using a D-efficient design based on the established attributes and attribute levels.

1.5 Approaches and Methodology

Given the cost-intensiveness and impracticality of implementing a design experiment with all possible combinations of the levels of the attributes, a partial factorial design was optimised using the D-efficient design to guarantee the generation of sufficient information to support the development of PEI for PCa survivors (Mangham et al., 2009a). Discrete choice experiments are quantitative research techniques employed to understand patients' preferences and the values placed on certain health services (including interventions, policies, programs, etc.) or products or their aspects (Wang et al., 2021). Discrete choice experiments allow designers and investigators to gain critical insight from the end-users or service providers before product development by inviting them to state their preferences over several hypothetical choice scenarios and using the information to determine not only product utility but, importantly, what attributes of the product that confer greater utility (Terris-Prestholt et al., 2019a; Wang et al., 2021). Several complex health services and interventions have been developed or optimised using DCEs before trying them for their effectiveness (Levati et al., 2016; Mangham et al., 2009a; Wang et al., 2021).

Two steps, 1) establishing attributes and 2) assigning levels to the attributes, not only are fundamentally crucial to developing nearly orthogonal and balanced experimental designs but also vital to the overall validity of a discrete choice experiment (Mangham et al., 2009a). While attribute levels represent the multiple functionalities of the variables classified as attributes, attributes themselves form the 'foundational stones' of the design experiment that determine the characteristic features of the choice sets (Mangham et al., 2009a; Terris-Prestholt et al., 2019a; Wang et al., 2021). Two major approaches were adopted in this research in establishing the attributes and their levels. The first step involved a comprehensive synthesis of relevant quantitative and qualitative literature to identify relevant factors or conditions and plausible mechanisms for increasing exercise behaviour in men with PCa using structured PEIs. The first question that was answered pertained to the effectiveness of structured PEIs

for increasing daily or weekly exercise in men with PCa. This was followed by a thematic synthesis of qualitative reports on patients' views and experiences after receiving PEIs. Using a sequential explanatory approach, findings from the quantitative and qualitative syntheses were combined in a mixed studies synthesis.

The sequential explanatory approach was fitting in this regard as it allowed the integration of findings from two independent reviews of quantitative studies evaluating PEI effectiveness in men with PCa and qualitative research of men's experiences with the intervention (Sandelowski, Voils & Barroso, 2006). Importantly, it offered an avenue that allowed the interpretation and appreciation of the quantitative findings using insights drawn from qualitative studies (Sandelowski, Voils & Barroso, 2006). Findings emanating from the mixed studies synthesis were modelled using the idea of context-mechanism-outcome configuration to elucidate the plausible conditions and mechanisms to explain the success (or failure) of PEI in increasing daily/weekly exercise (Long et al., 2022).

A scoping review was conducted as part of the broader evidence syntheses to clarify an issue that arose following the mixed studies synthesis. One of the major findings of the mixed studies synthesis was regarding the critical role of delivering exercise promotion and rehabilitation services in treatment settings to increase early uptake of regular exercise among PCa. Leveraging clinical settings for this purpose has the potential of allowing clinicians to intervene within the window of time when PCa survivors are more amenable to behaviour change, primarily given how enormously challenging exercise adoption and maintenance can be in post-treatment population, especially among previously non-exercising men (Rabin, 2009). Thus, a fundamental question—namely, of the feasibility of implementing such services in a clinical care setting—arose. Most fundamental to the overarching purpose of this thesis was whether the delivery setting is a potential attribute in designing the choice sets and whether a potential variation (or attribute level) could be treatment facilities. To consider treatment facilities as a potential attribute level of delivery setting, it was imperative to first consider the feasibility of embedding exercise-based programs in cancer treatment settings. This feasibility question was resolved using the scoping review, given the superiority of this approach for knowledge clarification over other systematic review methodologies (Munn et al., 2018).

Qualitative research was also conducted to further identify relevant attributes for the discrete choice experiment (Terris-Prestholt et al., 2019a). The qualitative research focused on the needs and priorities of men with PCa during and after treatment, and their exercise barriers and expectations, with keen attention to the local context. To address these interests, patient interviews were conducted with a diverse population of PCa survivors with a special interest in variations among patients in the public and private healthcare sectors. An interpretative description design was adopted for the qualitative research as it allowed critical insights to be generated on local challenges as experienced by patients and the crystallisation of the insights

to generate themes that would feed into the discrete choice experiment as attributes and attribute levels (Teherani et al., 2015). Fundamentally, the goal was to localise the factors/conditions that would later inform the attributes or their levels while consolidating findings from the evidence synthesis.

1.6 Thesis Structure

This thesis contains six chapters, organised as follows:

Chapter 2— the mixed studies synthesis, summarised existing evidence on the effectiveness of PEIs for increasing daily or weekly exercise in PCa survivors and men's experiences of PEIs. Using context-mechanism-outcome configuration, it further identified major contextual factors/conditions and plausible interactions between these factors to potentially drive exercise uptake in men with PCa using PEIs.

Chapter 3— the scoping review, examined the feasibility of embedding exercise promotion and rehabilitation services in clinical oncology settings. This chapter was critical in determining whether the delivery setting was a potential attribute for the discrete choice experiment and whether a potential variation (or attribute level) could be cancer-treating facilities.

Chapter 4— *the qualitative research* considered the exercise needs and priorities of men with PCa during and after treatment, in addition to their exercise challenges and expectations. This chapter localised multiple variables and elements that would later inform the attributes and attribute levels while consolidating the findings from the reviews.

Chapter 5— the discrete choice experiment, details the actual development of the discrete choice experiment. It details the conceptualisation process, including establishing the attributes and assigning them levels, combining the attribute levels to generate different alternatives, and their combinations to generate 27 choice sets.

Chapter 6— the final chapter summarises the entire thesis and discusses future work, including recommendations for pilot-testing of the discrete choice experiment.

1.7 Summary of Chapter

This chapter has presented the overview of this thesis, including the rationale, objectives and relevant literature. As a critical step in developing the discrete choice experiment, the next chapter presents the systematic synthesis of the literature, integrating findings from the independent evidence syntheses of quantitative and qualitative studies to identify plausible conditions and mechanisms for promoting regular exercise in men with PCa using PEIs.

Chapter 2— Plausible Conditions and Mechanisms for Promoting Regular Exercise Behaviour in Men with Prostate Cancer Using Patient Education Interventions

Sequential Explanatory Mixed Studies Synthesis

2.1 Abstract

Two research approaches were employed to elucidate the discrete choice experiment's key attributes and attribute levels. This chapter focuses on the first approach, a comprehensive evidence synthesis, integrating findings from segregated quantitative and qualitative literature syntheses. This study, a mixed studies synthesis with data configuration, sought to evaluate PEIs to understand relevant conditions and mechanisms for increasing exercise behaviour in men with PCa.

Specifically, studies that randomised men diagnosed with PCa, assessed PEIs and reported (1) between-group changes in the outcome measures of exercise self-efficacy, PA level, or patient-centred outcomes (cancer-related fatigue, aerobic fitness, and quality of life) at baseline and post-intervention, and/or (2) men's perceptions of structured PEIs were synthesised. Results from five randomised control trials reporting data on 895 men and qualitative reports from four studies were analysed independently using narrative and thematic synthesis. Findings from both syntheses were then integrated using the context-mechanism-outcome configuration (CMO) to elucidate potential factors and conditions that may support plausible PEI mechanisms.

Structured PEIs were associated with a beneficial increase in task self-efficacy, vigorous-intensity PA, minutes/week of resistance exercise, the proportion of men meeting ≥150 minutes/week of moderate-vigorous intensity aerobic exercise, and overall PA. No effects were found on patient-centred outcomes. Drawing upon the CMO configuration, attributes such as establishing a referral process, access to 'credible influence' (e.g., facilitating exercise promotion/PEIs with former PCa patients), and adopting hybrid service delivery may likely explain the success of PEIs in men with PCa. The likelihood of success was higher for interventions that prioritised credible influence and exercise referral as critical components, along with offering access to interventions within hospital settings in addition to home-based sessions. This study has been published in Springer Natures' Supportive Care in Cancer and is available at: https://doi.org/10.1007/s00520-021-06693-w

2.1 Background

Active treatments for PCa exert multisystemic impacts with several adverse effects that are likely to compromise the quality and length of life for men diagnosed with PCa (Stout et al., in press). Individuals receiving chemotherapy, radiation therapy, continuous or intermittent

hormone ablation, or surgery often experience multiple complications that may include chronic inflammation, metabolic syndrome, cancer-related fatigue, compromised aerobic capacity, psychosocial disorders, urinary incontinence, sexual dysfunctions, frailty, osteoporosis, and an increased risk of falling (Brearley et al., 2011b; Reilly et al., 2013b; Howell et al., 2017). These complications also have substantial socio-economic implications for survivors and their relatives and may persist for many years after active cancer treatment (18). Survivors may experience loss of jobs, loss of income, medical debt, social isolation, and the inability to engage in daily routines (Henry et al., 2008b; Carlotto et al., 2013b).

Several of these sequelae can be mitigated or ameliorated with regular PA (Bull et al., 2020). Engaging in regular PA right from the time of diagnosis has had demonstrable impacts on disease-specific (tumour progression and PCa survival) and patient health (treatment tolerance, early recovery, and length of hospital stay) outcomes (Buffart et al., 2014; Cormie et al., 2015; Galvão et al., 2007, 2014b; Galvão, Taaffe, et al., 2018b, 2021; Kenfield et al., 2011c; Lopez et al., n.d.; McCullough et al., 2014b; Wall et al., 2017); further translating into an early return to regular activities, better life-after-treatment and ultimately better quality of life (Kenfield et al., 2011c). Regardless of such compelling evidence on efficacy and safety, less than 40% of men diagnosed with PCa currently meet global exercise recommendations (Cormie et al., 2013; Galvão et al., 2015b). Lack of engagement in regular PA may be associated with several factors, including fear of musculoskeletal injury and symptoms exacerbation (Fox et al., 2019). This may further be amplified by the lack of exercise self-efficacy and perceived behavioural control (Fox et al., 2019). These factors derive primarily from a poor understanding of PCa as a disease and a knowledge gap on the (1) role of PA in PCa management and recovery and (2) the right exercise prescription to derive health benefits (Fox et al., 2019). Addressing these factors is critical for supporting survivors in building conviction in their capabilities to initiate and maintain optimal levels of PA (Bandura, 1977).

Structured patient education may serve as an important vehicle for delivering effective behaviour change techniques to improve PA behaviour among PCa survivors. Structured PEI is defined as a planned and graded program designed to improve patients' health behaviours and/or status by increasing knowledge, skills, and confidence, enabling patients to take control over their condition (Structured Patient Education in Diabetes Report from the Patient Education Working Group, n.d.; Riemsma et al., 2003; Adams, 2010). To be successful, PEIs must be comprehensive, flexible, adaptable, and well-grounded in a theoretical understanding of behaviour change (Wolf et al., 2002). PEIs may profoundly impact the core determinants of PA, namely, attitudes, intentions, and self-efficacy, ultimately improving patient-centred outcomes and overall quality of life [22].

Even though current literature supports the use of patient education in managing cancer and other chronic conditions, a consensus does not yet exist to optimise PEIs for improving PA behaviour (PA levels and mediators of change) in men with PCa (Abaraogu, Dall & Seenan, 2017; Howell et al., 2017). Developing effective PEI requires addressing the complex nature of the

intervention composites; hence, the need to identify core PEI components— including delivery procedures— and evaluate their mechanisms (Levati et al., 2016). This mixed studies synthesis aimed to evaluate PEIs, or their components, for their potential to change PA behaviour in men with PCa. First, it examined the effects of PEIs on PA behaviour— as a secondary outcome, it also considered these interventions for their potential to improve patient-centred outcomes. Second, it explored the perspectives of men who received PEIs in a thematic synthesis. In a final synthesis, findings that emerged from both analyses were integrated using the context-mechanism-outcome configuration to identify potential effect drivers and causal mechanisms.

2.3 Methods

2.3.1 Design

This review adopted a mixed research synthesis with segregated design (See fig. 2.1). Segregated synthesis upholds the traditional distinction between quantitative and qualitative research synthesis whilst allowing the integration into, for example, a conceptual model (in the case of this study), the separately synthesised quantitative and qualitative findings (Sandelowski, Voils & Barroso, 2006). The basic assumption is that whilst quantitative and qualitative research and their findings can complement each other to formulate superior answers to complex research questions, both designs belong to two distinctive paradigms and, therefore, should be treated separately with methods akin to them (Sandelowski, Voils & Barroso, 2006). This review was conducted following the Preferred Reporting Items for Systematic reviews and Meta-analyses guidelines (Moher et al., 2009a). Details of the review protocol are available on the International Prospective Register of Systematic Reviews (PROSPERO) (ID: CRD42020181733).

***Figure* 2.1:** *Separate synthesis of quantitative and qualitative research and subsequent configuration of findings in segregated design* (Sandelowski et al., 2006).

2.3.2 Eligibility Criteria

The Population Intervention Control Outcome (PICO) framework guided the articulation of the review's eligibility criteria. This PICO framework has gained significant interest in health and biomedical research because as enables authors and reviewers to effectively capture the essential elements of an answerable review question (Huang, Lin & Demner-Fushman, 2006).

- **Population:** Men diagnosed with PCa, regardless of cancer stage, treatment type, or whether [or not] participants had completed active cancer treatment.
- **Interventions:** Studies were eligible if they aimed for the following facets of PEIs or a mixture thereof: 1) increasing patients' understanding of the basic role of PA/exercise in cancer management and survivorship, 2) bridging exercise knowledge and skills gaps while supporting patients to develop confidence, enabling them to take individual responsibilities for increasing their PA level, 3) addressing illness cognition including dysfunctional beliefs about PA during and after PCa treatment, and 4) providing practical steps for addressing behaviours and practices that form barriers to service adoption and maintenance.
- **Controls:** Active or placebo controls.
- **Outcomes:** *Quantitative*: The following outcomes were included where a distinct assessment was conducted and results provided at baseline and post-intervention(s): 1) exercise self-efficacy and/or PA levels (primary outcomes); and 2) cancer-related fatigue (CRF), aerobic capacity, or quality of life (QoL) (secondary outcomes); *Qualitative:* Patients' perspectives and experiences.
- **Design:** *Quantitative:* RCT; *Qualitative*: All designs

2.3.3 Information Sources and Search Strategy

A comprehensive search strategy was developed and validated by the supervisory team before conducting the searches in accordance with widely used guidelines (Bramer et al., 2018). The search strategy was developed using relevant Medical Subject Headings (MeSH), keywords and search terms, combined using appropriate Boolean operators and wildcards. Search strings were designed to be sensitive to a broad array of alternative terminologies related to PCa and PEI (See Appendix 2.1 for sample search strategy). The pilot search strategy was optimised in PubMed and adapted for other databases.

Search for relevant RCTs and qualitative studies was conducted independently in six bibliographic databases, including PubMed/MEDLINE, CINAHL, the Cochrane Library, ProQuest, PsychINFO, and Web of Science Core Collections up to October 2020. Additionally, relevant citations were sought in recent systematic and meta-analytic reviews of PA behaviour change interventions in cancer survivors.

2.3.4 Study Screening and Selection

Search records were exported to RefWorks for duplicate removal and then to Microsoft Excel for screening and selection. The titles and abstracts of the retrieved studies were screened separately. Using the eligibility criteria, the suitability of the remaining full texts was examined for the current review. Since the information available in the studies was sufficient to make an informed decision regarding inclusion, study authors of the included studies were never contacted. Challenges arising during screening were discussed with the supervisory team and resolved by consensus.

2.3.5 Data Collection

2.3.5.1 Risk of Bias assessment

Risk of Bias (RoB) in the RCTs was assessed in five key domains using Cochrane Collaborations' 2019 Risk-of-Bias assessment tool (Rob 2): 1) randomisation process, 2) deviations from intended interventions, 3) missing outcome data, 4) measurement of outcomes, and 5) selection of the reported results (Higgins et al., n.d.; Sterne et al., 2019). RoB was assessed in the included studies using exercise self-efficacy and PA levels as references — even when reported as secondary outcomes — to determine the likelihood of bias in the results. For each outcome, a judgment of *low risk of bias*, *some concerns*, or *high risk of bias* was made based on a widely used algorithm (Büttner et al., 2019; Sterne et al., 2019).

The qualitative studies were appraised for inclusion using the 32-item Consolidated Criteria for Reporting Qualitative Research (COREQ) (Duong et al., 2007). Judgements were made on the quality of the included qualitative studies by scoring *Yes*, *No*, or *Not clear* for each of the items of the COREQ tool.

Challenges encountered during the appraisal process for the quantitative and qualitative studies were discussed and resolved by the supervisory team.

2.3.5.2 Data extraction

Data extraction spreadsheets were developed to guide the extraction of data from the (1) intervention studies and (2) qualitative research reports based on the Cochrane Consensus and Communication Review Group data extraction template and the Supplementary Guidance for Inclusion of Qualitative Research (Noyes et al., 2018; Ryan & Hill, 2019). For the quantitative synthesis, data were extracted for a broad range of variables, including participants' characteristics (age, disease stage, treatment type, and status), sample size (intervention group, control group), attrition/retention rate, intervention (education component, exercise component, behaviour change component, the context of delivery, personnel), duration, follow-up, outcome measures, assessment time points, and results. For the qualitative synthesis, patients' views and experiences were extracted.

2.3.6 Data Synthesis

Data synthesis was performed using a three-step sequential explanatory approach (Pluye & Hong, 2014). For the quantitative arm of the review, a narrative synthesis of RCTs evaluating the effects of PEIs on self-efficacy, daily and weekly exercise, and patient-centred outcomes was conducted. The results from all the intervention studies assessing PEI effectiveness were collected together in an evidence table. A narrative synthesis was adopted over meta-analysis in determining the summary intervention effects given the limited number of primary studies (five trials) and the variability in the outcome measures. This was the first step in the sequential explanatory approach.

For the qualitative arm, a thematic synthesis of the qualitative reports on men's experiences/perceptions of PEIs was performed. Men's experiences and perceptions were decomposed and summarized to generate descriptive themes. Further, a reciprocal translation of the descriptive themes [or categories] was performed to generate analytical themes featuring key intervention elements that could explain the success (or lack of it) of PEI in men with PCa. Each of these steps was validated by the reviewer team by comparing the emerging codes/themes with the findings/conclusions from the qualitative studies. This was the second step of the sequential explanatory approach. In performing qualitative data synthesis, data were from the findings/conclusions of the included studies rather than the direct quotes from the patients to allow for the combination of the different qualitative designs/methods into a single synthesis.

The sequential explanatory synthesis was concluded by integrating findings from both syntheses using the context-mechanism-outcome configuration to elucidate critical PEI effect drivers and causal mechanisms for future research and service planning.

2.4 Results

2.4.1 Description of included studies

In total, 531 references were retrieved after the bibliographic search. A total of 301 articles were screened for titles and abstracts following the removal of 230 duplicates. Sixty-eight full texts were subsequently read to determine their overall suitability for inclusion in the review. Based on the review's eligibility criteria, five RCTs with seven published articles (Carmack Taylor et al., 2006; Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018; Galvão, Newton, et al., 2018; Kim et al., 2018b) reporting data on 895 men with a mean age between 64.4 and 70.8 years were included in the narrative synthesis. Details of the studies' screening and selection processes are provided in Fig. 2.2. Most participants had localized PCa (stage I – III) (Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018; Galvão, Newton, et al., 2018; Kim et al., 2018b) and were still on androgen-ablation therapies (Carmack Taylor et al., 2006; Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017;

Craike et al., 2018; Galvão, Newton, et al., 2018; Kim et al., 2018b) at the time of baseline assessment.

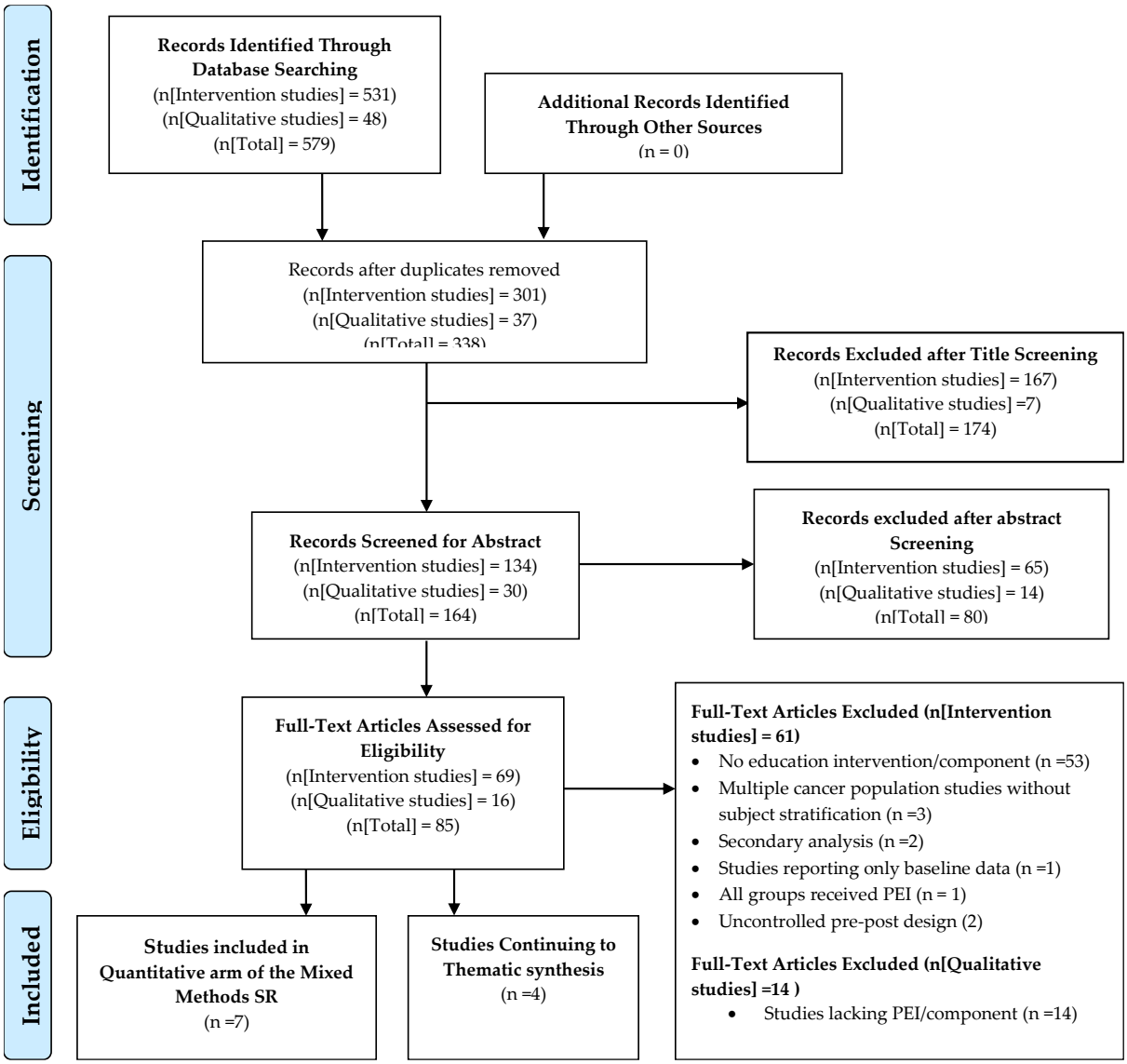

Fig. 2.2: *showing the number of articles screened, assessed for eligibility, and included in the mixed methods review (PRISMA Flow Chart is credited to* Moher et al., 2009b)

2.4.2 Description of interventions

The included RCTs varied considerably in the intervention components; however, they all offered an educational component and some behaviour change techniques. The nature and composition of the educational component were heterogeneous and included multiple sessions covering a wide range of topics. In most trials, participants randomised to receive patient education were taught cognitive-behavioural skills for increasing exercise adherence, among other things (Carmack Taylor et al., 2006; Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018; Galvão, Newton, et al., 2018; Kim et al., 2018b). In

one study comparing two educational interventions with standard care, participants randomised to one of the study groups neither received skills training nor behavioural change techniques but facilitated discussions on cancer-specific topics (Carmack Taylor et al., 2006).

In one trial, patient education was led by two experienced peer support volunteers and delivered virtually (Galvão, Newton, et al., 2018). One trial provided patient education on a one-on-one basis and offered participants the opportunity to socialise after sessions (Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018). In two trials (Galvão, Newton, et al., 2018; Kim et al., 2018b), participants received regular telephone counselling from exercise counsellors, nurses, or clinical psychologists. While three trials were based on known behaviour change theories, notably the transtheoretical model (Carmack Taylor et al., 2006) and socio-cognitive theory (Carmack Taylor et al., 2006; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018; Kim et al., 2018b), the overarching goal of the included trials was largely focused on building exercise self-efficacy and cognitive-behavioural skills to promote uptake and maintenance of optimal PA behaviour.

Three trials offered home-based exercise sessions, consisting primarily of different aerobic exercise modes, resistance, and weight-bearing exercises (Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018; Kim et al., 2018b). In addition to home-based sessions, two trials provided supervised, tailored gym-based exercise sessions (Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018). Two trials did not provide specific PA training but rather adopted the lifestyle approach to PA, emphasising the daily accumulation of ≥ 30 minutes of moderate-intensity PA (Carmack Taylor et al., 2006; Galvão, Newton, et al., 2018). In one trial (Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018), clinicians in the intervention group provided standardised referral slips to the participants, automatically assigning them to an exercise training program as part of their care. Study durations ranged from 12 weeks (Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018) to 6 months (Carmack Taylor et al., 2006; Kim et al., 2018b). One study conducted a post-intervention assessment at 16 weeks (Culos-Reed et al., 2010). More details are available in Table 2.1.

Table 2.1: Description of trials

Study Design (Country conducted) Attrition rate	Sample characteristics (Participants' description; Sample size; mean age)	Intervention description	Outcome measure	Conclusion
Carmack-Taylor et al. (Carmack Taylor et al., 2006) (USA) RCT 17.2 at 6 months 15.7 at 6 months follow up	PCa patients (Age (m): 69.2 years) receiving continuous androgen-ablation therapy Total n = 134 (G_1 = 46; G_2 = 51; G_0 = 37)	G_1: 6 months (16 weekly and 4 bi-weekly; 90mins/session) group-based PA lifestyle program [including facilitated discussion and presentations on selected topics] to build self-efficacy and cognitive-behavioural skills to adopt and maintain regular PA. No PA skills training was provided. Participants rather learned ways to monitor their activities including tracking daily minutes of activity, estimating daily kilocalorie expenditure, and using a step counter to track steps taken per day G_2: 6 months (16 weekly and 4 bi-weekly; 90mins/session) group-based educational support program providing facilitated discussions and presentations on selected topics including sexuality, treatment-related side-effects, or diet. Neither skills training nor instructions for behavioural changes were provided G_0: One mailing of educational material and information about community services	PA level: 7-Day PA Recall Fitness: 6-minute walk test Self-efficacy: PA self-efficacy questionnaire QoL: SF-36 Outcomes were assessed at baseline, 6 months and 6 months follow up	Neither the group-based PA lifestyle nor educational program increased self-efficacy, PA or treatment-related outcomes compared with standard care at 6 months or 6 months follow up
Livingston et al. (Livingston et al., 2015) Gaskin et al. (Gaskin et al., 2017)	Post-primary cancer treatment (stage I to III) Age (m): 65.6 ± 8.5 years	G_1: Clinician referral (standardized referral slip) + 12 weeks supervised aerobic and resistance (2x/wk, 50mins/session), and HB exercise (1session/wk) + discussions (one-on-one) and counselling sessions based on the SCT. Delivered by postgraduate clinical exercise physiology students/ clinical exercise	PA level (self-report): GLTEQ Accelerometer measure: The Actigraph GT3X accelerometer (hip-bound) Task self-efficacy: Participants rated their confidence on a 9 items Likert scale (from 0 [not at all confident] to 100	The clinician referral and 12-week exercise program improved vigorous exercise levels and task self-efficacy at 12 weeks and 3 months follow-up

Craike et al. (Craike et al., 2018) 2-armed prospective, multicentre RCT (Australia) 11.6% at 12 wks 16.7% at 3 months follow-up 19.4 at 9 months follow-up	Total n = 147 men (G_1 = 54; G_0 = 93)	physiologists at local community gym facilities. Written exercise program + discounted gym membership after 12 wks G_0: Advice involving minimal PA information	[extremely confident]) they believed they could perform three physical tasks for 10, 20, and 30 minutes. Barrier Self-Efficacy: Participants rated their confidence on a 25 items Likert scale (from 0 [not at all confident] to 100 [extremely confident]) they believe they can perform exercise when faced with specific barriers. QoL: EORTC QLQ-C30; QLQ PR25 Outcomes were assessed at 12 wks and 3 and 9 months follow-ups	
Culos-Reed et al. (Culos-Reed et al., 2010) (Canada) RCT 34% at 16 weeks	PCa survivors receiving ADT (Age (m): 67.6 ± 8.6years) Total n: 100 (G_1: 53, G_0: 47)	G_1: 16 weeks of a structured/group-based (1x/wk for 16wks, 1x/month during follow-up; 90mins/session) and individualised HB (3-5x/wk) PA (aerobic + resistance + stretching exercise) plus group-based educational (discussion) program based on the theory of planned behaviour (1x/wk for 16wks, 1x/month during follow up; 90mins/session). Delivered by a certified fitness professional in a fitness centre G_0: 1-year waitlist	PA level: GLTEQ Fatigue: Fatigue severity scale Fitness: 6-minute walk test QoL: EORTC QLQ-C30 Outcomes were assessed at baseline and after 16 weeks	Significant increase in PA levels
Galvao et al. (Galvão, Newton, et al., 2018) (Australia) RCT 17.7% at 6 months 18.4 at 6 months follow up	Men with localised PCa (Age (m): 64.4 ± 7.7) Total n: 463 (G_1: 232, G_0: 231)	G_1: Monthly telephone-based group peer support (60ms/session, 6 sessions), supported by self-management material and exercise equipment G_0: Standard medical management + a set of printed patient education materials	Adherence PA guideline PA level: GLTEQ Health-related QoL: AQoL-8D Disease-specific QoL: IPSS, EPIC Outcomes were assessed at baseline, 6 months and 6 months follow up	The peer-led intervention effectively increased patients' resistance exercise participation at 6 months but not at 6 months follow-up. Other outcomes did not change significantly at 6 months or 6 months followup
Kim et al. (Kim et al., 2018b) RCT, Pilot 19.6% at 6 months	Total n: 51 (G_1 = 26; G_0 = 25) PCa survivors receiving ADT	G_1:6 months individualised HB weight-bearing (150 mins/wk moderate intensity), resistance, stabilization/balance, and stretching exercises including circuit resistive callisthenics + Two 30 mins educational sessions + Ten 15 mins/session telephone	PA levels: GLTEQ Health-related QoL: FACT-Prostate Outcomes were assessed baseline and 6 months	The intervention did not produce any significant increase in PA levels and health-related QoL

	(stage I to III; age (m): 70.8 years)	counselling based on SCT (1 session/wk in the first 1 month) + a DVD or an 8 paged workbook with photographs to provide a vicarious experience G_0: Stretching exercise (3 to 5x/wk) + 10 mins telephone calls to ensure adherence		

Key: *PCa = Prostate Cancer; PA = Physical Activity; HB = Home Based; QoL = Quality of Life; G_0 = Control; G_1/ G_2 = Intervention Group(s); wk = week; G[M]LTEQ = Godin [Shephard] Leisure-Time Physical Activity Questionnaire; Functional Assessment of Cancer Therapy-Prostate Cancer questionnaire; SF-36 = The Medical Outcomes 36-item Short-Form Health Survey; EORTC QLQ-C30 = European Organisation of Research and Treatment of Cancer; AQoL-8D = The Assessment of Quality of Life [PsyQoL Multi-Attribute Utility] Instrument; IPSS = International Prostate Symptom Score; EPIC = [expanded UCLA] Prostate Cancer Index Composite*

2.4.3 Risk assessment

The data on the risk of bias for the included RCTs (Carmack Taylor et al., 2006; Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018; Galvão, Newton, et al., 2018; Kim et al., 2018b) are provided in Table 2.2. In summary, all but one (Culos-Reed et al., 2010) RCT was rigorous with the randomisation process. Evidence of participants, personnel, and assessor blinding was lacking in the five trials (Carmack Taylor et al., 2006; Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018; Galvão, Newton, et al., 2018; Kim et al., 2018b). Three trials (Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018; Galvão, Newton, et al., 2018) adequately accounted for missing outcome data and were at low risk of bias due to missing outcome data. Two trials (Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018; Galvão, Newton, et al., 2018) provided evidence of analysis and reporting based on previously published protocols.

Table 2.2: Risk of bias

	Carmack-Taylor et al. (Carmack Taylor et al., 2006)	**Livingston et al.** (Livingston et al., 2015)*	**Gaskin et al.** (Gaskin et al., 2017)*	**Craike et al.** (Craike et al., 2018)*	**Culos-Reed et al.** (Culos-Reed et al., 2010)	**Galvao et al.** (Galvão, Newton, et al., 2018)	**Kim et al.** (Kim et al., 2018b)
Domain 1: Risk of bias arising from the randomisation process							
1.1 Was the allocation sequence random?	**Y**	**Y**	**Y**	**Y**	**N**	**Y**	**Y**
1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	**Y**	**Y**	**Y**	**Y**	**N**	**Y**	**Y**
1.3 Did baseline differences between intervention groups suggest a problem with the randomisation process?	**N**	**N**	**N**	**N**	**-**	**N**	**Y**
Risk-of-bias judgment	**Low risk**	**Low risk**	**Low risk**	**Low risk**	**High risk**	**Low risk**	**Low risk**
Domain 2: RoB due to deviations from the intended interventions ***(effect of assignment to intervention)***							
2.1. Were participants aware of their assigned intervention during the trial?	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the trial context?	**NI**	**NI**	**NI**	**NI**	**NI**	**NI**	**NI**
2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2.5. If Y/PY/NI to 2.4: Were these deviations from the intended intervention balanced between groups?	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	**NI**	**NI**	**NI**	**NI**	**NI**	**NI**	**NI**
2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomised?	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Risk-of-bias judgment	**Some concerns**	**Some concerns**	**Some concerns**	**Some concerns**	**Some concerns**	**Some concerns**	**Some concerns**
Domain 3: Missing outcome data							

3.1 Were data for this outcome available for all, or nearly all, participants randomised?	**N**	**Y**	**Y**	**Y**	**N**	**N**	**N**
3.2 If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?	**N**	**Y**	**Y**	**Y**	**Y**	**Y**	**N**
3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	**Y**	**-**	**-**	**-**	**-**	**-**	**Y**
3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	**PY**	**-**	**-**	**-**	**-**	**-**	**PY**
Risk-of-bias judgment	**High risk**	**Low risk**	**Low risk**	**Low risk**	**Low risk**	**Low risk**	**High risk**
Domain 4: Risk of bias in measurement of the outcome							
4.1 Was the method of measuring the outcome inappropriate?	**N**	**N**	**N**	**N**	**N**	**N**	**N**
4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	**NI**	**NI**	**NI**	**NI**	**NI**	**NI**	**NI**
4.3 If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	**Y**	**Y**	**Y**	**Y**	**V**	**Y**	**Y**
4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	**PN**	**PN**	**PN**	**PN**	**PN**	**PN**	**PN**
Risk-of-bias judgment	**Some concerns**	**Some concerns**	**Some concerns**	**Some concerns**	**Some concerns**	**Some concerns**	**Some concerns**
Domain 5: Risk of bias in selection of the reported result							
5.1 Were the data that produced this result analysed following a pre-specified analysis plan that was finalised before unblinded outcome data were available for analysis?	**NI**	**Y**	**Y**	**Y**	**NI**	**Y**	**NI**
Is the numerical result being assessed likely to have been selected, on the basis of the results, from...							
5.2. ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	**NI**	**N**	**N**	**N**	**NI**	**N**	**NI**
5.3 ... multiple eligible analyses of the data?	**NI**	**N**	**N**	**N**	**NI**	**N**	**NI**
Risk-of-bias judgment	**Some concerns**	**Low risk**	**Low risk**	**Low risk**	**Some concerns**	**Low risk**	**Some concerns**

Key: *N/PN = No/Probably No; Y/PY = Yes/Probably Yes; NI = No Information*

Red fonts = major pointers to a high risk of bias; Orange fonts = concerns that could potentially lead to a high risk of bias; Green fonts = potentially free of bias

**Studies were published as parts of one RCT*

2.4.4 Between-group effects on:

2.4.4.1 Exercise self-efficacy

Two trials reported findings for changes in self-reported outcome measures of task (Craike et al., 2018) and barrier (Carmack Taylor et al., 2006; Craike et al., 2018) self-efficacy (Table 3). Both trials (Carmack Taylor et al., 2006; Craike et al., 2018) reported no significant improvement in barrier self-efficacy at post-intervention assessments or follow-up. However, compared with the control group, Craike et al. (Craike et al., 2018) reported a beneficial rise in task self-efficacy in the intervention group at 12 weeks (Δ = +16.23, 95% CI: +9.19 to +23.31; p <0 0.001) and sustained intervention effects at 3 months follow-up (Δ = +12.58, 95% CI: +4.45 to +20.71; p = 0.002).

Table 2.3: Effects of PEIs on exercise behaviour, daily/weekly exercise, and patient-centred outcomes

Study ID	Exercise Behaviour	Physical activity	Cancer-Related Fatigue	Aerobic Capacity	Quality of Life
Carmack-Taylor et al. (Carmack Taylor et al., 2006) (RCT)	At 6 months & 6 months follow: Exercise [barrier] self-efficacy (p = NS)	At 6 months & 6 months follow: Increase in self-reported PA (p = NS); Increase in energy expenditure (p = NS); Increase in days/week active for ≥ 30mins (p = NS); %increase in activity from baseline ≥ 2Kcal/kg/day (p = NS)		At 6 months & 6 months follow: 6-minute walk test (m) (p = NS)	At 6 months & 6 months follow: QoL (p = NS)
Livingston et al. (Livingston et al., 2015) Gaskin et al. (Gaskin et al., 2017) Craike et al. (Craike et al., 2018) *(RCT)*	At 12 weeks: Significant rise in task self-efficacy (Δ = +16.23 (+9.19 to +23.31); p <0 0.001); Barrier self-efficacy (p = NS) At 3 months follow up: Sustained intervention effect on task self-efficacy (Δ = +12.58 (+4.45 to +20.71); p = 0.002); Barrier self-efficacy (p = NS)	At 12 weeks: Beneficial increase in vigorous-intensity (self-reported) PA up to 45 minutes/week (95%CI: 11 to 79; p = 0.001); Greater % (i.e. 4 times greater in the intervention group compared with the control) of patients meeting 150min/week of MVPA (p = 0.02); Increase in (self-reported) moderate/moderate-vigorous intensity PA (p = NS); Increase in (objectively measured) moderate/moderate-vigorous/vigorous-intensity PA (p = NS). At 3 months follow up: Positive interaction effect for vigorous intensity (Self-reported) PA (Δ= 55.8; 95%CI: 14.2 to 97.5; p = 0.03);			At 12 weeks: Greater improvement in the cognitive component of QoL (e.g., 4 times higher; 95% CI: -0.2 to 8.2; p = NS); General QoL (p = NS) At 3 and 9 months follow up: QoL (p = NS)
Culos-Reed et al. (Culos-Reed et al., 2010) (RCT)		At 16 weeks: Beneficial increase in PA level (Δ = 18.69 ± 33.88 vs. -4.7 ± 23.00; p = 0.004)	At 16 weeks: Lowered level of fatigue severity (Δ = -0.34 ± 1.6 vs. -0.04 ± 1.10; p = NS)	At 16 weeks: 6-minute walk test (cm) (p = NS)	At 16 weeks: Increase in General QoL (Δ = 2.70 ± 0.92 vs. -2.33 ± 0.88; p = NS)
Galvao et al. (Galvão, Newton, et al., 2018) *(RCT)*		At 6 months: Beneficial increase in mins/wk resistance exercise (Δ = 14.6 [95% CI 1.69 to 27.58]; *p*=.027) Aerobic-based PA (p = NS)			At 6 months: Health-related/Disease specific QoL (p = NS)

		At 6 months follow-ups: Changes in mins/wk resistance exercise (p = NS) Aerobic-based PA (p = NS)			
Kim et al. (Kim et al., 2018b) *(RCT)*		Beneficial increase in PA (MET-hr/wk) (14.69 ± 5.67 vs. 7.02 ± 6.27; p = NS)			At 6 months: Increase in Health-related QoL (p = NS)

Key: *QoL = Quality of life; MET = Metabolic equivalent; hr/wk = hours per week; min/wk = Minutes per week; CI = Confidence interval; MV(PA) = Moderate to vigorous intensity (physical activity); NS = not statistically significant.*

Results are presented as between-group (mean) difference (plus standard deviation or 95% confidence interval.

2.4.4.2 Exercise (PA) levels

Five trials provided disparate results for the effects of PEIs on self-reported outcome measures of PA levels. PA levels were measured with The Leisure-Time Exercise Questionnaire (Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Galvão, Newton, et al., 2018; Kim et al., 2018b) **and the** 7-day Physical Activity Recall Scale (Carmack Taylor et al., 2006)**.** Vigorous-intensity PA increased by 45 minutes/week in one trial (95%CI: 11 to 79; p = 0.001), with more men (e.g., four times greater in the intervention group) meeting the recommended ≥ 150min/week of moderate-vigorous aerobic PA intensity (p = 0.02) (Livingston et al., 2015). Another trial reported a beneficial increase in overall PA level after a 6-month intervention (Δ = 18.69 ± 33.88 vs. -4.7 ± 23.00; p = 0.004) (Culos-Reed et al., 2010). Galvao et al. also reported a significant increase in minutes per week of resistance training at six months (Δ = 14.6, 95% CI: 1.69 to 27.58; *p*=.027). Only one trial reported a sustained increase at six months follow-up for minutes per week of vigorous-intensity PA (Gaskin et al., 2017). Two trials reported no intervention effects on PA level (Carmack Taylor et al., 2006; Kim et al., 2018b). Details are provided in Table 2.3.

2.4.4.3 Patient-centered (secondary) outcomes

Two trials evaluated changes in aerobic fitness using a 6-minute walk test and reported no statistically significant intervention effects at the end of the interventions (Carmack Taylor et al., 2006; Culos-Reed et al., 2010) or follow-up (Carmack Taylor et al., 2006). One trial evaluating changes in cancer-related fatigue reported lowered fatigue levels for the intervention group following an intervention that lasted 16 weeks (Culos-Reed et al., 2010). For studies reporting findings on QoL, participants did not experience any statistically significant effect on QoL (Carmack Taylor et al., 2006; Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018; Galvão, Newton, et al., 2018; Kim et al., 2018b) (Table 2.3).

2.4.5 Qualitative findings

Reports on men's experiences and/or perceptions of PEIs were provided by two mixed methods studies (Fox et al., 2017, 2020) and as parts of two trials (Carmack Taylor et al., 2006; Livingston et al., 2015). Table 2.4 provides information on the suitability of the qualitative reports from the mixed methods studies (Fox et al., 2017, 2020) for this review. From the four studies, men's experiences and/or perceptions were decomposed, coded into eleven categories, and merged to synthesise major contextual factors that determine PA behaviour— referral process, behaviour shaping, credible influence, social value, and hybrid service delivery (Tables 2.5 and 2.6).

Table 2.4: Appraisal of qualitative reports using 32-item checklist - Consolidated criteria for reporting qualitative studies (COREQ)

No. Item	Comment	
	(Fox et al., 2020)	(Fox et al., 2017)
Domain 1: Research team and reflexivity		
Personal Characteristics		
1. Interviewer/facilitator	—	—
2. Credentials	Clinician-scientists	Clinician-scientists
3. Occupation	—	—
4. Gender	—	—
5. Experience and training	—	Trained physiotherapists
Relationship with participants		
6. Relationship established	Participants were 148 men (n = 79 control; n = 69 intervention) who had received radical prostatectomy	Participants had been referred for a structured exercise program by their physician and then subsequently consented to a telephone survey
7. Participant knowledge of the interviewer	—	—
8. Interviewer characteristics	Emily Curtis holds shares in The Exercise Clinic, Ltd., which provides exercise programs to men diagnosed with prostate cancer.	—
Domain 2: study design		
Theoretical framework		
9. Methodological orientation and Theory	Grounded theory	An affinity diagram
Participant selection		
10. Sampling	Purpose	Purposive
11. Method of approach	Semi-structured interview	Telephone survey
12. Sample size	14	41
13. Non-participation	14 were interviewed (one did not attend his appointment)	41 men were successfully contacted. None declined to take part in the survey.
Setting		
14. Setting of data collection	Research office within the Hospital	Telephone
15. Presence of nonparticipants	—	—
16. Description of sample	men (n = 79 control; n = 69 intervention) who had received radical prostatectomy (i.e., curative therapy) for localised prostate cancer	—
Data collection		

17. Interview guide	The interviews followed a topic guide developed by two authors (LF and TW)	Predetermined multiple-choice questions, open-ended questions
18. Repeat interviews	NA	—
19. Audio/visual recording	Interviews were audio-recorded and transcribed	The conversations that took place during the telephone survey were written down by the researcher whilst conducting the interview
20. Field notes	—	Participants responded to predetermined multiple-choice questions, and notes were taken by the interviewing researcher that summarised any extra points made by each participant in the ensuing informal conversation
21. Duration	lasted approximately40 min	—
22. Data saturation	—	—
23. Transcripts returned	—	The information collected was thus not recorded and transcribed
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	—	The notes produced by the researchers were analysed using an affinity diagram by another researcher (LF), and these themes were assessed and validated by a third researcher
25. Description of the coding tree	—	affinity diagram
26. Derivation of themes	Derived from data	Source data were divided into discrete units. Units that are logically related are then grouped, establishing any consistent themes
27. Software	Data were analysed using ANCOVA models and Tests	—
28. Participant checking	—	Informal feedback from open-ended surveys with the PCa
Reporting		
29. Quotations presented	Yes	Yes
30. Data and findings consistent	Yes	Yes
31. Clarity of major themes	Yes	Yes
32. Clarity of minor themes	Yes	Yes

Key: *PCa = prostate cancer*

Table 2.5: Patients' experiences with PEIs

Category description	Category label
Average ratings showed that the participants were satisfied with the content of the programs (Carmack Taylor et al., 2006). Participants were satisfied with the format of the group classes; average ratings indicated that the program content was 'more than expected' and the duration and session lengths were 'just right' (Carmack Taylor et al., 2006). For some participants, the positively framed messages were enough motivation for signing up for the exercise (Fox et al., 2020).	Positive message framing
80% of the participants reported that the clinician's referral to take part in the 12-week program influenced their decision to participate (Livingston et al., 2015)	Exercise recommendation
In the context of the physical and mental complications that can accompany PCa, patients valued the guidance from the clinicians (e.g., physiotherapists) and the style of engagements and further remarked such as a major source of exercise confidence, "a primary reason that the exercise classes were received so positively on the whole" (Fox et al., 2017). Structured classes and physiotherapists' guidance provided participants with a push that moved them to make changes in their PA behaviours (Fox et al., 2017)	Exercise guidance
The structured timetabled appointments and tailored nature of the exercise classes provided enabling social environment (i.e., social support and friendly intergroup competition) that acted as a strong motivating force, "a massive boost," to their engagement with exercise (Fox et al., 2017). 90.2% of the patients noted that they would have been less likely to exercise if they had only received an advice leaflet on exercise but were not offered exercise classes within the hospital (Fox et al., 2017). Even some of the participants who were already previously engaging in physical exercise still found the classes to be a valuable component of their care, for example, as a way to facilitate re-engagement with physical exercise following radical surgery (Fox et al., 2017)	Individualised and structured exercise classes
Participants were enthused by the social value the group sessions offered them, painting a picture of a friendly and good-humoured environment that allowed them to interact and share thoughts with individuals that are going through similar experiences (Fox et al., 2017)	Social environment and peer support
75.6% of the participants noted that they would not have been more likely to exercise If their doctors had recommended exercise to them to improve treatment outcomes but were not offered exercise classes within the hospital (Fox et al., 2017). 95.2% of the participants reported that they would take part in the program if offered hospital-based exercise classes again (Fox et al., 2017)	Hospital-based 'in centre' delivery
More than inviting only the clinicians for presentations, participants valued "someone with a real-life story" to speak to them. Participants could relate to such a speaker as "a credible source" and felt more reassured of the future from their [patient speakers] experiences (Fox et al., 2020)	Reassurance about the future from someone with experience
Many patients acknowledged that the care pathway should include opportunities to interact and relate with patients that have been through similar experience, noting further that the clinical staff are not necessarily in the best place to provide such support (Fox et al., 2020)	A sense of social solidarity
Most participants could draw a direct causal link between their interactions and relationship with the patient speaker and their change in attitude and PA behaviour (Fox et al., 2020)	Attitudinal change
For many patients, relating to the patient speaker in solidarity led to a new exposure, "a lightbulb moment," and this inspired a renewed resolve to engage in PA (Fox et al., 2020)	Social comparison and attitudinal renewal
Some of the participants said that they would prefer to exercise independently, and many of these participants gave substantive reasons that relate to individual personality traits or lifestyle, for instance, having the ability to motivate oneself or integrating exercise into their recreational activities (Fox et al., 2017)	Individual preferences

Table 2.6: Grouping categories to synthesise analytical themes

Categories	Drivers
Exercise recommendation, clinician referral	Referral process
Exercise guidance, structured exercise classes, individualised training, positive message framing	Knowledge shaping
Reassurance about the future from someone with experience, a sense of solidarity, motivation, social comparison, and attitudinal renewal/change	Credible influence
Social environment, peer support, hospital setting	Social value
hospital-based, individual preferences	Hybrid service delivery

2.4.5.1 Referral process

Establishing and streamlining exercise referral pathways can invoke the right inspiration among clinicians to participate in exercise referrals, a critical lever for initiating behaviour change. In one study (Livingston et al., 2015), 80% of the participants reported that receiving exercise referrals from their doctors— e.g., a standard referral slip that contained the program details and indicated that they had been automatically assigned to take part in an exercise program as part of their care— influenced their decision to participate. In the report by Fox et al. (Fox et al., 2017), some men noted that they were very likely to exercise upon their doctors' recommendation, even without being offered exercise classes within the hospital.

2.4.5.2 Behaviour shaping

The structured and tailored nature of the programs was most likely to shape and improve exercise knowledge, skills, and confidence and motivate men to take active steps towards improving their exercise behaviour. Carmack Taylor et al. (Carmack Taylor et al., 2006) reported that participants were satisfied with the content and format of the program, with average ratings indicating that the program content was *"more than expected" (p 854, par 1).* In one study, some participants noted that the presentation, framed positively, was enough motivation for signing up for the program (Fox et al., 2020). Fox et al. (Fox et al., 2017) reported that men valued the guidance from the physiotherapists and how they engaged with patients, further acknowledging such as a major source of exercise confidence, *"a primary reason that the exercise classes were received so positively on the whole" (p 4, par 4).* Some participants who were already engaging in physical exercise still found the classes to be a valuable component of their care, for example, to facilitate re-engagement with physical exercise following radical surgery (Fox et al., 2017). In the same study, most participants noted that they would have been less likely to exercise if they had only received an advice leaflet or exercise recommendations from their doctors but were not offered exercise classes (Fox et al., 2017).

2.4.5.3 Credible influence

Presentations made by patient speakers, drawing thoughts and lessons from their history of treatment and positive PA experience, are likely to have a positive impact on men's PA behaviour. More than inviting only the clinicians for presentations, Fox et al. (Fox et al., 2020) reported that participants valued someone with a real-life story to speak to them. Participants could relate to such a speaker as a credible source and felt more reassured of the future (Fox et al., 2020). For many patients, relating to the patient speaker in solidarity led to a new exposure, 'a lightbulb moment', which inspired a change in attitude and a renewed resolve to engage in PA (Fox et al., 2020).

2.4.5.4 Social value

Fox et al. (Fox et al., 2017) reported that participants were enthused by the social value the group sessions offered them, painting a picture of a 'friendly and good-humoured environment' that allowed them to interact and share thoughts with individuals going through a similar experience.

2.4.5.5 Hybrid service delivery

Exercise services when delivered within the mainstream health care settings can increase access to timely and personalised exercise medicine for men receiving treatments for PCa. When complemented with home-based sessions, patients can improve their behaviours by integrating exercise into their daily routines (Fox et al., 2017).

2.4.6 Configuration of Findings

Figure 2.3 illustrates the organisation of the contextual factors or conditions using the context-mechanism-outcome configuration to show PEIs' effect drivers and plausible mechanisms. Referral process, credible influence, and hybrid service delivery appear more likely as the major effect drivers, with behaviour shaping and social value as critical intermediates —all interacting to create the desired outcomes, namely, exercise self-efficacy and improved PA behaviour.

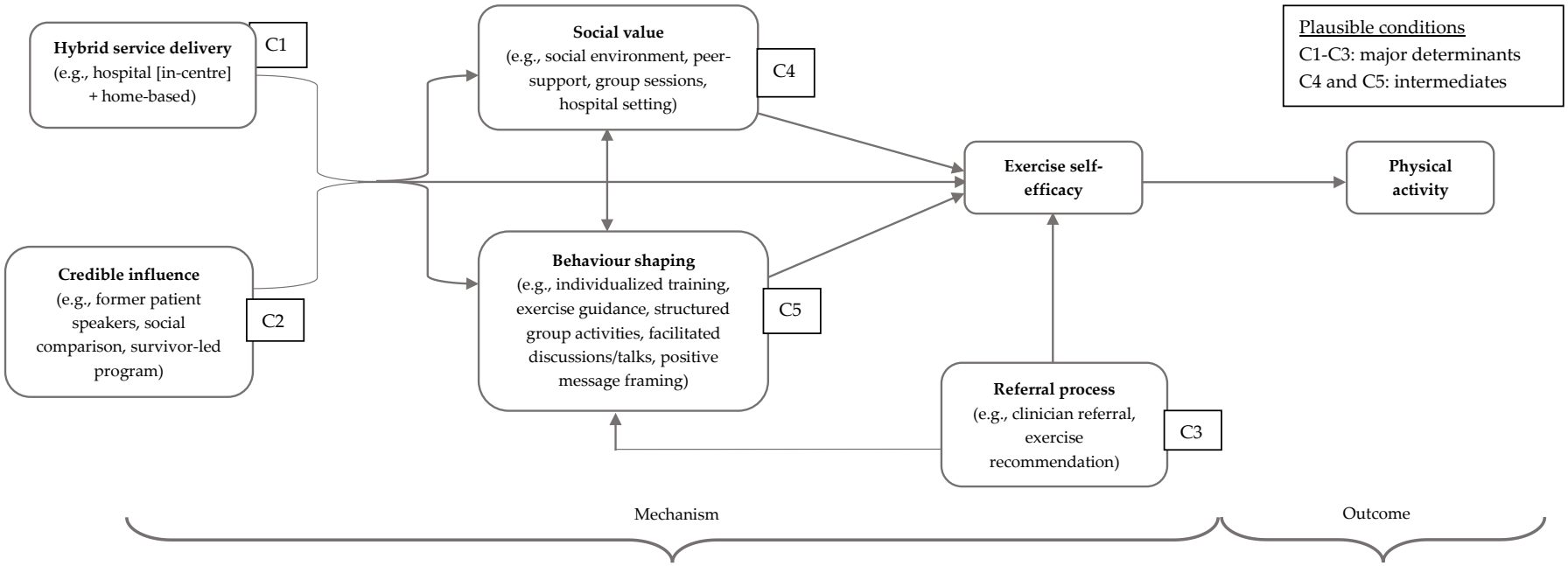

Fig. 2.3 *showing the organisation of PEIs driver and effect variables using context-mechanism-outcome configuration— arrows indicate direction of influence (i.e., the strength of each variable as an effect driver is weighed by the number of outgoing arrows)*

2.5 Discussion

This is the first review to consider PEI a potential vehicle for achieving behavioural changes relating to sustainable exercise uptake and maintenance in men with PCa. The strongest evidence emerges from composite PEIs inclusive of a multicomponent PA intervention (Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018). For example, the high-quality trial by Livingstone and colleagues (Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018), which delivered an intervention containing clinician referral, discussions, and individualised PA training, achieved significant changes in PA behaviour. In addition to demonstrating a sustained increase in exercise task self-efficacy, a significant increase in vigorous-intensity PA even at six months post-intervention, with more men (four times greater in the intervention group) meeting ≥ 150min/week of moderate-vigorous aerobic PA intensity were also reported (Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018). Comparing this trial to the other four trials (Carmack Taylor et al., 2006; Culos-Reed et al., 2010; Galvão, Newton, et al., 2018; Kim et al., 2018b), and drawing upon patients' experiences and perspectives (Fox et al., 2017, 2020) and the context-mechanism-outcome configuration (Figure 2), plausible causal mechanisms are likely driven by (1) a streamlined referral process, (2) credible influence (by integrating former patients as service facilitators and champions), (3) social value, (4) behaviour shaping, and (5) hybrid service delivery. Although implementing these conditions may be resource-intensive, planning a service pathway must consider all influential variables for achieving behaviour change.

PCa survivors may receive adequate knowledge and skill sets from clinicians or exercise specialists. Still, this review has shown that integrating former patients into the service programs as educators, champions, or leaders can be a strong condition for optimising PEIs. More than inviting only the clinicians to provide PCa or PA-related talks, men are likely to be motivated when they interact with and are led by someone that shares a similar experience. Survivors' narratives indicate that men relate to these individuals as a credible influence. The integration of a former patient in the service pathway may not only reassure patients of their safety during training — and this is particularly crucial for men in fear of musculoskeletal injury or aggravation of treatment-related side effects — but also invoke a renewed resolve to engage in PA. From the qualitative synthesis, men could draw a direct causal link between their interactions and relationship with a former patient and their change in attitude and behaviour toward PA. None of the trials in this review included talks or exercise guidance from a non-clinician previously treated for PCa. Regardless, drawing upon the qualitative analysis and the context-mechanism-outcome configuration, integrating a former patient in PEIs may yield the greatest effects in the causal pathway.

This does not preclude developing an action plan inclusive of a well-established and streamlined exercise referral pathway. In this review, one trial that included a referral pathway found a sustained increase in minutes/week of vigorous-intensity PA, even at six months follow-up, mediated by a significant rise in task self-efficacy (Livingston et al., 2015;

Gaskin et al., 2017; Craike et al., 2018). One important determinant of task self-efficacy is verbal persuasion (Bandura, 1977); this is likely influential in their trial through physician-patient engagement during the referral and follow-up processes. Further, the optimisation of PEIs can be achieved by planning a delivery that will combine hospital- (in-centre) and home-based sessions. From patients' experiences, integrating group sessions in the health service settings promotes social value by creating an environment that allows patients to interact with each other and their clinicians. Through sharing lessons, thoughts, and experiences, men are likely to receive verbal persuasion, which is critical for building self-efficacy and behavioural control. Combined with home-based sessions, patients may be supported to improve their behaviours through integrating exercise into their daily routine, thus, further consolidating the gains of supervised group-based exercise programs. In this review, two trials offered a combination of group- and home-based sessions (Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018). These trials demonstrated beneficial intervention effects on PA levels compared to the other trials that offered either a group (Carmack Taylor et al., 2006) or a home-based session (Kim et al., 2018b).

Similarly, exercise self-efficacy and a sustained increase in PA can be enhanced through vicarious experience and performance accomplishments (Bandura, 1977). Behaviour shaping —supported by individualised training, exercise guidance, structured group activities, and positive message framing— can facilitate vicarious experience and performance accomplishments, enabling patients to build exercise self-efficacy through avenues that foster 'peer learning,' verbal persuasion, constructive feedback, and successful performances (Bandura, 1977). Compared to other trials that offered either facilitated discussions and presentations (Carmack Taylor et al., 2006) or individualised home-based training (Kim et al., 2018b), two trials provided structured classes and individualised training in addition to exercise guidance, both recording significant between-groups differences in exercise self-efficacy and/or PA level (Culos-Reed et al., 2010; Livingston et al., 2015; Gaskin et al., 2017; Craike et al., 2018).

No changes were observed for patient-centred outcomes in the included trials. First, most of the trials not only evaluated these outcomes as secondary outcomes but also observed high baseline scores. This may have impacted the powers of these trials, thereby hindering them from detecting any meaningful small-to-moderate effect size changes. Again, realizing the benefits of PEIs may require a high level of participation and engagement [22], the lack of an active exercise component in some of the trials may have resulted in sub-optimal interventions with limited potential of invoking positive physiological and psychosocial changes to improve overall QoL (Carmack Taylor et al., 2006; Galvão, Newton, et al., 2018; Kim et al., 2018b). To improve patient-centred outcomes, recent international guidelines have recommended that interventions incorporate a multicomponent PA emphasizing strength training and functional balance at a moderate-vigorous intensity, ≥ 3 days per week [6]. As previous reviews have demonstrated evidence of the effects of physical exercises in cancer patients, including men with PCa (Stout et al., 2017), this review supports further

investigations using adequately powered and well-optimised trials, inclusive of behaviour change outcomes.

2.6 Limitation

The lack of adequate primary studies and marked variability in the intervention components and outcome measures precluded this review from pursuing overall intervention effects using the random-effects model of meta-analysis. Nonetheless, by adopting the sequential explanatory approach to evidence synthesis and the context-mechanism-outcome configuration to organize PEI driver and effect variables, this review provides key considerations for future research and service development.

2.7 Conclusion

The overall evidence from this review, albeit from a limited number of studies, demonstrates the potential for increasing PA in men with PCa using PEIs. Likely critical conditions that underpin potential causal mechanisms may include the referral process, credible influence, social value, behaviour shaping, and hybrid service delivery. To optimise the benefits of PEIs, the inclusion of (1) a well-defined, streamlined exercise referral pathway and (2) former patients as exercise service facilitators/champions should be prioritized in future interventions, while offering access to interventions within hospital settings, with home-based sessions in addition.

2.8 Summary of Chapter

This chapter has provided a comprehensive synthesis of the literature, presenting evidence on the plausible conditions, contextual factors and mechanisms for increasing daily or weekly exercise using PEIs, thus offering critical insight for establishing relevant attributes and their levels for the discrete choice experiment. This chapter demonstrated, among other things, the critical role of delivering exercise programs in clinical settings to promote exercise behaviour among PCa survivors. However, it further raised a vital question on the feasibility of implementing exercise programs in cancer-treating facilities. Examining the feasibility of implementing exercise promoting and rehabilitation services in clinical settings is critical if treatment facilities must be designated an attribute level when considering delivery setting as an attribute in the discrete choice experiment. Chapter 3 presents the second study of this project to address this question.

Chapter 3— Mapping Exercise Units Integration in Clinical Oncology Settings
A Scoping Review

3.1 Abstract

Clarifying uncertainties surrounding the feasibility of embedding exercise service units in clinical oncology settings is imperative to the overarching purpose of this thesis. The first study in this research, the mixed studies synthesis with segregated design (see Chapter 2), demonstrated the potential benefits of delivering exercise-promoting and rehabilitation services in treatment facilities for PCa, thus suggesting the designation of treatment facilities as a potential attribute level when considering delivery setting as an attribute in the design experiment. Given this, an important step is to examine the feasibility of implementing such services in hospital settings, for example. This chapter provides findings from a scoping review to clarify these issues.

In total, 4863 unique records identified in Embase, CINAHL, MEDLINE, Web of Science Core Collection, and ProQuest (Health and Medicine) were screened for studies that recruited cancer patients, assessed the co-location of exercise service and cancer treatment units, and reported findings on service implementation. While this thesis focuses on exercise participation in men with PCa, this scoping review was extended to other cancer sites to increase the pool of studies available for inclusion. Evidence from six studies providing data from over 30 programs and services was integrated using narrative synthesis.

Service implementation was relatively modest across the included studies. Exercise services were delivered by physiotherapists, exercise physiologists, and kinesiologists and funded mainly through grants and private donations, with staff salaries accruing as the major expense. Service penetration, adoption, and acceptability were generally low. Nonetheless, studies recorded high clinician/patient satisfaction. Major barriers to service integration were limited funding, lack of a detailed implementation plan, and low organisational buy-in. Common reasons for non-utilization, missed sessions, and dropouts were lack of interest, unwellness, hospital readmission, disease progression, and adverse skeletal events.

Implementing exercise services in clinical oncology settings seems effective for increasing access to exercise promotion and rehabilitation for individuals on cancer treatment. While this model appears feasible for patients/clinicians, efforts are required to optimise service integration both in the short and long term. Key priorities include seeking [local] actions to address issues relating to funding and organisational buy-in. Important considerations may include developing an implementation plan to guide the implementation process, expanding the patient core management team to include staff from the exercise rehabilitation unit, and exploring the role of patient feedback in increasing clinician participation (e.g., treating

oncologists and nurses) in the referral process. Future research should consider effective strategies to promote patients' sense of self-efficacy and behavioural control and, further, the place of audit and feedback in improving exercise service delivery and overall service implementation. This study has been published in BMC Health Services Research and can be accessed using the link: https://doi.org/10.1186/s12913-022-07598-y

3.2 Background

Calls to make exercise-based rehabilitation an integral component of routine oncology care are gaining more traction globally as the World Health Organization moves to increase *global access to high-quality rehabilitation as an essential healthcare service* for individuals with chronic disease (Stout, Santa Mina, et al., 2021). Many stakeholders are increasingly acknowledging the foremost implication of this 'call to action' to include embedding exercise services in cancer treatment settings (Schmitz, Campbell, Stuiver, Pinto, Schwartz, Morris, Ligibel, Cheville, Galvão, Alfano, Patel, Hue, Gerber, Sallis, Gusani, Stout, Chan, Flowers, Doyle, Helmrich, Bain, Sokolof, Winters-Stone, et al., 2019). Oncology care models that foster integrative exercise-cancer care units may provide a more pragmatic approach to delivering access to timely, flexible, and high-quality exercise-based rehabilitation to cancer patients. When patients are offered early access to individualised and supervised exercise programs, they become better positioned to develop the physical, mental and psychosocial capabilities to confront the challenges associated with cancer treatment even before they set in.

Providing access to exercise-based rehabilitation within a cancer care setting is likely to encourage integrated and multidisciplinary oversight, creating opportunities for routine joint patient evaluation and shared decision-making. A key benefit of this approach is that oncology clinicians, including doctors, nurses, and exercise specialists, can recognize any potential risks/threats and intervene holistically and timeously. This approach is likely to increase patients' confidence and satisfaction in their care. As exercise adoption and maintenance are particularly challenging in posttreatment populations, an integrated exercise-oncology care model may be the greatest leverage available to healthcare providers to intervene most critically within the window of time when patients are more amenable to behaviour change (Rabin, 2009).

Embedding an exercise service unit in a typical cancer treatment setting may present some challenges to patients, clinicians, and the health service system. First, the actual process of installing an exercise unit within existing treatment settings may require slight to huge (infra)structural (re)adjustments. The likely potential for disruption to workflow could come at a risk to patients as they may be unable to access routine care more efficiently during such time. Second, many health systems are currently grappling with underfunding globally. Hence even where integrative exercise-oncology models are less resource-intensive, health services may find it challenging to hire exercise specialists with the right credentials and experience for handling the peculiar exercise needs and challenges of cancer patients. Another

critical factor is the capacity for patient screening, triage, and referral. As this is a relatively new frontier, the present clinical oncology workforce may lack the clarity, culture, and will to assess, advise, and rightly refer patients to exercise programs (Schmitz, Campbell, Stuiver, Pinto, Schwartz, Morris, Ligibel, Cheville, Galvão, Alfano, Patel, Hue, Gerber, Sallis, Gusani, Stout, Chan, Flowers, Doyle, Helmrich, Bain, Sokolof, Winters-Stone, et al., 2019). Many facilities further lack robust guideline-concordant care with well-defined and streamlined patient screening/evaluation algorithms and referral pathways (NL et al., 2020).

Together, these concerns raise a question about the feasibility, including the cost implications and sustainability of implementing an exercise service unit in a standard oncology clinical setting.

3.3 Methods

3.3.1 Review objective

This study provides a comprehensive summary of peer-reviewed literature on the feasibility of implementing an exercise service unit within a cancer treatment setting. To achieve this, a scoping review of the literature was conducted using the modified framework of Levac and colleagues (Levac, Colquhoun & O'Brien, 2010). The review did not warrant consent to participate, or institutional ethics approval as only publicly available peer-reviewed literature was utilised, with no primary data collection (Levac, Colquhoun & O'Brien, 2010). However, findings were reported following the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines (AC et al., 2018).

3.3.2 Study eligibility

This review included studies that evaluated the implementation of exercise service units within cancer care settings. To be eligible, service units were to have a well-defined structure and be located in a clinical setting (e.g., inpatient or outpatient services, public and private practice). Essentially, studies must report data for one of the following implementation outcomes: acceptability, adoption, appropriateness, practicality (including cost), feasibility, fidelity, penetration, sustainability, and quality assessment. Thus, studies including trials evaluating exercise benefits in the cancer population were excluded. This review also included studies providing stakeholder perspectives on the co-location of exercise services and cancer care units. No restrictions were placed on the study design or publication date. Non-primary research, including reviews, commentaries, and viewpoint articles, including non-English studies were also excluded.

3.3.3 Information sources and search

A comprehensive literature search was conducted in Embase via Ovid, CINAHL via EBSCOhost, MEDLINE via Ovid, Web of Science Core Collection via Clarivate Analytics, and ProQuest (Health and Medicine). In developing the search strategy, relevant search terms and medical subject headings (MeSH) were identified by exploring the National Library of

Medicine Database (Bramer et al., 2018) and, further, by reviewing a recent review of exercise intervention for cancer survivors (Czosnek et al., 2021). Specific keywords and MeSH terms applied in the search include (but are not limited to) cancer, neoplasm, exercise, feasibility, etc., and implementation outcomes such as acceptability, adoption, appropriateness, and practicality (See Appendix 3.1). Additionally, recent systematic and meta-analytic reviews of cancer exercise literature were scanned for relevant citations.

3.3.4 Article screening and selection

Identified records were exported to RefWorks software for de-duplication and then Microsoft Excel Spreadsheet for screening. The titles and abstracts of all retrieved citations were screened and, further, followed by the full texts of the remaining articles using the review's eligibility criteria. Challenges encountered during screening were resolved by the supervisory team.

3.3.5 Data extraction and analysis

A data extraction form was developed and tested to guide the data extraction. First, a variety of constructs as considered in the Implementation Outcome Framework of Proctor and Colleagues (Proctor et al., 2010), Bowen's framework (Bowen et al., 2009), and the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework of Glasgow and colleagues (Glasgow et al., 2019) were identified. Next, the list was reviewed and streamlined to generate priority outcomes, drawing on recent evidence and the experience of the supervisory team in implementation research (Table 3.1). Data on study characteristics, cancer care setting, nature/components of exercise services, and implementation outcomes were extracted. This review focused on the following key implementation outcomes: implementation, cost, reach/penetration, service uptake/adoption, acceptability, patient satisfaction, fidelity, and sustainability. Quantitative and qualitative results were extracted, analysed, and integrated to produce the final synthesis.

Table 3.1: Operationalisation of implementation outcomes

Outcomes	Definition	Measurement metrics
Reach/Penetration	The absolute representativeness of individuals, including healthcare providers and patients, and organisations who are willing to utilize exercise services integrated as part of cancer care	• Total number of referrals to exercise service relative to the total eligible patient population
Service uptake/adoption	Service utilisation by an organisation as evidenced by reports on the total number of staff referring patients to exercise services	• Number of patient referrers
Acceptability	The extent to which exercise services are deemed suitable, satisfactory, and attractive to the patients or the healthcare providers	• Number of accepted referrals • Service compliance (including attrition) • Adverse events
Patient Satisfaction	The extent to which exercise services are deemed satisfactory by the patients	• Documented reports on patient satisfaction
Practicality	The extent to which service implementation can occur using existing means, resources, and infrastructure	• Service promotion • Referral mechanism/pathway • Waiting time • Session duration
Implementation	The extent to which the services can be delivered to the intended population successfully	• Funding • Workforce • Equipment
Cost	The cost implications of service implementation	• Salaries • Purchase cost • Delivery cost
Fidelity	The degree of service providers' compliance with existing pre-implementation plan and recommendation guidelines	• Documented efforts including strategies to ensure fidelity including consistency of service delivery
Sustainability	The extent to which exercise services become institutionalised as a standard in routine cancer care	• [infra]structural adjustments • Increased workforce • Increased funding

3.4 Results

3.4.1 Study Description

Six studies providing data from over 30 exercise services and programs were included in this review (AM et al., 2017, 2021b; Dalzell et al., 2017; Dennett et al., 2021; Kennedy et al., 2020; Newton et al., 2020). Details of the screening and selection process are provided in Figure 3.1. One of the studies was conducted in Canada (Dalzell et al., 2017) and the rest were carried out in Australia (AM et al., 2017, 2021b; Dennett et al., 2021; Kennedy et al., 2020; Newton et al., 2020). Included studies were largely prospective, involving varying cancer types and patient demographics except for Dennett et al., (Dennett et al., 2021)— a qualitative report on clinicians' perspectives. Patients were generally above 50 years and on active treatment with either chemotherapy, radiation therapy, or immunotherapy. Of the included oncology services, two were publicly funded hospitals (AM et al., 2021b; Dalzell et al., 2017), one was privately funded (Kennedy et al., 2020; Newton et al., 2020), and another involved both public and private hospitals/cancer centres (AM et al., 2017). Exercise services were individualised and group-based and largely featured a combination of aerobic and resistance exercise (AM

et al., 2017, 2021b; Dalzell et al., 2017; Kennedy et al., 2020; Newton et al., 2020). More details on the included studies are provided in Table 3.2.

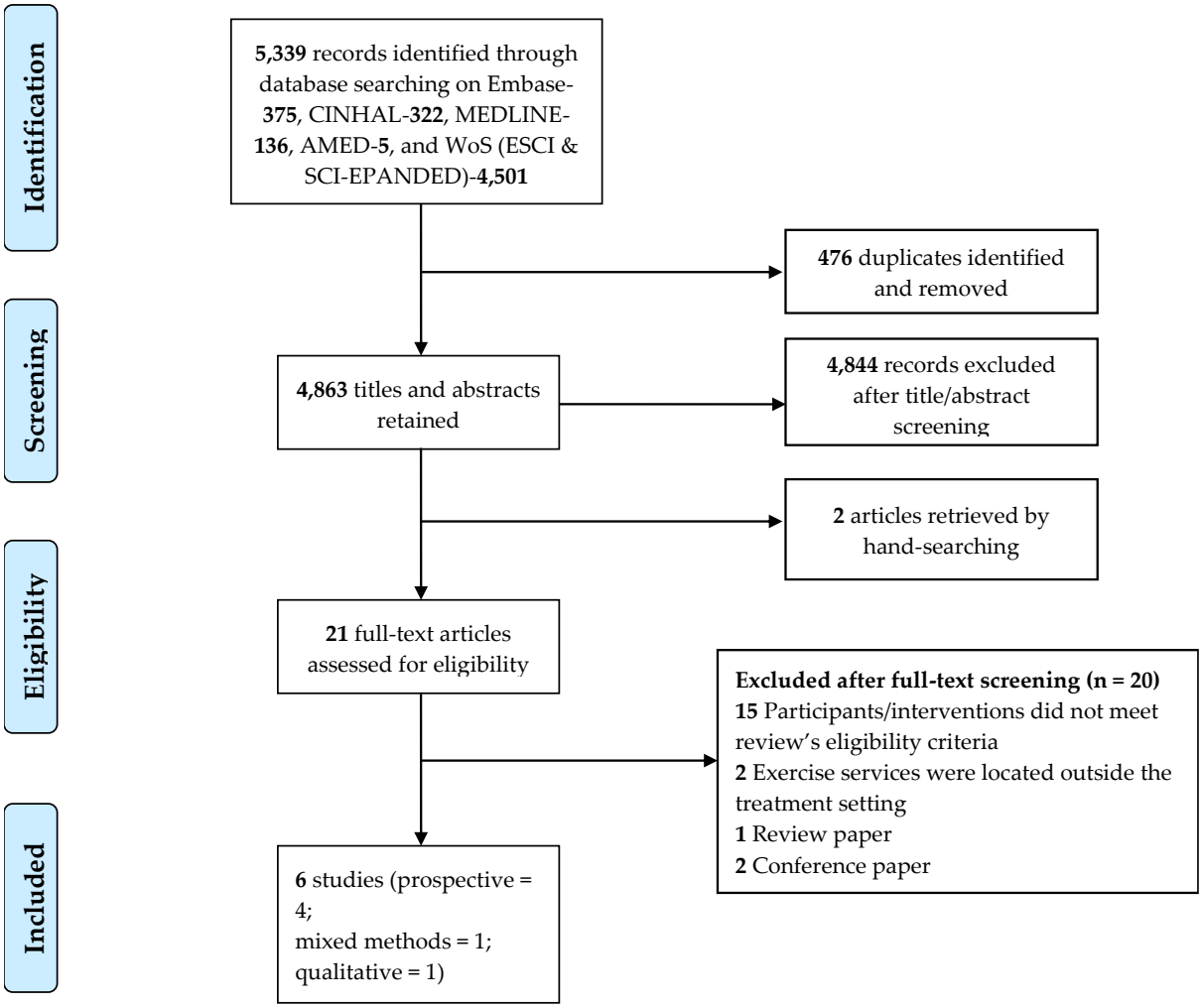

Figure 3.1: *PRISMA flow diagram detailing study screening and selection*

Table 3.2: Description of included studies

Author Country	Study	Population	Healthcare setting	Exercise service	Service description	Implementation outcomes
Dennett 2021 (27); Dennett 2021 (28) Australia	**Design:** Prospective pre-post design Qualitative exploration **Evaluation:** 6 months	Adult cancer survivors (n = 64) currently receiving or preparing for cancer treatment (curative or palliative) admitted as an inpatient or outpatient Age: 63 ± 11yrs Gender: Male: n = 41; 56%; Female: n = 32, 44%	Cancer unit — inpatient oncology ward + outpatient day oncology centre offering chemotherapy — embedded in a publicly funded tertiary hospital	Exercise-based rehabilitation within a hospital-based cancer treatment centre	Individually tailored, physiotherapist-led group-based circuit exercise class **Frequency**: 1-2x/wk **Duration:** 8 weeks	All
Kennedy 2020 (29); Newton 2020 (30) Australia	**Design:** Retrospective evaluation **Evaluation:** 50 months	Individuals (n = 73) receiving radiation therapy and/or chemotherapy **Median age:** 58.5; IQR: 48-67) **Gender:** Female: n = 43, 67.2%; male: n = 21, 32.8% **Cancer type:** Breast: n = 39, 60.9%; Prostate: n = 13, 20.3%; Colorectal: n = 3, 4.7%; Lung: n = 3, 4.7%; Other: n = 6, 9.4% **Secondary cancer report:** n = 3, 4.8% **Treatment type:** Radiation: n = 55, 85.9%; Chemo: n = 4, 6.3%); Radio + chemo: n = 5, 7.8%	Private oncology care clinic (GenesisCare) providing primarily outpatient-based radiation therapy and medical oncology treatments	Exercise service Clinic (Co-LEC) established in 2013 by researchers from Edit Cowan University, in partnership with GenesisCare	Patient-tailored (progressive)/group-based resistance (2-3 sets; 6-12 reps) + aerobic exercise (20mins; 60%-80% estimated HRmax) delivered by an AEP **Frequency:** 60mins/session; 2-3x/wk **Duration:** Throughout the treatment course (Average: 13wks)	All
Dalzell 2017 (31) Canada	**Design:** Prospective **Evaluation:** 60 months	234 new and follow-up cancer patients e.g., sample demographics for sample 2 months evaluation (multiple cancer types;)	Integrated oncology and palliative care centre within a publicly funded general hospital	Multimodal rehabilitation care model with hospital-based exercise oncology referral component	Individualised plus group-based multicomponent exercise with patient education, exercise counselling, and self-management	All but sustainability and cost

		Mean Age: 52 ± 15.5yrs Female: 65% Patients on active treatment: 52% Patients with advanced disease or metastatic cancer: 35.5% Bone metastasis: 16% Bone metastasis: 16%		(ActivOnco) embedded in a cancer centre		
Dennett 2017 (32) Australia	Design: Ex post facto design using a mixed methods approach Evaluation: 2 wks	Patients with different cancer diagnoses, disease stages, and treatment status	Public and private hospitals/cancer centres across 6 states/territories	31 eligible programs identified from 56 public settings and 9 private settings	Individualised exercise program (Block = 14 programs; rolling = 17 programs) comprising mainly a combination of aerobic, resistance, and flexibility exercise 6-10 patients/session **Frequency/duration:** Outpatient: 2x/wk for 8wks; inpatient: 2x/day for the duration of inpatient stay (~ 2 wks)	All but sustainability and cost

Note: AEP Accredited exercise physiologist, wk week

3.4.2 Summary of implementation

3.4.2.1 Service implementation

Exercise services were largely operated independently of the housing treatment settings; program staff members were also generally not part of the patient core management team (AM et al., 2017, 2021b; Dalzell et al., 2017; Kennedy et al., 2020). More details are in Table 3.2. Exercise services were delivered by physiotherapists (AM et al., 2017, 2021b; Dalzell et al., 2017), exercise physiologists (AM et al., 2017; Kennedy et al., 2020), and kinesiologists (Dalzell et al., 2017) experienced in oncology settings. One study reported a clinician-to-patient ratio of 1:4 (AM et al., 2021b). Access to exercise services varied across the included studies. In one study, exercise sessions were available every Monday to Thursday, also participants had access to a one-hour gym session once or twice a week (AM et al., 2021b). In another study, participants had access to three exercise sessions per week, with each session lasting two hours (Kennedy et al., 2020). In Dennett et al., (AM et al., 2017) outpatients accessed programs twice a week for eight weeks while inpatients attended up to two sessions per day for the entire duration of their hospital stay. Early morning sessions and lack of coordination between treatment and gym times were reported as key barriers to program access (AM et al., 2017; Kennedy et al., 2020). A structured patient referral mechanism was generally lacking except for one study that showed evidence of well-designed patient triage and referral pathways (Dalzell et al., 2017). Referrals were largely verbal, from the oncologist and other healthcare providers directly to the exercise programs (AM et al., 2017, 2021b; Kennedy et al., 2020). Self-referrals were also reported in all the included studies (AM et al., 2017, 2021b; Dalzell et al., 2017; Kennedy et al., 2020). One study reported using an email system to create a central access point for clinicians (AM et al., 2021b). Exercise programs were promoted differently across the included studies. Strategies such as flyers (AM et al., 2017, 2021b), posters (AM et al., 2021b), newsletters (AM et al., 2021b), letters to general practitioners (AM et al., 2017), community awareness (AM et al., 2017), and in-hospital presentations (Dalzell et al., 2017) were adopted to promote the programs within and outside the health facilities. At program completion, patients were largely recommended home-based exercise programs (AM et al., 2017, 2021b; Dalzell et al., 2017), a hospital-based multidisciplinary rehabilitation program (AM et al., 2021b) or community-based rehabilitation programs (AM et al., 2017, 2021b; Dalzell et al., 2017).

Table 3.3: Summary of implementation outcomes

	Dennett 2021 (27); 2021 (28)	Kennedy 2020 (29); Newton 2020 (30)	Dalzell 2017 (31)	Dennett 2017 (32)
Implementation	**Workforce** **Employed clinical staff**: 1 Senior physiotherapist (20hr/wk) 1 Mid-level physiotherapist (19.5hr/wk) **Support staff:** 1 senior research physiotherapist **Service operation** **Resources:** physiotherapy gym with existing equipment **Average wait time to the first appointment:** 20 days (range 0–99) **Average time taken for first appointment:** 51 min (SD 7) **Service access:** 4d/wk (Mon-Thur) **Attendance option**: 1x or 2x/wk (Ihr/session) **Clinician-to-patient ration (per group class):** 1:4 **Service promotion:** Within and outside health facility **(e.g.,** flyer, poster, newsletter) with the aid of the organization's communications officer **Referral mechanism:** Direct verbal referral (i.e., in-person, telephone); use of centralized email address (i.e., by including patient name/contact details); self-referral Clinicians were encouraged to have a brief conversation on exercise with patients before referrals. **Transition plan:** Patients were referred to community-based rehab, existing sub-acute multidisciplinary Cancer rehab, home-based rehab, and occupational therapy	**Workforce:** 4 AEPs including consultants (AEPs were separate from the patient core care team) **Service operation:** Independent of the cancer centre: patient triage and integrated medical record were lacking **Resources:** Provided by ECU **Service access:** 3 days/wk; 2hrs/session with lack of coordination between gym and treatment times **Service promotion:** Not reported **Referral mechanism** Pathway: direct verbal referrals from clinicians; self-referral Referrals were made only when oncologists remembered and had the time	**Workforce:** 5 physiotherapists (I clinical director and 4 staff physiotherapists) + 3 kinesiologists with training and experience in oncology **Service operation:** Independent of the cancer centre **Resources:** Provided by Hope and Care **Service promotion:** Presentations on the values of exercise interventions to various departments **Referral mechanism:** well-defined patient triage and referral pathways Sources include oncologists, allied health workers, and self-referral; other sources included wellness centres **Transition plan:** Home-based exercise program, wellness centre	**Workforce:** Physiotherapy: 21/31 programs; Exercise Physiology: 20/31 programs **Service promotion:** Exercise fliers, letters to GPs, community awareness programs **Service structure:** outpatient programs: 2x/wk for 8 wks; inpatient programs: 2x/day for the duration of inpatient stay (approximately 2 weeks) Early morning sessions were less practical and received the lowest patient attendance Developing flexible and rolling program is critical to enhancing practicality **Referral mechanism** Patient feedback to their primary doctors was a key driver of more referrals from doctors **Transition plan:** Home-based exercise program, community groups
Cost	**Funding:** External service improvement grant **Cost to patient:** no cost **Health service**	**Funding:** ECU research grant **Cost to patient:** no cost	**Funding: P**rivate donations	**Funding sources:** public = 14; private = 17

	Staffing, e.g., payment of salaries: AUD 160,916 **Consumables:** Mobile phone costs (AUD 180; $30 per month) Printing of assessment forms and home exercise programs (5 pages per patient x 73 patients @ 0.66 c /page) (AUD 2) **Total Cost:** AUD 161,098 **Cost to health service per patient:** AUD 1,104	Operational cost was covered through a research grant		
Reach/Penetration	~10% of patients treated in the cancer centre (i.e., 155 referrals including self-referrals)	12% (i.e., 237 out of 1963 patients that received cancer treatment over 50 months) Average annual reach = 10-14%	1635 patients over a 5-year evaluation period, with an average of 5.8 follow-up visits	31 eligible programs identified from 46 public hospitals/cancer centres and 39 private hospitals/centres across 6 out of 8 states/territories
Service uptake	46 staff made 148 referrals over the 6 months evaluation period: medical: n = 32, 22%; nurses: n = 53, 36%; allied health: n = 63, 43% **Facilitators of service utilization:** Service visibility, convenience, building rapport, accessibility, timing, and staff experience	Number of oncologists with at least 1 patient attending Co-LEC = 11/11 **Sources of referrals:** oncologists = 21%; nurses = 20%	Referrals were largely from oncologists (35%) and nurses (36%) (e.g., over a 2-month referral period)	Referral sources: oncologists (28/31 programs); allied health clinicians (21/31 programs) Poor knowledge among doctors on the role of exercise in cancer management was a major limiting factor
Acceptability	44% (52* out of eligible 119 patients) **Refused referrals**: n = 67, 43% [Reasons: not interested (n = 17), unsure (n = 16), unwell/treatment related (n = 3), work (n = 2), location/parking (n = 2), home-based exercise (21) other (n = 6)] **No. of refusals after 1st session:** n = 2 (reason: readmission = 1) **Compliance:** 38 patients elected for 2x/wk with 56% completing 7/16 sessions; 14 patients elected for 1x/wk with 40% completing 3/8 sessions **Missed sessions were due to:** Refusal (25%) Unwell due to treatment (23%) **Drop out:** n = 20; 38% (Reasons: COVID-19 restrictions; hospital readmission, disease progression)	27% (i.e., 64 out of 237 referrals over 50 months) Common reason for non-service utilization was lack of awareness of its availability	71% compliance (over 3 years) in a sample of 41 patients with multiple myeloma (81% had bone lesions) on active treatment **Dropouts**: Increased with the incidence of skeletal-related events, including pathologic fracture, spinal cord compression, and radiation for stabilisation of bone lesions	Overall, annual enrolment per program: 10-70 patients; 2000 survivors per year across Australia

Satisfaction	n = 57[#], 100%) Access (timing, facility, location): n = 46, 81% Willingness to recommend others to participate during treatment: n = 57, 100% Feeling of improved overall health/well-being: n = 56, 98% **Sources of dissatisfaction** Difficulties with access: n = 6, 8% Difficulties were largely due to lack of parking space	Social value: n = 11 out of 61 patients Improved treatment experience: 12 out of 61 patients Positivity: 24/61 patients Staff experience/professionalism: 17/61 patients **Sources of dissatisfaction** Lack of coordination between treatment and gym times: 33/51 patients Parking issues: 5/51 patients Lack of transition plan at the end of the program: 4/51 patients	—	Patient centred: programs addressed individual patient needs and goals Programs increased opportunities for social support **Sources of dissatisfaction** Program timing (attendance was lowest for early morning sessions) Parking issues Travel distances particularly for metropolitan centres
Fidelity	Exercise service was implemented by clinicians with 5.5 years of oncology-specific experience and prior cancer-specific training in acute and community cancer settings. A steering committee comprising a consumer, clinical directors, physiotherapy manager and a community partner ensured service implementation Program staff and other hospital physiotherapists received three 1hr education sessions on cancer and rehabilitation Medical, nursing, and allied health staff received 3 presentations to provide updates throughout program implementation	Service implementation was spearheaded by 3 AEPs with experience in exercise oncology	Continuous staff mentoring and education	—
Sustainability	Philanthropic funds were sought to pay staff salaries to sustain the program beyond the pilot period	**Funding:** Direct clinical operational cost was covered by ECU and GenesisCare to support service continuation at the end of the feasibility phase **Structural adjustments (mainly due to inadequate funds):** Operational hours reduced to 2hrs/wk (1hr/2days/wk) Eligibility was rescinded for patients	—	—

		receiving chemotherapy alone Service duration was reduced to 3 months for all patients regardless of treatment duration **Challenges** Communication gap between ECU and GenesisCare Financial model was lacking— Co-LEC was not generating revenue		

Note: AEP Accredited exercise physiologist, ECU Edith Cowan University, Co-LEC Co-located exercise clinic, wk week

3.4.2.2 Cost

Exercise programs were delivered at no cost to the patients; however, operational costs were largely covered using public funds, including grants (AM et al., 2021b; Kennedy et al., 2020) and private donations (Dalzell et al., 2017). Staff salaries accrued a greater part of the operational cost (AM et al., 2021b; Kennedy et al., 2020). In one study, the per-patient cost to the health service system within the evaluation period was AUD 1,104 (Kennedy et al., 2020).

3.4.2.3 Service reach

Program reach as reported in two studies was 10% (AM et al., 2021b) and 12% (Kennedy et al., 2020), with Kennedy et al. (Kennedy et al., 2020) reporting an annual reach of 10% to 14% over a 50-month evaluation period. In one study,(Dalzell et al., 2017) 1635 patients were evaluated over 5 years with an average of 5.8 follow-up visits. Another study identified only 31 programs from 85 public and private hospitals/cancer centres in 6 out of 8 states/territories in Australia (AM et al., 2017).

3.4.2.4 Service uptake

Data on patient referrals were generally lacking in the included studies. In one study, 46 staff made 148 referrals over a 6-month evaluation period (AM et al., 2021b). In another study, all the oncologists (n = 11) consulting in the cancer centre had at least one patient under their management attending an exercise clinic within the 50-month evaluation period (Kennedy et al., 2020). Referrals were largely from doctors, nurses, and allied health staff (AM et al., 2017, 2021a; Dalzell et al., 2017; Kennedy et al., 2020). Referrals from nurses were around 20% (Kennedy et al., 2020) and 36% (AM et al., 2021b; Dalzell et al., 2017) of the total referrals. Referrals from doctors were largely poor —i.e., 21-22% (AM et al., 2021b; Kennedy et al., 2020) and 35% (Dalzell et al., 2017). Factors that improved service uptake among clinicians were patient feedback, regular service promotion, enhanced visibility, convenience, building rapport, accessibility, timing, and staff experience (AM et al., 2017, 2021b; Dennett et al., 2021). Poor knowledge among doctors on the role of exercise in cancer management was reported as a major barrier to service uptake (AM et al., 2017).

3.4.2.5 Acceptability

Two studies reported 27% (AM et al., 2021b) and 44% (Kennedy et al., 2020) acceptance rates. One study reported 71% compliance in a sample of 41 patients over three years (Dalzell et al., 2017). In another study, 56% of the participants who elected for three weekly exercise sessions attended 7 out of 16 sessions (AM et al., 2021b). In the same study, 40% of the participants electing for once-per-week exercise sessions attended only 3 out of 8 sessions (AM et al., 2021b). A different study reported 10% to 70% annual enrolment per program (n = 31 programs), averaging 2000 cancer survivors per year across Australia (AM et al., 2017). Common reasons for non-utilization, missed sessions, and dropout were COVID-19 restrictions (AM et al., 2021b), hospital readmission (AM et al., 2021b), disease progression

(AM et al., 2021b), lack of awareness of service availability (Kennedy et al., 2020), adverse skeletal events, (Dalzell et al., 2017) unwellness due to treatment (AM et al., 2021b), and patient refusal (AM et al., 2021b).

3.4.2.6 Patient satisfaction

Patient satisfaction was high amid varying cancer types and patient demographics. In one study, 81% of the total responders (n = 46) were satisfied with the facility, location, and timing of the program, and all the responders (n = 57) reported their willingness to refer other patients to participate in the program during treatment (AM et al., 2021b). Key drivers of patient satisfaction were improved well-being and overall treatment experience (AM et al., 2021b; Kennedy et al., 2020), staff experience and professionalism (Kennedy et al., 2020), social value (AM et al., 2017, 2021b; Kennedy et al., 2020), feeling of empowerment (Kennedy et al., 2020), and patient-centred service (AM et al., 2017). Program timing (AM et al., 2017), lack of coordination between gym and treatment times (Kennedy et al., 2020), parking issues (AM et al., 2017, 2021b; Kennedy et al., 2020), travel distance (AM et al., 2017), and lack of transition plan (Kennedy et al., 2020) were frequently mentioned as major causes of dissatisfaction.

3.4.2.7 Fidelity proxy

None of the studies provided reports on service fidelity. However, to ensure a high standard of care, service implementation was largely led by clinicians with experience in the oncology setting (AM et al., 2017, 2021b; Dalzell et al., 2017; Kennedy et al., 2020). In one study, this was further ensured by a steering committee comprising a patient, clinical directors, a physiotherapy manager, and a community partner (AM et al., 2021b). Other approaches maintained to ensure a high-quality service delivery were regular updates (AM et al., 2021b) and continuous staff mentoring and education (Dalzell et al., 2017).

3.4.2.8 Sustainability

To sustain exercise services beyond the evaluation period, in one study, philanthropic funds were sought to pay staff salaries (AM et al., 2021b). In another study (Kennedy et al., 2020), the program duration was reduced to three months besides partnering with the cancer care centre to cover operational costs and scaling down the operational hours to two days per week (one hour per session). Eligibility was further rescinded for patients receiving chemotherapy alone in the same study (Kennedy et al., 2020). Reported lack of a financial model and effective communication between partnering organisations were the major threats to the program's sustainability (Kennedy et al., 2020).

3.5 Discussion

The impetus for the current review stems partly from the growing need to close an important research-practice gap that has long existed in the field of exercise oncology. Even with the overwhelming evidence on the feasibility, safety, and clinical benefits of exercise in cancer patients, exercise-based rehabilitation is still generally considered an adjunct instead of an

integral component of care during treatment. The result of this evidence-practice gap is that most patients do not have access to exercise services while receiving cancer treatment, a period when the debilitating effects of cancer treatments are at their peak and can best be mitigated or ameliorated with exercise-based rehabilitation (NL et al., 2020; Schmitz, Campbell, Stuiver, Pinto, Schwartz, Morris, Ligibel, Cheville, Galvão, Alfano, Patel, Hue, Gerber, Sallis, Gusani, Stout, Chan, Flowers, Doyle, Helmrich, Bain, Sokolof, Winters-Stone, et al., 2019; Schmitz et al., 2021). Despite a limited number of studies, implementing exercise services in [proximity to] a cancer unit appears to be an effective approach for increasing access to exercise-based rehabilitation for individuals on active treatment (AM et al., 2017, 2021b; Dalzell et al., 2017; Dennett et al., 2021; Kennedy et al., 2020; Newton et al., 2020). While this approach seems to be feasible for both the clinicians (the referring clinicians and those delivering the program) and patients, the current evidence is not a confirmation of the overall feasibility of exercise service integration in oncology care settings. The lack of a clear implementation plan was evident across the included studies (AM et al., 2017, 2021b; Dalzell et al., 2017; Dennett et al., 2021; Kennedy et al., 2020; Newton et al., 2020). As critical to a successful service implementation as this may be, issues relating to funding and organisational buy-in hold even far greater implications for effective service integration and long-term sustainability.

Overall, service implementation was modest even though fidelity to any pre-implementation plan was not demonstrated. As a direct consequence, the capacity for patient screening and risk stratification, effective patient triage, and structured referral mechanisms were mostly lacking. Exercise services were largely operated independent of the clinical settings in which they were embedded, and staff leading these programs were generally not part of the patient core management team (AM et al., 2017; Kennedy et al., 2020). This compromised the potential for shared decision-making in most programs and enabled communication gaps between the clinical staff and exercise service providers (AM et al., 2017; Kennedy et al., 2020). The lack of an implementation plan was implicated in the poor coordination between exercise sessions and treatment time. In one study, patients reported that they could not attend exercise sessions because they constantly clashed with their treatment times (Kennedy et al., 2020). As co-location does not automatically translate to successful service integration, a detailed implementation plan ensures that structures and strategies that reflect the changing dynamics of the clinical environment housing an exercise service unit are put in place to drive effective and sustainable integration.

Access to exercise programs was relatively feasible and similar across the included studies. Most programs were open to participants two to three times a week (AM et al., 2017, 2021b; Dalzell et al., 2017; Kennedy et al., 2020). In one study, for example, exercise services were available from Monday to Thursday during the six months evaluation period (AM et al., 2021b). In another study, patients on admission had daily access to exercise programs throughout their inpatient stay (AM et al., 2017). Another consistent finding across the

included studies was the simplified and convenient nature of the referral process (AM et al., 2017, 2021b; Dalzell et al., 2017; Kennedy et al., 2020). Although well-defined referral pathways were generally lacking, patient referrals were simple and convenient. Exercise referrals were mostly verbal, directly from the referring clinicians (the oncologists, nurses, and other allied health staff) to the exercise programs (AM et al., 2017, 2021b; Kennedy et al., 2020). One study reported an additional use of a central access point (email referral) to facilitate patient referrals further (AM et al., 2021b). Another major facilitator of referrals was patient feedback (AM et al., 2017, 2021b; Dennett et al., 2021). One study reported that doctors who received positive feedback directly from their patients were more inclined to refer more patients to the exercise program (Dennett et al., 2021). By encouraging patients to feedback to their clinicians on their thoughts, experiences, and concerns with the exercise program, exercise service providers can motivate doctors [and nurses] to engage fully and proactively with the referral process. Barriers to patient referrals were recorded at both individual and health service levels. At the individual level, while most doctors were aware of exercise benefits, particularly during cancer treatment, many lacked the agency to refer patients to exercise programs. In one study, doctors reported referring patients to the exercise program only when they remembered and had the time to do so (Kennedy et al., 2020). At the health service level, low organisational buy-in, even with the reported evidence of adequate service promotion, was a major finding (AM et al., 2017, 2021b; Dalzell et al., 2017; Kennedy et al., 2020).

Lack of organisational buy-in may be responsible for the overall low service penetration and utilisation among clinicians. For example, two studies reported overall service reach ranging between 10% and 12% (AM et al., 2021b; Kennedy et al., 2020), with Kennedy et al. (Kennedy et al., 2020) reporting an annual reach of 10% to 14% over a 50-month evaluation period. One study identified only 31 exercise service programs in the whole of 6 out of 8 states/territories in Australia (AM et al., 2017). Successful integration of exercise services in routine oncology care demands a concerted effort to develop and identify the right implementation strategies to provoke a cultural shift in the host organisation. This is critical for increasing organisational buy-in. One way to achieve this is by providing education to the healthcare providers working in oncology settings. Healthcare providers can only refer patients to exercise service programs if they know how, when, and where patients can be referred for such services (NL et al., 2020). To refer patients for exercise services, doctors and nurses, for example, should understand and appreciate the rehabilitation dimensions of their patient care and effectively and proactively screen patients for exercise interventions (NL et al., 2020; K. H. Schmitz et al., 2021). As this is a relatively new frontier in cancer care, many healthcare providers in oncology settings may need to be trained on how to use exercise screening algorithms and referral guidelines before adopting these tools (NL et al., 2020; K. H. Schmitz et al., 2021). Tools such as electronic medical records and integrated/central referral systems can improve service ease and efficiency, and ultimately utilisation (NL et al., 2020; K. H. Schmitz et al., 2021).

Organisational buy-in can also be improved by enhancing the visibility of the service units. In one study, the referring clinicians were pleased with the value created by the frequent presence of physiotherapists in the cancer unit as they actively featured in ward rounds, offered clinical insights even during informal discussions, and took part in patient assessment and decision-making (Dennett et al., 2021). Another strategy to increase service utilisation is to increase staff confidence, particularly in the safety of exercise programs (Dennett et al., 2021). This can be achieved by ensuring that the physiotherapists and other exercise specialists working in these settings have the right skills and training to match the peculiarities and dynamics of cancer care. Specifically, exercise prescriptions must be based on well-established international guidelines and recommendations while reflecting patients' circumstances, needs, preferences, and values (Stout, Santa Mina, et al., 2021). Good communication, knowledge sharing, patient responsiveness, and teamwork can foster strong relationships between staff leading exercise programs and oncology clinicians and ultimately enhance service utilisation (Dennett et al., 2021). Regular service promotion within the clinical setting is another strategy to increase organisational buy-in. One study achieved this by providing regular updates and timely reminders through staff presentations, the use of newsletters, and by introducing an alerting system in electronic medical records (AM et al., 2017, 2021b; Dalzell et al., 2017; Dennett et al., 2021). Staff rotations and turnover reflect the dynamics of typical cancer care clinics. Regular awareness programs are thus critical to ensure that new staff members are aware of the existence of these services.

Acceptance rate was relatively low across the included studies. One study, for example, found that only 64 patients took part in the exercise program out of 237 referrals received over 50 months (Kennedy et al., 2020). Another study reported an almost 50% rejection rate among eligible patients referred to the exercise programs (AM et al., 2021b). In one study, some programs recorded even as low as 10% annual enrolment (AM et al., 2017). Service compliance was also low among those that participated in the exercise program except for one study that recorded as high as 71% compliance over a three-year evaluation period (Dalzell et al., 2017). The widely reported seemingly poor referral process may explain the low acceptance rate across the included studies. While the referral process was found to be simple and convenient for the clinicians, it may have lacked some critical elements that guarantee an effective referral mechanism, one of which is patient engagement.

Illustratively, common reasons for non-utilisation, missed sessions, and dropouts across the included studies were lack of interest (AM et al., 2021b), unwell due to treatment (AM et al., 2021b), COVID-19 restrictions (AM et al., 2021b), hospital readmission (AM et al., 2021b), disease progression (AM et al., 2021b), lack of awareness of service availability (Kennedy et al., 2020), and worsening symptoms including adverse skeletal events (Dalzell et al., 2017). These experiences appear to be underlined by a general lack of exercise self-efficacy and behavioural control which is a common observation in patients on active cancer treatment (G et al., 2018; HEL et al., 2021). The poor understanding of the complex nature of cancer disease and the appropriate exercise dose with minimal adverse effects required to derive health

benefits are also potential accentuating factors among these patients (G et al., 2018; HEL et al., 2021). The referral process thus offers the treating oncologists and nurses a unique opportunity to support their patients in building confidence in their capabilities to initiate and maintain optimal exercise behaviour. Oversimplifying the referral process robs the referring clinicians of opportunities to engage proactively with and counsel patients before their exercise journey.

The observed low service uptake further speaks to the peculiar challenges of patients on active cancer treatment, especially those on hospital admission. These individuals constantly battle multiple treatment-related complications and are generally unwell. Offering regular counselling and psychosocial support and adapting exercise programs to reflect individual capacities, needs, and preferences can be another useful approach to increase uptake. Even though most patients were satisfied and willing to refer others to these programs, low service uptake and high dropout rates can be improved especially in the outpatient population by addressing sources of dissatisfaction, including early morning sessions, scheduling conflicts (i.e., by enabling more flexible programs), absence of continuation plans (i.e., perhaps by considering more transformative exercise programs), and parking issues (i.e., by eliminating or subsidising parking fees) (AM et al., 2017, 2021b; Kennedy et al., 2020).

Issues relating to funding also pose a major threat to sustainable service integration. Even though exercise services can be delivered with less sophisticated equipment, funds are required to cover routine operational costs, including daily consumables, staff salaries, maintenance, and in some locations, rents. Most of the programs were funded through grants and private donations (AM et al., 2017, 2021b; Dalzell et al., 2017; Kennedy et al., 2020). These sources are largely volatile and unsustainable. In one study, the average cost of the exercise service per patient was AUD 1, 104 with staff salaries being the primary expense (Kennedy et al., 2020). Most of the programs could not be sustained after the evaluation period, largely due to inadequate resources. For example, one study reported that two programs were closed because of a lack of funds (AM et al., 2017). In another study, the authors reported that the exercise program was restructured at the end of the evaluation period to ensure that the available funds are used to cover the basic operational costs (Kennedy et al., 2020). Funding is a key driver of long-term service and should form primary consideration during the program planning phase. As health systems continue to grapple with limited resource allocation globally, funding challenges are even more pronounced in exercise oncology, given the pervasive misconception about rehabilitation as largely an adjunctive service. Governments, corporate sponsors, and insurance agencies are potential opportunities that could be explored for multiple funding streams (Mina et al., 2012). More research is therefore required to confirm the greater merits of integrative exercise-cancer care models to the broader health systems. This can provoke a cultural shift in healthcare funding policies to guarantee sustainable funding for exercise-based rehabilitation.

3.6 Strengths and Limitations

The strength of this review is evident in the reliance on multiple implementation outcome frameworks. By drawing extensively on well-established frameworks, the findings and recommendations offer critical information to support evidence-based practice, decision-making, and future research. One major limitation of the current review is the limited number of studies available for inclusion, hence the inability to weigh fully without overstating the extent to which the differences across treatment settings may have influenced service implementation and how implementation may change in other cultures/settings. Further, per the aim, this review did not evaluate the potential for this approach to translate into measurable clinical benefits. By excluding non-English articles, this review may have further missed out on studies that could strengthen the findings and recommendations. Oncology care models that foster integrative exercise-cancer care units are recent and largely at the evaluation stage. While this may explain the paucity of literature, this review cautions that the current evidence only informs decision-making and evidence-based practice in light of these limitations and individual local settings.

3.7 Conclusion

Addressing questions around the feasibility of embedding exercise service units in clinical oncology settings is imperative for developing a sustainable exercise-oncology clinical pathway. While this appears to be an effective approach for increasing access to exercise-based rehabilitation for individuals on active cancer treatment, the current findings reveal major challenges with service penetration, adoption, and utilisation. Issues relating to funding, lack of a detailed implementation plan, and low organisational buy-in were the major barriers to effective service integration, particularly at the health service level. Common reasons for non-utilisation, missed sessions, and dropouts were lack of interest, unwellness due to treatment, COVID-19 restrictions, hospital readmission, disease progression, lack of awareness of service availability, and adverse skeletal events.

Even though this model appears feasible for clinicians and patients, efforts are still required to drive sustainable service integration. Key priorities include seeking [local] actions to address issues relating to funding and organisational buy-in. Important considerations may include developing an implementation plan to guide the implementation process, expanding the patient core management team to include staff from the exercise unit, and exploring the role of patient feedback in increasing clinician participation (e.g., treating physicians and nurses) in the referral process. Future research should consider effective strategies to promote patients' sense of self-efficacy and behavioural control and the place of audit and feedback for improving exercise service delivery and overall service implementation. The current review recognises the integration of exercise services with oncology care as a complex process and calls for efforts, including strategies and structures, that reflect the organisational dynamics of the clinical service environment housing the exercise unit.

3.8 Summary of Chapter

Even with significant challenges impacting the integration of exercise units in treatment facilities to deliver exercise-promoting and rehabilitation services to PCa survivors, there is sufficient evidence to support the practice. This approach holds significant promise for effectively delivering PEIs to increase daily and weekly exercise among men with PCa, especially during active treatment. Hence this study supports the designation of treatment facilities as an attribute level when considering establishing delivery setting as an attribute in the discrete choice experiment.

Chapter 4 presents the third study in this research, utilizing qualitative research as the second approach in further identifying and localisng the key attributes and attribute levels for the discrete choice experiments.

Chapter 4— ***"I didn't…hear any car…, nothing! The next thing I knew, I was lying on the ground": Qualiative research approach to*** **juxtaposing established exercise-promoting attributes with contextual influences akin to prostate cancer survivors in low/middle-income contexts**

4.1 Abstract

Chapters two and three provided findings from a comprehensive evidence synthesis of diverse literature to elucidate attributes potentially essential to PEIs for increasing exercise engagement during and beyond treatment for PCa. The ultimate goal is to design a DCE that will evaluate these elements and prioritise attributes most valued by PCa survivors for developing a structured PEI.

This chapter consolidates these elements by subjecting them to local and contextual scrutiny using qualitative research. Specifically, this chapter examines the PA and exercise needs and priorities of men with PCa during and after treatment, in addition to their preferences and expectations, using the interpretative description qualitative research design. Telephonic interviews were conducted with 16 PCa survivors from Cape Town, aged 53 to 77. Data analysis was performed using thematic analysis. Findings were analysed to understand the challenges surrounding exercise engagement during and beyond PCa treatment and patients' views regarding integrating exercise-promoting and rehabilitation programs in their routine care.

This study sheds light on the vastly disparate exercise experiences, especially between men who visited government and private healthcare facilities, regarding their peculiar exercise needs, priorities, and perceived exercise challenges and expectations. While several men who attended private healthcare facilities had decades of exercise history, most men who received treatments at government facilities showed a complete lack of interest in PA and exercise or the idea of integrating exercise-based programs into their routine care. Major capability issues, like knowledge gaps, especially regarding the benefits of PA and exercise training for cancer survivors and the place of exercise programs in routine PCa management, along with factors such as new treatment complications, (fear over) worsening post-treatment experiences, ageing and (age-related) comorbidities, had substantial impacts on men's attitude and disposition towards exercise in general. In like manner, environmental issues like neighbourhood safety concerns and poor work-life balance presented fewer opportunities to integrate exercise into daily routines.

Facility-level challenges like mixed messages from healthcare providers, lack of an exercise oncology clinical pathway and absence of a streamlined referral system for exercise and

rehabilitation were further identified. Several participants desired interventions that provide training on safe exercise practices, professional support, and supervision. Further, participants suggested that interventions integrating education and counselling could be implemented before treatment to expand their knowledge base, increase their understanding and ownership of the condition, promote patient-centred self-management practices, and empower patients to overcome barriers, including environmental roadblocks, to their exercise goals.

4.2 Background

Exercise interventions can mitigate challenges and complications associated with cancer treatment (Stout et al., in press). These challenges, notwithstanding, also influence exercise participation and maintenance in men with PCa (Fox et al., 2019). Lack of exercise engagement is associated with poor exercise self-efficacy and behavioural control (Bandura, 1977). In addition to the economic and psychosocial burden of PCa treatment, these factors derive fundamentally from a confluence of physical and psychological factors, including fear of adverse skeletal injuries and symptom aggravation (Chambers et al., 2018; Evans et al., 2020, 2021; Sheill et al., 2018a). The poor understanding of the complex nature of PCa and uncertainties regarding the right exercise amount with minimal adverse effects to derive health benefits have further been highlighted as potential accentuating factors (Chambers et al., 2018; Evans et al., 2021; Sheill et al., 2018a). A current research priority, thus, is to identify evidence-based approaches to motivate the right attitudes and positive intentions and support men in building strong convictions in their capability to initiate, increase and sustain optimum exercise levels.

Participatory research is currently widely advocated as a viable tool for developing effective behaviour change interventions to address complex health challenges (Andersson, 2018; White & Verhoef, 2005). Previous engagements with men may have uncovered many general and treatment-related exercise barriers (Avancini et al., 2020; Craike et al., 2011; Evans et al., 2020; Frikkel et al., 2020; Sheill et al., 2018b). However, attempts to engage with individuals with PCa in planning effective and patient-centred behaviour change interventions are rare among PA program developers. Information from men with lived experience suggests that individualised and patient-led interventions; structured multi-component exercise programs with streamlined referral systems; and interventions offering social value, clinician guidance and patient education will likely facilitate early exercise adoption effectively (Ezenwankwo, Motsoeneng, et al., 2022a). Regardless, there still needs to be more evidence to support these attributes in low/middle-income countries, like South Africa.

Program developers have primarily focused on intrinsic dimensions of complex intervention development, i.e., identifying effective intervention components, in almost every attempt at developing viable complex interventions and programs in health care (Levati et al., 2016). However, with the continuing shift in population dynamics and social and economic disruptions, key external factors characterising the rather complicated and complex element

of "context" must now form part of early considerations, especially where the program in question does not yet form part of patients' core management suite. In planning exercise promotion and rehabilitation programs for men with PCa, such early considerations must include, among others, healthcare accessibility, patients' economic stability, family and social dynamics, and neighbourhood characteristics (including built environments) (Gupta et al., 2023).

Using a qualitative research approach, this study examines exercise promotion in low/middle-income contexts by subjecting attributes known to the literature for promoting exercise participation in PCa survivors to local and contextual scrutiny to explore opportunities and challenges for increasing exercise participation in this population. It considered the PA and exercise needs and priorities of men with PCa during and after treatment, in addition to their preferences and expectations, as part of a coordinated [patient-centred] approach to developing an effective behavioural intervention to facilitate optimum exercise engagement in Cape Town, South Africa. Specifically, this qualitative study explored the following:

1. daily activities and life priorities of men with PCa during and after treatment;
2. current exercise behaviour, needs, and expectations of men with PCa;
3. men's views regarding integrating exercise programs in their routine management.

4.3 Methods

4.3.1 Study design

This study utilised the interpretative description design and was reported based on the Consolidated Criteria for Reporting Qualitative Research (COREQ)'s guideline (Duong et al., 2007). The interpretative description design allowed for the comprehensive evaluation and interpretation of patients' experiences and narratives to draw links between their experiences and current attitude and behaviour to exercise (Thorne, 2016). Even when participants have not directly linked their experiences to their exercise behaviours [by acknowledging that these experiences have impacted negatively (or otherwise) on their exercise behaviour], the choice of research design empowers us to interpret patients' narratives more broadly to isolate potential influencers or determinants of men's exercise behaviour in general.

4.3.2 Characteristics of the study population

This study involved PCa. The broader concept of a survivor by the National Cancer Institute, i.e. any individual diagnosed with cancer from the point of diagnosis throughout the entire cancer continuum, was extended to this study (Definition of survivor - NCI Dictionary of Cancer Terms - National Cancer Institute, n.d.; Marzorati et al., 2017). Hence, participants were recruited regardless of age, disease stage or treatment status.

4.3.3 Recruitment and Enrolment

To ensure the recruitment of men from diverse socioeconomic backgrounds, recruitment was carried out from two central locations, Groote Schuur Hospitals' PCa Outpatient Clinic and the Prostate Cancer Foundation of South Africa (https://prostate-ca.co.za). Specifically, the Outpatient Clinic and Prostate Cancer Foundation circulated invitations to potential participants telephonically and by email (see appendix 4.1 for sample flyer). In addition, given the hard-to-reach nature of the population (Bamidele et al., 2018), chain-referral sampling, an adaptation of snowball sampling, was also deployed to ensure comprehensive and efficient recruitment.

A minimum sample of 15 participants was initially proposed and recruited using purposive sampling. However, a few additional participants were recruited to attain data saturation— the point where all emerging concepts/categories have been fully explored and no new data was required.

4.3.4 Research Procedure and data collection

Following recruitment, all potential participants received a telephone call from the research team inviting them to a virtual screening based on the following eligibility criteria:

Inclusion criteria

- Confirmation of a diagnosis of PCa— participants were not selected based on age, race, colour, disease stage, type of treatment or whether (or not) they have completed primary cancer treatment.

Exclusion criteria

- Men who were unable to understand and communicate in the English language

After the screening, eligible participants received the study information document detailing the study's purpose, procedure, and potential benefits/harm. Participants were informed that their participation was entirely voluntary. Participants were notified of their rights to withdraw from the study at any point should they need to do so. Once all questions and concerns were resolved, participants were invited to indicate their interest in participating and formalise their decisions by signing the informed consent forms.

This study involved a semi-structured interview. All interviews were conducted telephonically and recorded using an audio-recording device. An interview guide (IG), developed based on the previous studies and the researchers' experiences in PA research, qualitative methodology, and behavioural science, was deployed for the semi-structured interviews. The IG was framed to elicit relevant information to identify issues and challenges

surrounding exercise participation, including opportunities for increasing exercise behaviour using appropriate programs (See Box 4.1 for sample IG adapted for the interviews).

Boc 4.1: Sample questions for participant interview

INTERVIEW GUIDE

1. Can you walk us through what an average week looks like for you?
   a. What things would you say are most important to you now?
   b. How have your priorities changed due to the treatment that you have received?

2. Can you tell us what you are doing regarding exercise now?
Has anyone ever recommended exercise to you as part of your care plan for prostate cancer?
   a. For people not exercising: Would you be confident to start exercising if you wanted to? Why? What don't you know or what do you need?
   b. For people exercising: What got you started? Is there anything you need help with? Or anything you would like help with?

3. Our research team is trying to design a program that will help you to learn about exercise benefits, what exercises are safe and appropriate, and how to exercise in a way that is likely to lead to health benefits:
   a. What is your honest opinion about this kind of program?
   b. What are likely to be the positives and negatives of this type of program?
   c. If you are to participate in this program, can you walk us through your expectations?
   d. Can you think of some elements or components you believe such a program must contain, and why?
   e. At the moment, tell us:
      i. What do you think this program or service should include, and why (exercise [supervised/personalised/unsupervised], education [talks, presentations- on what? what kind of information do you seek?], counselling, etc.)
      ii. How do you want this service/program to be delivered (i.e., individual, group-based, face-to-face, internet)
      iii. Where you may prefer to receive this service (i.e., home, hospital, community-based/gym)
      iv. Who do you want to see on the team delivering this service (i.e., your doctor, exercise specialist, nurse, former patients, etc.)
      v. How you could enroll in this program/service (automatic enrollment by your doctor, doctor's recommendation, referral, etc.)
      vi. What the program/service should cost (i.e., free of charge)

The interviews were conducted telephonically based on the IG by the student researcher and guided by an experienced senior researcher. During each interview, the senior researcher kept notes to remark on critical insights from the participants. In addition to the main questions, additional (thought-provoking) questions were asked to probe for further clarification. The first interview served as a pilot test. Based on the outcome, the IG was revised and assessed for face validity before subsequent implementation. Each interview lasted at most 45 minutes.

4.3.5 Ethical Considerations

This study was approved by the Human Research Ethics Committee of the University of Cape Town/Groote Schuur Hospital (HREC REF: 329/2021; see Appendices 4.2 and 4.3) and conducted in accordance with the principles of the Declaration of Helsinki (2013, Fortaleza, Brazil), the International Conference on Harmonization and the European GCP guidelines, the South African GCP guidelines, and the laws of South Africa. No person was included in this study unless they signed an informed consent form (ICF). Participants were informed about the voluntary nature of their participation and their right to withdraw from the study at any time without prejudice. Audio recordings and transcripts were safely stored in a password-protected computer accessible to the research team. All collected data were anonymised and will be deleted upon the submission of the thesis.

4.3.6 Data analysis

The NVivo qualitative data analysis software package (v.12) was used for the qualitative data analysis. First, two researchers listened to the recorded conversations and transcribed them line-by-line independently. Then, each transcript was compared with the original tape to ensure robustness, rigour, and credibility. Finally, where there were differences in opinions, a consensus was reached in consultation with the research team through reflection and discussion.

All transcripts were imported into NVivo software. Recurring ideas and concepts were identified and coded using an inductive approach. Data were coded by iteration and constant comparison with the original tape, using active words in participants' narratives (Appendix 4.4). Further, the nodes were refined and regrouped to generate descriptive categories in an inductive manner. Using thematic analysis approach, a higher-order interpretation of the descriptive themes was carried out to create analytical themes. Data analysis was performed in constant comparison with the notes maintained during data collection to ensure that the understanding of descriptive themes was based on the participants' data. Participants' details were replaced with pseudonyms to ensure confidentiality.

4.4 Result

Sixteen interviews were conducted with PCa survivors, aged 53 to 77 years, over three months. Seven participants visited private health facilities and received surgical treatment (primarily robot-assisted radical prostatectomy). Nine participants visited government facilities (i.e., public health sector patients) and mainly received radiotherapy. At the time of the enrolment, participants were 12 to 132 months post-diagnosis. More details on participants' characteristics are provided in Table 4.1.

Table 4.1: Participant Characteristics

	Private healthcare patients (PrHC)	Public healthcare patients (PuHC)
n	7	9
Age	53-71	55-77
Marital status	Married (n = 5); Divorced (n = 1); With partner (n = 1)	Married (n = 5); Divorced (n = 2); With partner (n = 1); Single/widower (n = 1)
Time of diagnosis	2-6 years post-diagnosis	1-11 years post-diagnosis
Education	College/Diploma (n = 6); High school (n = 2)	College/Diploma (n = 1); High school (n = 8)
Treatment type	Surgery (n = 7); Radiotherapy/Hormonal therapy (n = 1)	Radiotherapy (n = 6); Chemotherapy (n = 1); Watchful waiting (n = 2)
Disease stage	Localized (n = 5); Advanced (n = 2)	Localized (n =4); Advanced (n = 5)

In the sections below, findings from the interviews are presented under three themes to highlight issues and challenges surrounding exercise engagement post-PCa treatment and patients' views regarding integrating exercise-promoting and rehabilitation programs as part of their routine care. Findings further reflect inequalities in exercise promotion and rehabilitation services in Cape Town by comparing private healthcare (PrHC) and public healthcare (PuHC) experiences.

4.4.1 Treatment complications

Several participants expressed frustration with the significant decline or complete loss of sexual function. Sexual dysfunction was reported widely regardless of treatment types or healthcare accessibility. Even though some patients had started witnessing declining sexual function before treatment initiation, the further worsening of their condition after treatment resulted in deep-seated pain and frustration, along with a strong sense of helplessness.

> *"I don't have any [sexual] function at all. Because of the seriousness of my cancer, ...there was no nerve sparing. So any function that was left was destroyed by the radiation therapy and the anti-deprivation therapy."* **(PrHC: surgery (+RT/ADT)/>4yrs PD; 74yrs)**

> *"Okay, look, I certainly did not enjoy the fact that after operation, I suffered more from erectile dysfunction. It was there before the operation, but I could manage to get erections and achieve orgasm and have penetrative sex. After the operation, [the doctors] could not save the nerves on both sides…. … …that pretty much prevented me from that point onwards from achieving a full erection. That was a big change for*

> *me. I haven't been happy about that, but I just got to live with it."* **(PrHC: surgery/7yrs PD; 69yrs)**

One patient, after downplaying the significance of sexual functioning post-treatment due to his advanced age, *"regrettably"* found that to his partner, it was *"something significant* **(PuHC: RT/11yrs PD; 77yrs)**." Another participant, whilst *"hoping that things will normalise,"* reported using medication "*which sort of helps him* **(PrHC: surgery/<2yrs PD; 54yrs)**." Consistent with this challenge, one patient made a strong case for *"sexual rehabilitation"* as follow-up care for PCa survivors:

> *"You know, sexual rehabilitation is quite a useful thing for somebody who has [PCa]. Fortunately, my wife is a medical doctor, so you know I've been very lucky in that sense; but I think for someone who doesn't have that facility, that would be a very useful thing to have."* **(PrHC: surgery/3yrs PD; 63yrs)**

In addition to declining sexual function, some men reported changes in bowel and bladder function after surgery and/or radiation treatment. Two participants noted, for example, the burden of staying close to a toilet facility. To one man, there was always the constant need to limit fluid intake in the morning. According to some participants, severity was highest during treatment or a few weeks after but generally resolved over time.

> *"The radiation therapy, in particular, impacts your bowel function. … If I need to go to the toilet, I can't delay it. There's a bit of weakness to the system as a result of the radiation."* **(PrHC: surgery + (RT/ADT)/>4yrs PD; 74yrs)**

> *"The leakage was an issue for about 12 weeks; well, they've got less and less and less. […] Once every five, six months, if you had a lot of alcohol or a lot of coffee, there might be like three or four drops."* **(PrHC: surgery/2yrs PD; 71yrs)**

On the burden of having to use adult pads, for example, participants' ordeals and their journey towards regaining control (i.e., autonomy) using self-management practices are reflected in the following quote:

> *"I think it's to try and not use [pads] as much as possible. Don't be a baby and a dummy. I'm thinking [that] the mental part of it [referring to mind-body connection] is very important in terms of controlling the leaking— yeah, if you don't wear [a pad], you know it's going to be a problem if you don't think about [any effort to stop the leaking]. Whereas if you're wearing it, you can almost forget about [such efforts]: you get lazy, in other words. It makes you think about it if you [are not wearing your pad]. It makes you exercise your 'Kegel' [patient referring to pelvic floor muscles exercises] more. I think that's quite important. I've only just realised this on my own. I would say two months after my surgery, I started realising that I was using [pads] because it was easy, and then I thought, 'Okay, now I'm actually just getting lazy. Let's try without'. The weekends, I don't use [them] if I'm at home."* **(PrHC: surgery/<2yrs PD; 54yrs)**

One patient made a strong case for physiotherapy-based rehabilitation for managing post-treatment incontinence among PCa survivors:

> *"I think it's absolutely essential, especially as I said a minute ago about the PT's 'thing'. That is very critical because it's the difference between being incontinent post-op or being in control of your bladder. So that is of huge importance."* **(PrHC: surgery/2yrs PD; 74yrs)**

4.4.2 Exercise engagement

Most private healthcare sector patients (n = 6/7) appeared to lead a purposeful exercise lifestyle. On the contrary, only two out of the nine interviewed public healthcare sector patients exercised or saw the need to exercise as cancer survivors. To most men in public healthcare sector, exercise was already part of their routine, for example, by the nature of their jobs or daily activities. In addition, public healthcare sector patients hardly saw the need for designated or supervised exercise sessions or were unaware of the value of such activity/program.

> *"Well, I am always busy every day of the week. I do the sweeping of the garden; I clean the pool… I cut my grass; I do my washing; I do my ironing."* **(PuHC: RT/10yrs PD; 73yrs)**

> *"…by working a lot. Yeah, you know, most of the time I'm driving…. Sometimes I walk around. …physical exercise is just a normal routine for me."* **(PuHC: WW/1yrs PD; 58yrs)**

Unlike public sector men, one major factor that led to the early uptake of exercise among private healthcare sector men was the pre-diagnosis/treatment exercise lifestyle. Most private healthcare sector patients were actively exercising before receiving their diagnosis and continued after their treatment.

> *"I've always kept active by riding a bicycle. I used to run marathons. I've been paddling, I've got cycling tours. So I've always been fit and active, and I continue to be fit and active. I just came back from a ride half an hour ago. I ride a couple of times a week. I go to the gym a couple of times a week. I just do, you know, an hour and a half, two or three times a week."* **(PrHC: surgery/2yrs PD; 71yrs)**

Some private sector patients even admitted to intensifying their activity before surgery. Not only could some men see a direct correlation between increased pre-treatment exercise and the immediate relief experienced after treatment, but also, they were further strengthened by that. One patent puts it this way:

> *"Before my operation, I intensified my exercise so that when I went in for my operation…I was very active. I think that had a massive benefit. I was out of hospital the day after my operation. The day after that, I was already walking in Kirstenbosch…. And I've maintained that. At the moment, we walk, I would say, 5*

> *to 6 days of the week...including hiking trips…."* **(PrHC: surgery + (RT/ADT)/>4yrs PD; 74yrs)**

Recounting how instrumental their previous exercise history was to post-treatment exercise engagement, including having access to gym membership, some men noted:

> *"I was really fit before I went into the operation. And six weeks later, I did a bicycle race. So, it was a relatively seamless changeover for me to the new format."* **(PrHC: surgery/2yrs PD; 74yrs)**

> *"[My exercise routine] has not changed. It [only] took after a few weeks. I think it was recommended six weeks before I got back on my bike. After six weeks, I was back to normal."* **(PrHC: surgery/2yrs PD; 71yrs)**

> *"I've always exercised since I was 35...and for the last maybe 40 years, I've exercised continuously. I've never stopped."* **(PrHC: surgery (+RT/ADT)/>4yrs PD; 74yrs)**

Stressing the importance of a pre-treatment exercise lifestyle to exercise motivation and, ultimately, engagement after treatment, one man noted:

> *"I think the pre-op is as important…. I was surprised that— and no one said I couldn't, but I was surprised that I could actually do a push-up [after my surgery]. And it didn't feel [painful] where I thought it would. …that's suddenly the encouragement."* **(PrHC: surgery/<2yrs PD; 54yrs)**

Among the private sector participants, exercising with their partners must have also increased their motivation and supported them to exercise more.

> *"I cycle (mountain biking) with my wife over weekends when we can. I do a lot of walking with her. I walk an average of five kilometres daily, and then we hike in our mountains."* **(PrHC: surgery/<5yrs PD; 68yrs)**

> *"My wife and I are both keen on exercise. …we exercise 5 to 6 days a week. If we go on the long hiking trip to Cedaberg, we hike every day, 5 to 6, maybe 4 of 5 hours of hiking."* **(PrHC: surgery + (RT/ADT)/>4yrs PD; 74yrs)**

Among many private healthcare sector participants, exercise motivation stemmed from the perceived physical and psychological benefits. For example, many participants tied regular exercise to rapid recovery, including improvement in treatment complications. Other patients reported a strong sense of validation and the ability to cope better with their condition.

> *"I understood what [the exercises] were doing. And if I did find myself dribbling a bit due to incontinence, it was because I hadn't been doing my exercises."* **(PrHC: surgery/2yrs PD; 71yrs)**

> *"I was surfing 4 weeks to the day— surfing is like swimming, its energy-sapping. It involves a huge range of motion, and you need strength. Exactly 4 weeks after my surgery, I felt strong, I felt good, I felt healthy. I think one of the keys to that speedy*

> *recovery was being healthy before the operation. … When I was diagnosed, I got even healthier."* **(PrHC: surgery/<2yrs PD; 54yrs)**

> *"Anybody, if you're not exercising already after cancer diagnosis, you should very seriously think about that. Because it not only helps with your fitness and recovery, but it also helps with your mental calmness; it helps you cope with the disease much better, in my opinion."* **(PrHC: surgery (+RT/ADT)/>4yrs PD; 74yrs)**

To some participants, alarms help them to keep to their routine.

> *"I've just got an alarm that goes off at half past six every evening on my phone. I'm very low scope. I don't remember things. So, when it goes off, I do a few minutes of Kegel exercises."* **(PrHC: surgery/2yrs PD; 71yrs)**

Several issues were identified in connection to participants' exercise lifestyles. Prominent among them was the apparent lack of exercise recommendations. Only four private health sector patients acknowledged receiving physiotherapy referrals after surgery from their urologists. One patient mentioned that it "*was specifically to deal with the leaking, the incontinence* **(PrHC: surgery/<2yrs PD; 54yrs)**." However, hardly any patients were referred to exercise specialists for post-treatment evaluation and guidance on safe exercise practices.

> *"Nobody recommended exercise as such. I would have been surprised had they recommended it because most doctors don't really go into a full post-operation discussion."* **(PrHC: surgery/7yrs PD; 69yrs)**

Clearly, there were some efforts on the part of many patients to obtain practical information on exercise benefits and safe practices, including searching the internet and reading medical literature. However, many expressed concerns over their inability to distil the right information and feared the likelihood of aggravating their condition while exercising without professional guidance.

> *"I tried to do a bit of reading on the internet, but it becomes dangerous when you start to read and pick up knowledge; it wouldn't help. In fact, I often thought when people get radiotherapy or chemo, somebody should have...said, 'You know, now that you have the treatment, this is what you should do and not do.' Simple things like that would have been immensely helpful for anybody."* **(PuHC: RT/11yrs PD; 77yrs)**

> *"I read some medical books. I've got the Medical Chancellor…, It's like an encyclopaedia. … Whatever I have a problem with, I consult my medical books."* **(PuHC: RT/10yrs PD; 73yrs)**

Some private sector patients expressed concerns over the nature of advice they received from their doctors. While the advice may have been intended to ensure patient safety in the post-operative recovery period, patients noted message framing effects injurious to their exercise motivation, further heightening patients' concerns over the likelihood of new adverse events or worsening of existing complications.

> *"I wasn't advised on the sporting side of things other than I asked a question, and he said, 'Look, six weeks! Just take it easy, don't be manic.' And I listened to that."* **(PrHC: surgery/2yrs PD; 71yrs)**

Even with the poor message framing, some patients still acknowledged the place of exercise during recovery whilst noting that certain exercises can be carried out safely.

> *"[The] doctor might say, 'Oh, you got to be careful of a hernia.' But I would say to work on core muscles as soon as possible. ... I think there's not enough emphasis on focusing on what you can do. As a patient, post-op, especially the first couple of weeks, you don't do it [referring to exercise] because you're scared of tearing something or something happening."* **(PrHC: surgery/<2yrs PD; 54yrs)**

Several private and public health sector participants were unaware of exercise's role in cancer survivorship. To most patients, exercise benefit does not extend beyond pelvic floor health after surgery.

> *"You see, I don't know even now (referring to even as he currently exercised regularly) if exercise is of any benefit to PCa patients. I never made the connection. And I never asked any of the doctors."* **(PuHC: RT/11yrs PD; 77yrs)**

> *"I think exercise can be good, specifically for the pelvic floor. But that's all exercise will do; it won't help anything else. It won't help the erectile dysfunction."* **(PrHC: surgery/7yrs PD; 69yrs)**

Ageing, combined with failing strength and [age-associated] comorbidities, was reported mainly as a major exercise-limiting factor. Several participants expressed declining motivation to exercise, given their age and worsening comorbidities, like osteoarthritis, Parkinson's disease, and diminished vision.

> *"I found that as I've gotten older, I don't really want to do the running and that sort of stuff anymore. …. Some people ride bikes every day; some people climb the mountain every day. I don't do that. But it is sort of part of my life- one way or another, I will be doing something which exercises my muscles."* **(PrHC: surgery/7yrs PD; 69yrs)**

> *"I think the level of fitness when you were 45…50 has changed. You don't have the stamina— what I had when I was 45. So I don't have the physical stamina…."* **(PrHC: surgery/<4yrs PD; 68yrs)**

> *"...with Parkinson's, it is a bit difficult to have an exercise program because not every day is the same. Some days, I have very good highs, and some days I have very bad lows, you know, so it's a bit difficult."* **(PrHC: surgery/3yrs PD; 63yrs)**

Most public sector patients raised several neighbourhood concerns. For example, many participants complained about the high crime rate in many townships, especially Black and Coloured neighbourhoods, making these areas unsafe for PA.

> *"The area now that we live in? With all kinds of things that can affect you, you know, crime, you can't just get up and walk like in the old days for 5 or 6 kilometres. It is difficult because the possibility is there that around the next corner, you'd get robbed and mugged. So it's a totally different thing than the earlier years."* **(PuHC: WW/5yrs PD; 78yrs)**

> *"It's difficult for me as a privileged Whitey to sort of put myself in the position of someone who's living in a township, let's say, where you almost don't go outside because you couldn't for reasons of safety and security."* **(PrHC: surgery/2yrs PD; 71yrs)**

> *"The area where we are now, as I speak to you, there is a lot of crime. If you go to the media, you can see all the crime that is happening here. There are gangsters. There are guns everywhere. Police are not performing the way they should perform. It has a huge impact on your and the community."* **(PuHC: Brachy/5yrs PD; 59yrs)**

Several patients complained about busy neighbourhoods, noting, particularly, motorists' lack of consideration for older individuals. One patient puts his previous encounters this way:

> *"I used to walk to the shops…but it's not safe to walk anymore. I've been knocked down twice. The last time was in 2020. My legs got numbed because of that. I also had a concussion. I didn't know where I was. I remembered…I walked into the road coming home and stopped to look at the car coming towards me. The car seemed to slow down, [so] I took a step forward. I didn't hear anybody hoot. I didn't hear any car. Nothing. The next thing I know, I was [on the ground]."* **(PuHC: WW/5yrs PD; 78yrs)**

Exercise cost was another barrier that many public sector patients raised. As one patient would put it: *"...and money. If someone will pay for your gym or subsidise [the cost], it will help* **(PuHC: Brachy/5yrs PD; 59yrs)**.*"* Other issues included cancer-related fatigue and new complications. One private healthcare sector patient complained: *"…for reasons that no one can quite explain, I had a blockage. I had to be re-catheterised. ... I wasn't quite as continent after the second catheter was removed. … And I do [still exercise], but not as I did [PT recommended] exercises…."***(PrHC: surgery/2yrs PD; 71yrs).** There was also evidence of a lack of motivation in some interviews. According to one patient **(PrHC: surgery/3yrs PD; 63yrs)**, *"… there is always an excuse— you'll always find an excuse for not to do [something]."*

Job demands and time constraints were other major issues the public health sector patients facilities raised.

> *"But the main problem is the time. Because for now, I have to go earlier in the morning. What time does the gym open in the morning? I have to go earlier, before 5 o'clock, so that I can leave there by 5 o'clock to go to work. And how much time do I have in the morning? Maybe, half an hour or 20 minutes, not much of a time. … Saturday, okay, maybe I can go longer. But you have to prepare again for Sunday service at 6 am.* **(PuHC: Brachy/5yrs PD; 59yrs)**

4.4.3 Embedding exercise in routine cancer care

4.4.3.1 Perception of exercise program as part of routine care

Most men could hardly anticipate any positive value in integrating exercise-based rehabilitation into their care. Underlying participants' perception appears to be an apparent lack of awareness of exercise benefits for men during and beyond PCa treatment.

> *"I'm not sure if you are saying that there is a benefit from exercise for people who had PCa. If you are saying that, which I really was not aware of, then I really would like to see if I am not doing some of those things that would be in your program which is more relevant to me. [My focus has been to] improve my capability and balance. I'm not really sure if exercise has any correlation with getting better after PCa [treatment]."* **(PuHC: RT/11yrs PD; 77yrs)**

> *"I don't think [the program] is of much use to me. PCa is a genetic thing. My father had it; my brother also had it. I am not sure if exercise before diagnosis would have helped. If there's any study available that proves that, then that would…motivate me to get onto an exercise program."* **(PrHC: surgery/3yrs PD; 63yrs)**

A few private sector patients, however, acknowledged some potential benefits. For example, one patient **(PrHC: surgery/2yrs PD; 71yrs)** saw such a program as *"the difference between being incontinent post-op and being in control of your bladder"*. Regarding the potential impacts of lifestyle change post-diagnosis on treatment recovery, another patient noted:

> *"I think the recovery after treatment cannot work properly without a change in lifestyle before. I think they go together. What you put in, what happens before your prostatectomy, or even your diagnosis is important— as important as how you deal with it afterwards, in my opinion. And I think that's what got me to such a speedy recovery...."* **(PrHC: surgery/<2yrs PD; 54yrs)**

Some private sector participants spoke about how access to the right information through the program can increase exercise self-efficacy and, ultimately, engagement. One patient puts it this way:

> *"...the program would be hugely beneficial, hugely, because I think people don't— there's a lot of information out there on what to do...but I don't think people know what to believe or not to believe. Because they don't know what to believe or not to believe, there is not enough motivation. So I think the programme will motivate people, once they are diagnosed, to a healthier lifestyle."* **(PrHC: surgery/<2yrs PD; 54yrs)**

When asked about the nature and mode of delivery, participants' responses were varied. Some participants preferred the one-on-one session as it would allow for a more individualised program tailored to their needs. One public healthcare sector patient noted:

> *"I suppose it all depends on one's personal condition— like I really needed personal attention. I had to force my budget to accommodate the cost of a trainer. It's difficult*

> *for a pensioner. [...] ...I think people have different needs depending on their physical condition or how they have neglected their bodies or not neglected them."* **(PuHC: RT/11yrs PD; 77yrs)**

Another private sector patient indicated an interest in an online-based program even when he could not envisage how exercise might help:

> *"I have seen some exercises that my wife has been following due to the lockdown online. In your own time, you don't have to go to the gym. Just some basic floor equipment. So probably an online exercise program would be more beneficial to me."* **(PrHC: surgery/3yrs PD; 63yrs)**

One private sector participant feared that being part of a group could amply the feeling of self-pity.

> *"Although I'm part of the prostatectomy group, I don't take part in anything. One of the reasons, rightly or wrongly, is that I don't want to fall into the trap of feeling sorry for myself, and I don't want to be dragged down by people feeling sorry for themselves. I find that very irritating. I want to be part of the group…but I don't want to get dragged into things. It's not my identity. My identity is recovering from it with confidence and just getting on with my life in a healthy way. That's my identity. And not the fact that I'm a cancer survivor or a member of that group. I don't want that featuring in my life."* **(PrHC: surgery/<2yrs PD; 54yrs)**

Some participants, on the other hand, felt that group sessions could offer an avenue for men to interact, sharing thoughts and experiences while exchanging ideas on how to deal with the everyday challenges that are associated with PCa. For example, one private sector patient who was part of a similar survivorship support group narrated his experience:

> *"… We are now…80 people on that group, asking any questions, practical experiences, what happened…. And you find that people ask not the strangest question but something which you have never thought of. That's a very valuable forum where you can ask any question which bugs you. And then you find out some people have really, really good experiences, and some people were struggling. A common denominator to me is definitely the physical thing— the sexual ability is the thing which comes up very frequently."* **(PrHC; surgery/2yrs PD; 74yrs)**

4.4.3.2 Program component/elements

Participants could only comment minimally when asked about their views on the possible nature and component of the program if it was to be embedded in their care pathway. However, a few interests were expressed, including primarily for such a program to educate and provide guidance. For example, many patients know that they should exercise but worry about how to exercise safely.

> *"I think there's a bit of psychological component to it. [The support from] the doctors and physiotherapist gave me peace of mind. I had internal stitches, so I was worried that exercising would pull those; [feared that] the exercise the physiotherapist gave me*

> *would upset something internally. Just because we're not medical people, it's kind of a blind spot. One has quite a bit of questions afterwards, and one needs to be able to ask those questions."* **(PrHC: surgery/2yrs PD; 74yrs)**

> *"…I think that it is essential that initially, there should be supervision. … [many] clearly don't know what they are doing in terms of getting benefits from a particular exercise. [...] That also caused me two years of pain and suffering when my neck collapsed because I wasn't aware that even though I was doing the exercising, I was not strengthening the correct muscle…. I was thinking of that kind of education given the experience that I had."* **(PuHC: RT/11yrs PD; 77yrs)**

In addition to providing professional support, participants further expressed the importance of skills transfer, for example, using the right visual aids.

> *"The typical thing which I valued so much was that the physiotherapist gave me the exercises in visual formats. So, I'm thinking if you want to transmit that to somebody else, it's quite easy to do. A short description of, let's say, planking or whatever other exercises we were doing, like an information sheet [saying] this is the exercise you need to do, this is the goal; and [visual aids] like stick figures which would demonstrate it nicely to any person."* **(PrHC; surgery/2yrs PD; 74yrs)**

On the nature and focus of the exercise component, many participants stressed the importance of integrating moderate forms of exercise in addition to Kegel's exercises. In addition, participants noted that much could be accomplished with, for example, push-ups, regular walking, etc., even in the post-operative recovery stage.

> *"Given that your average age of men is the 60s and upwards, …I would say that your main component would probably be walking. … People should try to start walking as frequently as possible, and try and build it up to the point where they are hiking or walking for an hour or more for 5 days a week."* ***(PrHC: surgery + (RT/ADT)/>4yrs PD; 74yrs)***

> *"Push-ops and planking are good for your core muscles. The doctor might say, 'Oh' you've got to be very careful of hernia,' but I would say to work on core muscles as soon as possible. So planking and push-ups, and not just pelvic floor exercises. Try and push to do new exercises because what I found was that I was encouraged every time I could do a push-up. …that's suddenly the encouragement. I thought, hey, I'm actually getting back to normalcy. I'm not such an invalid."* **(PrHC: surgery/<2yrs PD; 54yrs)**

> *"Walking is as good as anything. And that's what [the PT] suggested we do. In fact, as soon as you are up and about with your catheter bag on, start walking. Don't sit in a chair and feel sorry for yourself. Get up and walk; up and down steps is always good. Get your heart rate up because that is all that speeds up the healing process because it obviously gets your blood circulating"* **(PrHC: surgery/2yrs PD; 71yrs)**

4.5 Discussion

The key to developing health interventions and programs to address complex challenges effectively is to consider, beyond essential intervention components, critical contextual influences that can aid or derail the intended outcomes. In cancer survivorship care, mainly in planning exercise promotion and rehabilitation services, such is rarely the case, as critical aspects of complex intervention development, like accounting for exogenic factors and delineating plausible causal pathways, have often received the least attention (Gupta et al., 2023). In the context of PCa management and survivorship, a recent review demonstrated the superior potential of programs and services that are individualised, patient-led, and structured with multi-component PA and streamlined referral pathways, along with interventions and programs offering patients access to social support, clinician guidance and patient education (Ezenwankwo, Motsoeneng, et al., 2022a). The current study juxtaposes these attributes with key contextual influences to explore opportunities and challenges for developing interventions to increase PA and exercise among men with PCa in low/middle-income contexts, like Cape Town, South Africa.

First, this study sheds light on crucial capability issues influencing exercise participation in men with PCa regardless of socioeconomic status. While some men showed a general understanding of exercise benefits in the life course, there were knowledge gaps, especially regarding the benefits of PA and exercise for cancer survivors and, ultimately, the place of exercise programs in routine PCa management. This study further shows that factors such as new treatment complications, fear of re-injury/worsening post-treatment experiences, ageing, and (age-related) comorbidities strongly impact men's exercise attitudes and disposition. Consistent with existing literature, these factors can introduce significant limitations in exercise engagements even among men with decades of exercise experience (Fox et al., 2019; Stout, Brown, et al., 2020).

Any intervention to effectively increase and optimise exercise behaviour in low/middle-income contexts must first increase men's awareness and understanding of the importance of daily/weekly exercise throughout the PCa continuum whilst addressing uncertainties surrounding exercise safety. We found that patients repeatedly expressed fear over the likelihood of re-injury, especially in the immediate post-operative recovery period, and the desire for interventions that provide education and training on safe exercise practices, professional guidance and supervision. Prior to treatment completion, interventions integrating education and counselling can be implemented to expand patients' knowledge base, increase understanding and ownership of patients' condition, promote self-management efforts, and empower patients to take steps towards overcoming daily obstacles to their exercise goals, including those presenting in the immediate physical and social environment (Mina et al., 2012; K. Schmitz et al., 2019). Strategies such as those leveraging enabling technologies or involving former patients in holding talks and discussions on critical

issues/questions surrounding PA/exercise and PCa can also strongly influence attitude renewal and behaviour change (Fox et al., 2020; HEL et al., 2021).

There is an opportunity for healthcare providers to play a significant role in promoting exercise participation and dissipating fears in patients through positive communication and messaging. Among healthcare providers, findings highlight the tendency to provide patients with health information using cautionary undertones. This is a facility-level barrier with the unintended consequence of undermining patients' motivation for exercise (Stout, 2022). Opportunities like this can better be harnessed as teachable moments for reinforcing positive exercise beliefs and convictions whilst referring patients to specialists for during and post-treatment exercise evaluation and prescription.

The lack of established exercise oncology clinical pathways is further implicated in this study by the absence of standard referral systems for exercise and rehabilitation. This is a critical gap in cancer care delivery in low/middle-income settings with implications for the current healthcare system's capacity to provide balanced, well-rounded care for men undergoing PCa treatment (Gupta et al., 2023). In this study, none of the patients who received treatment at government facilities admitted to receiving any referral for exercise screening and prescription. Among the few private sector patients that admitted to receiving exercise recommendations from their treating doctors, the emphasis was mainly on pelvic floor rehabilitation. The physical and psychological demands of PCa treatment are well known and require early and regular access to personalised exercise and rehabilitation during and beyond active treatment (Stout, 2022). Even when these services are unavailable within conventional treatment settings, establishing a screening algorithm along with streamlined referral pathways and mechanisms ensures that patients can find the right provider (Stout, 2022).

Between government and private sector patients, an important question raised in the study pertains to whom any future intervention or program holds greater promise and how best to reach them. The finding that most men who visited government facilities have poor exercise lifestyles and showed a complete lack of interest in participating in any exercise program is noteworthy. Reasons may be similar in many countries (Ezenwankwo, Nnate, et al., 2022; Kennedy et al., 2022). Notably, exercise oncology does not yet form part of patient care management pack for PCa, especially across government facilities in Cape Town. Evident in this study, more advanced stage PCa and several comorbidities put this population at a greater burden of the complex challenges associated with PCa treatment. Compare this population to men that received treatment in private healthcare facilities: while many displayed a shallow understanding of the complex role of PA and exercise in PCa management, this study found evidence of exercise appreciation in many, generally, along with decades of purposeful exercise lifestyle.

This study shows that any possible exercise promotion and rehabilitation intervention or service will most likely have the most significant impacts if implemented for patients receiving

treatment in government facilities. Our study showed that this population has the greatest need for such programs, given widespread barriers and poor exercise motivation. Coupled with low health literacy and high socioeconomic deprivation, the prevalent neighbourhood crime and safety concerns render access to outdoor programs challenging for the population. Previous studies have found co-locating exercise-promotion services with PCa treatment feasible and effective for increasing capability and performance (Kennedy et al., 2020). This approach may be explored as part of facility-level efforts to build exercise motivation, leveraging the window of opportunity when behaviour change is most tenable (Kennedy et al., 2022). Several attributes of hospital-based (in-centre) programs, like structured exercise classes, group sessions, professional guidance and strong social support, have shown tremendous benefits in the behaviour change process in men with PCa (Ezenwankwo, Motsoeneng, et al., 2022a). Even among those with long-standing pre-diagnosis exercise history, these programs can facilitate re-engagement after radical procedures (Fox et al., 2017, 2020). They also offer an excellent opportunity for subsidised yet transformative exercise promotion programs, allowing service providers to effectively transition patients from hospital/clinic-based to community/home-based exercise programs.

Strength and limitations

The interpretative description design allowed for a more rigorous and methodological approach to consider through a more local and contextual lens attributes previously known to the literature to effectively support exercise engagement in PCa survivors and better formulate interventions for local use. The strength of this study is further evident in recognising that issues and challenges may vary between government and private healthcare patients, including opportunities and mechanisms for improvement, and allowing this understanding to inform design, sampling and analysis. A major limitation, however, is reflected in our inability to extend the study beyond non-English speakers. In addition, the purposive and convenient nature of our sampling further holds implications for the generalizability of the findings of this study.

Conclusion

This study shows the differences in experiences between men who visited government and private healthcare facilities in typical low/middle-contexts, along with their expectations and perceived needs, especially regarding integrating exercise-based programs into their routine care. Major capability issues, like knowledge gaps, particularly regarding the benefits of PA and exercise for cancer survivors and the place of exercise programs in routine PCa management, and factors such as new treatment complications, (fear of) worsening post-treatment conditions, ageing and (age-related) comorbidities, have substantial impacts on men's attitude and disposition towards exercise. Environmental issues like neighbourhood characteristics and poor work-life balance presented fewer opportunities for integrating exercise into daily routines. Facility-level challenges like dysfunctional messaging among

healthcare providers, lack of exercise oncology clinical pathways and absence of referral systems for exercise and rehabilitation were further identified. Several participants desired interventions that provide training on safe exercise practices, professional support, and supervision. In addition, interventions integrating education and counselling can be implemented before completing treatment to expand patients' knowledge base, increase their understanding and ownership of the condition, promote patient-centred self-management practices, and empower patients to overcome barriers to their exercise goals.

Summary of Chapter

Chapters two and three of this thesis provide findings from a comprehensive evidence synthesis of diverse literature to elucidate elements potentially essential to increasing exercise engagement during and beyond treatment for PCa using PEIs. To further consolidate these elements, recognising both the mediatory and modulatory roles of external and contextual influences on exercise engagement, this chapter subjects these attributes to local and contextual scrutiny using qualitative research. The next chapter will detail the design process for a DCE to prioritise features most valued by PCa survivors for developing PEI.

Chapter 5— Targeting Uptake of Exercise-Promoting Structured Patient Education Intervention: Process Description of a Discrete Choice Experiment to Understand Perceived Intervention Utility and Design Preferences for Men with Prostate Cancer

5.1 Introduction

Critical to the uptake of PEI, as is the case with every complex healthcare intervention, is elucidating intervention attributes that matter most to the patients from a range of potentially relevant conditions. The discrete choice experiment (DCE) offers a pragmatic consumer-oriented approach to exploring and understanding individual preferences and perceived utility when planning interventions, particularly in the absence of real-life observational data. Using a DCE, intervention developers can subject several competing but relevant and context-specific attributes of PEI to scrutiny to prioritise those most valued by PCa survivors.

Chapters 2-4 of this thesis provided findings from three foundational studies to map a broad range of attributes relevant to PEI for promoting exercise engagement among PCa survivors. Along with interventions and programs offering patients access to social support, clinician guidance and patient education, attributes including structured, individualised, and patient-led interventions with multi-component PA/exercise and streamlined referral pathways were identified and enumerated in Chapters 2 and 3. In trying to localise these attributes, major capability issues, including knowledge gaps on the benefits of PA and exercise for cancer survivors and the place of exercise programs in routine PCa management, and factors such as new treatment complications, worsening post-treatment conditions, ageing and (age-related) comorbidities, were highlighted using qualitative research (see Chapter 4) as critical influencers of exercise engagement among PCa survivors in Cape Town. These factors, along with critical environmental and healthcare-level issues like neighbourhood safety, dysfunctional messaging among healthcare providers, lack of exercise oncology clinical pathways and absence of an exercise referral system, were also critical to PEI's viability in this population.

This Chapter details the development of a DCE that will test five major attributes that emerged from the foundational research studies to prioritise conditions most valued by patients for developing PEI.

5.2 Background

With the increasing use of participatory methodologies in health research, efforts are now being made to involve patients and survivors in the early (planning) phase of developing complex health interventions as one critical strategy to increase their uptake (Ostermann et al., 2017). More often, evidence has shown that regardless of proven intervention effectiveness, critical aspects of the design process, including the organisation of the various

often independent components and features of the interventions and how they are presented to the users, can influence overall utilisation and long-term sustainability (Klaic et al., 2022; Sekhon et al., 2017). Therefore, early investments on the part of program planners and intervention developers must include efforts to identify and map intervention elements and components that matter most to the users—the patients— from the myriads of potentially effective yet competing attributes (Ostermann et al., 2017; Szinay et al., 2021). Eliciting patients' preferences and the values they place on intervention attributes remained a major challenge in the real world in the absence of observational data until the emergence of DCE as a major stated preference method (Carlsson & Martinsson, 2003; Kuhfeld, n.d.). Currently, the DCE has found multiple applications in healthcare and public health in the last two decades in critical areas such as digital health/health technology (Szinay et al., 2021), cancer (Bentley et al., 2022; Delmas et al., 2023; Raginel et al., 2020), HIV (Belay et al., 2023; Michaels-Igbokwe et al., 2014), primary health care (Kleij et al., 2017), and surgery (Gidman et al., 2007), and diverse contexts including developing economies (Abiiro et al., 2014; Belay et al., 2022; Michaels-Igbokwe et al., 2014; Tan et al., 2022).

The DCE was developed initially by Louviere and colleagues in 1982/83 as an economic and marketing tool to study and align products and innovations to consumer preferences (Spinks et al., 2015; Szinay et al., 2021). DCEs use survey-based experimental designs to understand consumer desires and user values by presenting them with a series of hypothetical choice scenarios featuring two or multiple alternatives of services or products or their aspects and allowing them to choose based on their preferences and perceived benefits (Mangham et al., 2009b; Terris-Prestholt et al., 2019b). By participating in the experiment, intended consumers mimic real-world decision-making as they register their preferred choices over two or more competing alternatives, allowing program planners to make meaningful estimations, including user value in the absence of observable markets (Mangham et al., 2009b). Precisely, program planners can determine not only the overall user values but also, for example, possible interactions between specific intervention attributes and the strength of preferences for different attributes in relation to diverse groups/interests, primarily where the intervention is intended for multiple populations groups or groups within a given population (Mariel et al., 2021; Terris-Prestholt et al., 2019b). DCE methodology has continued to evolve with significant influences from economics and psychology in recent years (Carlsson & Martinsson, 2003; Kuhfeld, n.d.; Mariel et al., 2021; Szinay et al., 2021).

DCE can generate statistical models with outputs instructive for developing PEI to promote exercise engagement among men with PCa. This is particularly crucial for increasing daily/weekly exercise in contexts and settings such as Capet Town, where exercise oncology still needs to form an integral part of oncology services for PCa survivors. This approach and methodology are superior to other strategies, including those relying more on expert opinions, as it brings PCa survivors to the centre of the intervention planning efforts, allowing program planners to ultimately develop PEIs that will increase exercise uptake in the local context (Terris-Prestholt et al., 2019b).

This chapter details the development of a DCE that aims to elicit men's preferences on increasing exercise engagement during and after PCa treatment using PEI. It describes how the attributes and their levels were selected and how the choice sets and the overall experimental design were constructed. Several guidelines and recommendations were followed in developing the DCE (Kuhfeld, n.d.; Mangham et al., 2009b; P'erez-Troncoso, 2020; Szinay et al., 2021; Terris-Prestholt et al., 2019b; Weber, 2019).

5.3 Establishing Attributes

Attributes represent the foundational stones of a DCE that determine the characteristic features of the choice tasks (Mangham et al., 2009b). To qualify as an attribute in a given experimental design, an element must possess the intrinsic ability to be varied, whether qualitative elements like the product's design features or quantitative variables like the cost of delivery (Szinay et al., 2021). Consistent with widely used recommendations, this project conducted three foundational studies in identifying attributes potentially relevant to exercise promotion for men with PCa using PEIs (Abiiro et al., 2014; Bentley et al., 2022; Mangham et al., 2009b; Szinay et al., 2021). Fig. 5.1 depicts the integration of data, and a summary of the information brought forward from each study to establish the attributes [and their levels].

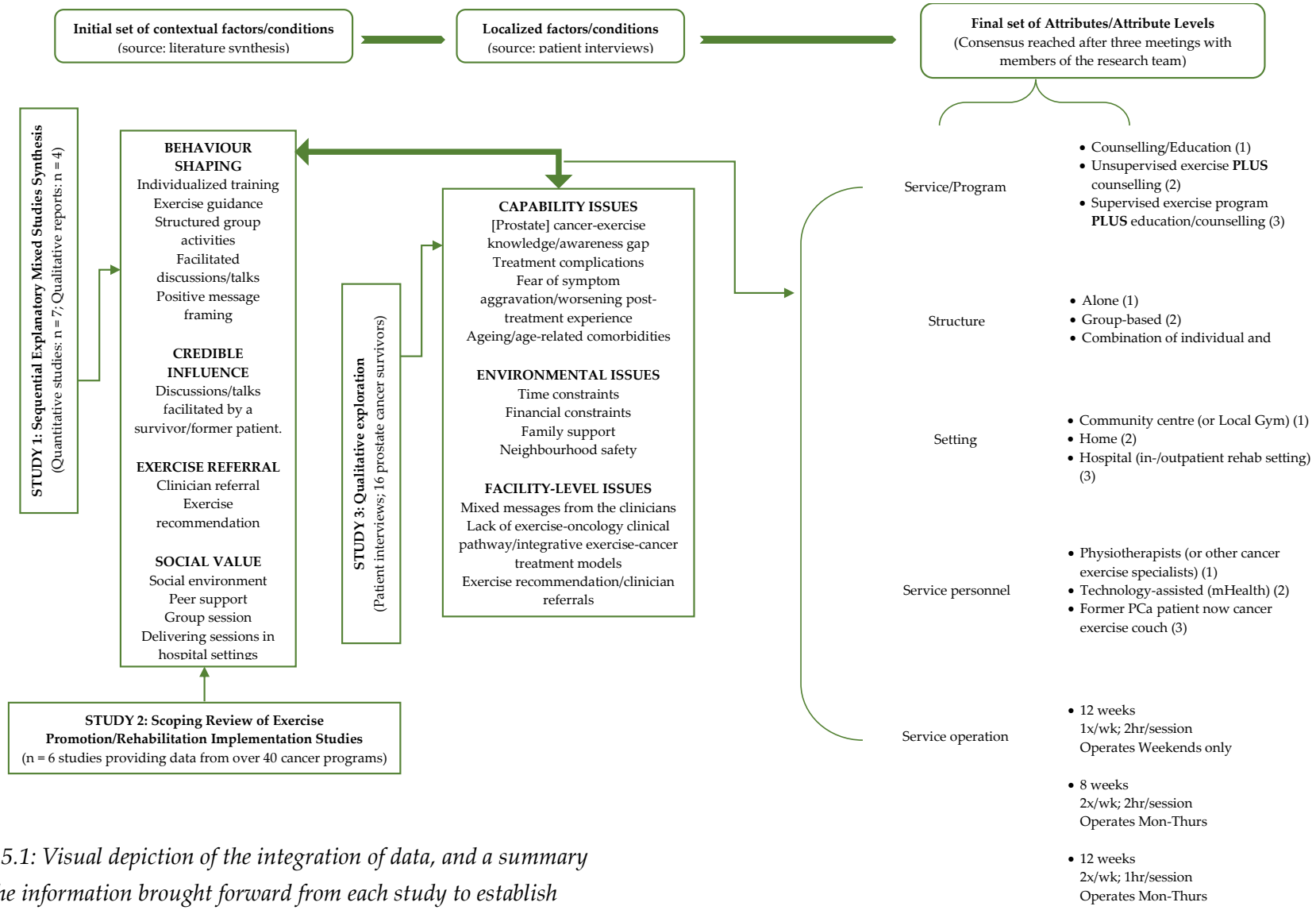

Fig 5.1: Visual depiction of the integration of data, and a summary of the information brought forward from each study to establish attributes and their levels.

First, a mixed studies synthesis was conducted, integrating findings from quantitative and qualitative studies and configuring data using ideas from the context-mechanism-outcome configuration (Ezenwankwo, Motsoeneng, et al., 2022b). As shown in Chapter 2, the success (or lack thereof) of PEI in PCa survivors can be ascribed to over 25 conditions or attributes, with the likelihood of success higher for interventions prioritising credible influence (e.g., involving former patients as program facilitators) and exercise referral as critical components, and offering access to interventions within hospital settings in addition to home-based programs (Ezenwankwo, Motsoeneng, et al., 2022b).

Although regarded as fundamental to establishing an exercise-oncology clinical pathway, the notion of offering exercise-promotion interventions in hospitals or other treatment settings raised questions about the overall feasibility, which needed to be addressed to consider delivery setting a potential attribute in the experimental design. In Table 2.5 (see Chapter 2), nearly 76% of the participants in one of the studies included in the review admitted they would not have participated in the program were the exercise classes not offered in the hospital setting, even with recommendations from their doctors (Ezenwankwo, Motsoeneng, et al., 2022b). In the study, over 90% of the participants indicated an interest in participating in the program if invited the second time, provided the intervention is offered in the hospital (Ezenwankwo, Motsoeneng, et al., 2022b).

The feasibility of embedding an exercise-promoting intervention in a cancer treatment setting was resolved following a scoping review (See Chapter 3), making a delivery setting a key consideration in planning and delivering PEI. While efforts are required to optimise service integration both in the short and long term, there is sufficient evidence that embedding such programs in treatment settings is feasible for patients and clinicians and can serve as an effective strategy for increasing access to exercise promotion and rehabilitation for individuals on cancer treatment (Ezenwankwo, Nnate, et al., 2022).

Figure 2.3 (see Chapter 2) shows the collapsing of several factors into five crucial conditions when considering PEI for increasing exercise engagement in PCa survivors. These attributes, namely, hybrid service delivery, credible influence, social support, behaviour shaping, and referral process, are fundamental to the success or failures of PEI in PCa survivors. They, however, needed to be localised, using a qualitative research approach, to identify opportunities and challenges specific to Cape Town, South Africa.

The qualitative research identified several individual, environmental and health system-level conditions for increasing exercise engagement using PEI, guaranteeing that only attributes relevant to men with PCa in Cape Town were included in the DCE. While several factors resonated with PCa survivors in Cape Town, they anchored primarily along four major attributes: program/service, delivery structure, setting, and service personnel. A fifth attribute, service operation, was further introduced, taking into account the time and economic costs of attending the program pose to patients. As an important attribute, service operation speaks primarily to the timeframe (i.e., in terms of frequency and duration) patients

not only are willing to commit to the behaviour change exercise but also believe and anticipate for achieving sufficient gains in exercise skills and confidence to lead an independent and sustainable active lifestyle. In total, five attributes were retained in the DCE. While some literature may support more than five attributes, this number was deemed sufficient for the DCE to minimise the potential for a higher cognitive burden on the patients (P'erez-Troncoso, 2020; Szinay et al., 2021).

5.3.1 Establishing Attribute Levels

Attribute levels ensure trade-offs between attributes in design experiments (Mangham et al., 2009b). They represent an attribute's various functionalities (or variations) in experimental design, the combination of which creates alternatives and, ultimately, choice sets (Szinay et al., 2021). Table 5.1 presents the attribute levels for the five attributes. In determining the attribute levels, qualitative research played a crucial role in establishing among PCa survivors the range of factors and conditions that are critical to exercise engagement in the local context and uptake of PEI. This project aimed for three levels for each attribute to limit the cognitive burden on participants and ensure balance in the design. Lower attribute levels have been associated with reduced measurement error and higher statistical precision (Mangham et al., 2009b). It has also been found to enhance trade-offs between attributes (Szinay et al., 2021).

Table 5.1: Attributes attribute levels

Attributes	Levels
Service/Program	• Counselling/Education (1) • Unsupervised exercise **PLUS** counselling (2) • Supervised exercise program **PLUS** education/counselling (3)
Structure	• Alone (1) • Group-based (2) • Combination of individual and group-based (3)
Setting	• Community centre (or Local Gym) (1) • Home (2) • Hospital (in-/outpatient rehab setting) (3)
Service personnel	• Physiotherapists (or other cancer exercise specialists) (1) • Technology-assisted (mHealth) (2) • Former PCa patient now cancer exercise couch (3)
Service operation	• 12 weeks 1x/wk; 2hr/session Operates Weekends only • 8 weeks 2x/wk; 2hr/session Operates Mon-Thurs • 12 weeks 2x/wk; 1hr/session Operates Mon-Thurs

Note: the numbers in parenthesis (or priors) indicate the weight of a given attribute level relative to others for each attribute (3>2>1)

5.4 Choice Tasks and Blocking

The current experiment is an unlabelled fractional-factorial design with 27 choice tasks. A fractional factorial design was adopted, given the impracticality of including all possible combinations of the attribute levels in the experiment (Carlsson & Martinsson, 2003; Shmatukha et al., 2019). Ideally, a complete factorial design with five attributes and three levels for each attribute will yield around 121 choice tasks. However, using the fractional factorial design, this was reduced to 27 choice tasks with 54 alternatives (or choices). An unlabelled alternative was chosen primarily as the essence of the DCE was to present multiple-choice tasks representing different iterations of key aspects of PEIs to PCa survivors (Jin et al., 2017; Szinay et al., 2021). Moreover, the choices (or alternatives) in the current experiment are unspecified and have similar attributes, consistent with unlabelled DCEs (Jin et al., 2017).

The D-efficient design was implemented in Ngene software (v.1.3) to ensure a relatively balanced and orthogonal fractional-factorial experiment (P'erez-Troncoso, 2020; Shmatukha et al., 2019; Szinay et al., 2021). In balancing the design, priors (i.e., the relative weight of each attribute level) were determined and assigned to the attribute levels by considering data from similar previous experiments (Robles et al., 2020) and relying on the appreciation of the perceived importance placed on certain key factors/conditions by the patients during the qualitative research. While the literature advocates using pilot experiments to determine priors, some studies have shown that insight can be gained from similar past experiments and qualitative research (Kuhfeld, n.d.; Mangham et al., 2009b).

To minimise the burden on the participants and increase the chances and efficiency of completing the task, the 27 choice tasks were further blocked into three separate surveys of 9 tasks each. The choice tests and the blockings were generated in Ngene software. While recent studies have deployed experiments with 13 to 18 choice sets per survey (Abiiro et al., 2014; Michaels-Igbokwe et al., 2014; Szinay et al., 2021; Tan et al., 2022; Tobin et al., 2021), the peculiar nature and treatment burden of PCa was considered. In this experiment, nine tasks per survey were deemed sufficient to optimise the regression model whilst minimising the load on the participants.

To mimic the real world more closely, a neutral option, an opt-out, was included in this experiment (Determann et al., 2019). Consistent with previous experiments, using opt-out will allow the participant the liberty to reject the two alternatives where they have not sufficiently reflected their preferred choice or promised sufficient utility (Mangham et al., 2009b). See Appendices 5.1 to 5.3 for the choice tasks as provided for each of the three surveys/blocks.

5.5 Experimental Design

The Multinomial Logit Regression will be used to determine the main effect of each of the independent variables— the five attributes: program/service, delivery structure, setting, service personnel, and service operation— on the dependent variables, i.e., the 54 choice alternatives (Kuhfeld, n.d.; Mangham et al., 2009b). The utility function for a participant ***i*** making a choice ***j*** in the current experiment is expressed as follows:

$$U_j = (\beta_{j\ service} + (\gamma\beta_{j\ service} \times X_{ij})) + (\beta_{j\ structure} + (\gamma\beta_{j\ structure} \times X_{ij})) + (\beta_{j\ setting} + (\gamma\beta_{j\ setting} \times X_{ij})) + (\beta_{j\ personnel} + (\gamma\beta_{j\ personnel} \times X_{ij})) + (\beta_{j\ operation} + (\gamma\beta_{j\ operation} \times X_{ij})) + \varepsilon$$

Where:

U— represents the overall utility for the choice (or alternative) j

β— represents the part-worth utility associated with one or more features for the choice ***j*** for a given attribute.

γ— represents, for a given attribute, the interaction of choice features for the choice ***j*** and the individual characteristics $\boldsymbol{X_i}$.

The variable **γ** is critical since the overall utility $\boldsymbol{U}$ for a participant $\boldsymbol{i}$ making a choice $\boldsymbol{j}$ is not exclusively the function of one or more observed features of the choice $\boldsymbol{j}$ but also partly the function of the individual characteristics (including the prevailing circumstances) X_i of the participant $\boldsymbol{i}$,

ε— represents the random error of the model or the unobserved attributes of the choices and the individual characteristics.

5.6 Future Research: Piloting/Validating the DCE

The DCE will be piloted and validated once the survey questionnaire is finalised (This is beyond the scope of the MSc thesis). The final survey questionnaire will feature an introduction to the DCE and a sample illustration of how to complete the tasks. The choice tasks will be presented using pictures and fewer scientific expressions (jargon) to ensure ease of comprehension among participants (Fig 5.1). The final version will also be adapted into three other local languages, Zulu, Afrikaans and IsiKhosa and undergo cross-cultural validation before implementation. The final version will also collect socioeconomic data to explore the impact of patients' characteristics and circumstances on their choices. A new application will be submitted to the University of Cape Town's Health Research Ethics Committee to validate and pre-test the final survey.

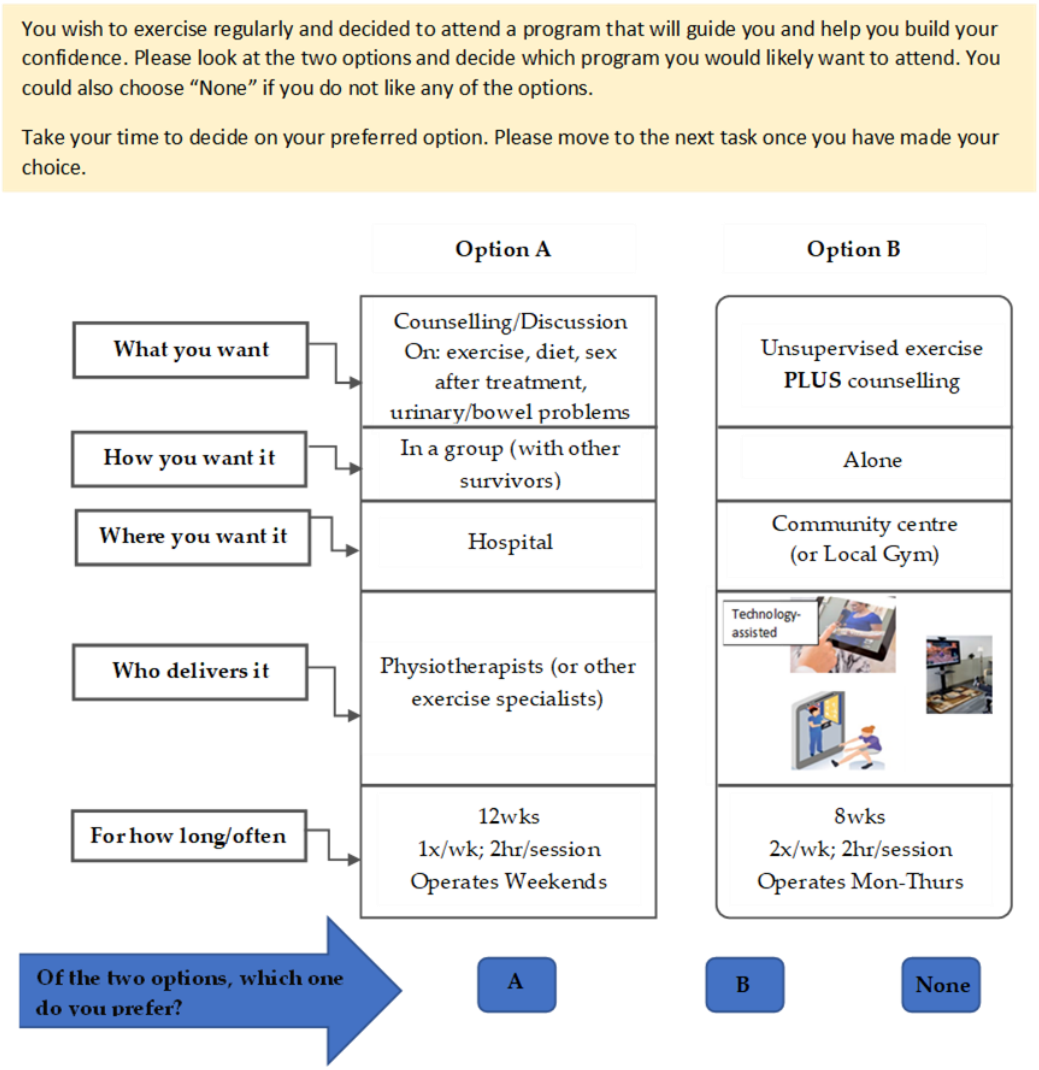

Fig. 5.2: *Sample choice task with an opt-out option*

Validation and pre-testing may lead to minor modifications in the survey, including the rewording of attributes and their levels. Insight will be gained on the ease of comprehension and extent of cognitive burden among participants. The *within-set dominated pairs* will be used to estimate the internal consistency of the DCE (Mangham et al., 2009b; Szinay et al., 2021). Specifically, one choice task with a superior (or dominant) alternative (i.e., an alternative with better characteristics across the five attributes) will be included per survey. Thus, each survey will feature one additional task; each participant will be shown ten choice tasks. The data generated from the added task will serve only to validate the experiment, hence will be excluded from the primary analysis (Szinay et al., 2021).

5.7 Conclusion

Targeting the uptake of complex healthcare interventions in resource-constrained settings requires due diligence from program planners and intervention developers in the planning

phase, especially when considering novel interventions. Efforts must be invested rightly in the early stage to elicit the preferences of the intended users to drive uptake effectively. The current chapter describes the development of a DCE to understand perceived intervention utility and design preferences for a structured PEI to increase exercise engagement during and after PCa treatment in the South African public healthcare context. It has shown how the attributes and their levels were established, the choice sets (and ultimately the surveys), and how the overall experimental design was constructed. The surveys could not be validated at this point, reflecting a major limitation of the current project. While this is beyond the scope of this thesis, validation and pre-testing required a new ethics application and additional funding for execution.

The reliance on primary and secondary sources in elucidating and contextualising attributes and attribute levels reflects the current design's strength. By implementing systematic review methodologies and qualitative research, factors and conditions for increasing exercise engagement among PCa survivors using PEI were identified and subjected to local consideration to understand opportunities and contextual limitations for targeting the uptake of PEI in Cape Town, South Africa. The strength of the current design is also reflected in blocking the choice pairs into three separate surveys. Whilst ensuring that the participants are only subjected to minimal burden as they complete the tasks, it further allows the survey to be deployed over a larger sample of PCa survivors to generate a more statistically efficient model.

The introduction of opt-out further adds to the strength of this design. By allowing the participants to reject the alternatives freely, the current experiment will likely generate a model that sufficiently reflects real-world scenarios. The design is further strengthened by introducing prior at this stage. Although prior is generally established after pilot experiments, data and information from similar past designs and the insight gathered during patient interaction made the introduction of prior and, ultimately, the implementation of D-efficient design feasible at this point.

5.8 Summary of Chapter

This chapter addressed the overarching purpose of this thesis by presenting the design process for a DCE to understand the attributes most valued by PCa survivors for the uptake of PEI. The last chapter of this thesis, Chapter 6, will summarise the entire body of work and provide directions for future works.

Chapter 6— Final Reflections and Future Research Conclusion

6.1 Introduction

This final chapter reflects on the entire project, drawing conclusions and recommendations based on the findings and discussions. It highlights critical research impacts and contributions to knowledge and reflects on the limitations encountered in the course of the project and areas for further work.

6.2 Conclusions

The overarching purpose of this research was to design a DCE to understand critical issues pertaining to effective components and delivery procedures for developing and implementing a PEI to increase daily/weekly exercise in men with PCa. Specifically, the following objectives were covered in this thesis to address the overarching purpose:

1. ***Identify attributes (or characteristics [also variables]) and attribute levels (i.e., different functionalities of each attribute) for developing the discrete choice experiment.***

Two reviews were first conducted to address this foundational question. At the end of the reviews, up to 25 factors and conditions were identified as critical to PEI's success (or lack thereof) in increasing daily/weekly exercises among PCa survivors. Using qualitative research, these factors were further subjected to contextual scrutiny. While several factors resonated with PCa survivors in Cape Town, they varied mainly along four major attributes: program/service, program structure, delivery setting, and service personnel. A fifth attribute, service operation, was introduced, bringing the total number of attributes to five. Qualitative research played a crucial role in establishing the attribute levels. Overall, this research aimed for three levels for each attribute. See Table 5.1 (Chapter 5) for the attribute and the attribute levels.

2. ***Design a discrete choice experiment using a D-efficient design based on the established attributes and attribute levels.***

An unlabelled fractional-factorial design with 27 choice tasks was developed using Ngene software (v.1.3). The 27 choice tasks were further blocked into three separate surveys of 9 choice sets each. An 'opt-out' was included in this experiment to allow respondents to reject the two alternatives in a given choice set where such options have not reflected their preferred choice. The Multinomial Logit Regression was chosen to determine the main effect of each attribute (the independent variables) on the choice alternatives (the dependent variables).

Overall, nine choice tasks were deemed sufficient per survey to fit a regression model while minimising the burden on the participants.

6.3 Contribution to Knowledge

At the beginning of this research, there needed to be more knowledge on the application of structured PEIs for increasing daily/weekly exercise among PCa survivors. Whilst fewer primary studies existed, there needed to be more summary evidence on the overall intervention effectiveness or factors contributing to the success (or the lack of it) in this context. This research provided evidence to support the use of PEIs in this population and further identified plausible conditions and mechanisms critical to the success or failure of structured PEIs for exercise promotion among PCa survivors.

This research further responded to the call to deepen the knowledge base around integrating exercise-based services in routine cancer care. It offered the first comprehensive evidence synthesis of implementation studies that evaluated the near- and long-term benefits of the co-location of exercise and cancer treatment units. It also provided recommendations to support evidence-based practice and policy adjustments for healthcare managers, cancer clinicians, and scientists.

This thesis also provided findings from qualitative research juxtaposing established exercise-promoting attributes with contextual influences akin to PCa survivors in low/middle-income contexts. Being the first to be conducted in South Africa, the study explored major influencers of exercise uptake among PCa survivors. It highlighted opportunities and challenges surrounding using structured PEI for increasing exercise engagement in the local context.

Finally, the overarching purpose of this thesis was to respond to the knowledge gap in the area of using DCE to understand and target the uptake of PEIs to increase exercise engagement during and beyond PCa treatment. An essential aspect of developing complex interventions critical to their uptake and long-term sustainability is eliciting intended user preferences. This thesis detailed the development of a DCE and presented three separate surveys to support program planners and intervention develops in prioritising patient-centred and context-specific attributes critical to the success of PEIs.

6.4 Impact

Part of this research has already been published in two reputable journals. The first study (Ezenwankwo, Motsoeneng, et al., 2022b), published in the journal Supportive Care in Cancer, and explored plausible conditions and mechanisms for increasing exercise in PCa survivors using PEI has been accessed 597 times and cited two times since publication. The second study (Ezenwankwo, Nnate, et al., 2022), a scoping review exploring the feasibility of embedding exercise-promoting and rehabilitation services within conventional cancer treatment settings, was published in 2022 in BMC Health Services Research and currently in the 82nd and 85th percentile of the articles of similar age in all journals and BMC Health Services Research,

respectively. The scoping review has been accessed over 3000 times, cited 10 times, and tweeted 19 times since publication. Remarkably, findings from the scoping study were featured in the American Society of Clinical Oncology (ASCO) Evidence Review on Exercise for oncology clinicians caring for people living with and beyond cancer and published in the ASCO Educational Book (Coletta, Basen-Engquist & Schmitz, 2022), an annual publication of ASCO and featuring selected topics by ASCO'a Annual Meeting Education Committee.

Plans are underway to submit the manuscript from the qualitative research for publication in the journal *ecancer.* Chapter 5, the process description for the DCE, will also be submitted to Taylor & Francis' Cancer Survivorship Research & Care journal. The goal is that this entire body of work provides the foundation and influences the concerted effort required to establish and mainstream exercise oncology clinical pathways in PCa and cancer care in Cape Town and the larger South Africa.

6.5 Limitations to the Research

The COVID-19 pandemic constituted a major limitation to the current project. Given the pandemic outbreak and the broader health systems impact of the disease in South Africa, this research, although initiated in February 2020, could not pick up until July 2021 upon lifting the hold on all human subject research by the University's Health Research Ethics Committee. Whilst the pandemic introduced us to a new set of opportunities including exploring virtual means of engaging with patients during the research, several adaptations to the research protocols in response to the COVID-19 pandemic further meant that the project needed longer time to complete.

6.6 Future work

The next step is the validation and piloting of the survey experiments. This requires administering the survey to a small sample of PCa survivors and improving the surveys using the information gathered. The next step after validation will be to implement the survey over a larger sample and develop a statistical model to understand the design preferences and perceived intervention utility and, ultimately, utilising this information to design and implement a structured PEI among PCa survivors to promote exercise uptake along the care continuum.

6.7 Final reflection

Exercise oncology is yet to be an integral part of PCa management in Cape Town and South Africa, even when sufficient evidence demonstrates the benefit of exercise during and beyond PCa treatment. It is anticipated that this research advances current practices whilst catalysing more research. Factors influencing exercise engagement among PCa survivors are complex and multi-layered. To successfully establish a robust exercise oncology clinical pathway that will effectively address the exercise needs of PCa survivors, current investments must include efforts to account for external factors and delineate plausible intervention pathways.

Recognising the role of PEIs in exercise promotion and the place of a DCE in designing and implementing effective PEI, it is hoped that this thesis will contribute ultimately to efforts to increase daily/weekly exercise among PCa survivors and mainstream exercise oncology in standard cancer care practice in Cape Town, South Africa.

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Appendix 2.1

Sample search strategy (Initial search strategy developed in PubMed)

Population	#1	Prostate cancer OR malignan* OR oncolog* OR neoplasm* OR tumor OR carcinoma OR Neoplasms OR Radiation Oncology OR Medical Oncology OR Radical Prostatectomy
Intervention	#2	exercise OR exercise intervention OR physical exercise OR aerobic exercise OR aerobic training OR aerobic activities OR resistance training OR activity bout OR high intensity OR moderate intensity OR vigorous intensity OR strength training" OR activity bout OR walking OR physical activity) AND (pedometer OR accelerometer OR step counts OR daily steps OR daily walking OR home based OR community based OR group based OR unsupervised OR lifestyle OR lifestyle change OR lifestyle modification OR lifestyle behavior" OR behavior change OR cognitive behavior OR health promotion OR patient education OR lifestyle education OR structured patient education
Outcomes	#3	exercise behavior OR self-efficacy OR behavior control OR daily steps OR step counts OR metabolic equivalents OR metabolic equivalent OR HRQOL OR quality of life OR wellbeing OR fatigue OR cancer related fatigue OR cardiopulmonary fitness OR fitness OR aerobic fitness OR aerobic capacity OR cardiovascular endurance OR VO2 OR walk test OR adherence
P+I+O	#4	#1 AND #2 AND #3
P+I+O+ Intervention studies	#5	#4 AND **(randomized controlled trial OR RCT OR quasi randomized controlled trial OR Quasi RCT" OR controlled clinical trial OR "controlled trial OR pretest post-test OR crossover)**
P+I+O+ Qualitative studies	#6	#4 AND (patient reported experience OR patient experience OR illness beliefs OR **qualitative study)**

Appendix 3.1

Sample search strategy (Initial search strategy developed in PubMed)

Cancer	#1	cancer OR malignan* OR oncolog* OR neoplasm* OR tumor OR tumor OR carcinoma OR (MH "Neoplasms") OR (MH "Radiation Oncology") OR (MH "Medical Oncology")
Exercise	#2	exercis* OR "exercise-based rehabilitation" OR "exercise clinic" OR "exercise services" OR "exercise oncology clinical pathway" OR "exercise program*" OR (MH "Exercise Therapy") OR (MH "Exercise")
Outcomes	#3	(Acceptab* Or Satisf*) OR (Adopt* OR Uptake OR utili*OR implement* OR "intention to try" OR barrier* OR enable* OR facilitate*) OR (Appropriat* OR "perceived fit" OR relevan* OR compat* OR suitab* OR useful* OR practica*) OR (cost* OR economic* OR finance*) OR (Feasibil*OR Utili* OR Practica*) OR (Fidelity OR Integrity OR "delivered as intended" OR adhere* OR "quality of program delivery") OR (Penetrat* OR integrat* OR "spread" OR "service access") OR (Sustain* OR maintenance OR continu* OR durab* OR incorporate*OR integrat* OR institutionaliz* OR maintain* OR routin*OR institutionalis*) OR (MH "Patient Satisfaction") OR (MH "Intention") OR (MH "Costs and Cost Analysis") OR (MH "Cost-Benefit Analysis") OR (MH "Cost Savings") OR (MH "Cost of Illness") OR (MH "Quality Control") OR (MH "Delivery of health care") OR (MH "Comprehensive health care") OR ("MH "Quality of health care")
	#4	#1 AND #2 AND #3
	#5	#**4 AND** (randomized controlled trial OR RCT OR quasi randomized controlled trial OR Quasi RCT" OR controlled clinical trial OR "controlled trial OR pretest post-test OR crossover OR cohort OR prospective OR observation* OR quantitative* OR mixed methods OR qualitative*)

Appendix 4.1

Sample flier for participant recruitment

Appendix 4.2

UCT HREC Ethics Approval

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room G50- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-submissions@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

26 July 2021

HREC REF: 329/2021

Dr Y Albertus
Division of Exercise and Sports Science Medicine
Newlands
Email: Yumna.albertus@uct.ac.za
Student: Eznelo001@myuct.ac.za

Dear Dr Albertus

PROJECT TITLE: EXAMINING PRIORITIES, NEEDS, PREFERENCES AND EXPECTATIONS OF MEN WITH PROSTATE CANCER TO OPTIMIZE PATIENT EDUCATION INTERVENTION FOR PROMOTING PHYSICAL ACTIVITY ENGAGEMENT-MSC CANDIDATE-ELOCHUKWU F EZENWANKWO

Thank you for your response letter, addressing the issues raised by the Faculty of Health Sciences Human Research Ethics Committee.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020 & 06 July 2020.

Approval is granted for one year until the 30 July 2022.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Elochukwu Ezenwankwo will also be involved in this study.

Please quote the HREC REF 329/2021 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

HREC/REF329/2021sa

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE
Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2020), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

Appendix 4.3

Groote Schuur Hospital Ethics Approval

Western Cape Government

GROOTE SCHUUR HOSPITAL
Enquiries: Dr Bernadette Eick
e-mail: GSHReserach.Request@westerncape.gov.za

DR YUMNA ALBERTUS
DIVISION OF EXERCISE AND SPORTS SCIENCE MEDICINE

E-mail: yumna.albertus@uct.ac.za/ eznelo001@myuct.ac.za

Dear Dr Albertus

RESEARCH PROJECT: Examining Priorities, Needs, Preferences and Expectations of Men with Prostate Cancer to Optimize Patient Education Intervention for Promoting Physical Activity Engagement- MSC candidate: Elochukwu F Ezenwankwo

Your recent letter to the hospital refers.

You are granted permission to proceed with your research, which is valid until **30 July 2022.**

Please note the following:

a) Your research may not interfere with normal patient care.
b) Hospital staff may not be asked to assist with the research.
c) Confidentiality must always be maintained.
d) No additional costs to the hospital should be incurred as indicated in your Annexure 2 i.e. Lab, consumables or stationery. **If access to TRACK Care/NHLS is required, kindly attach our letter of approval to the application form and approach Information Management to assist with data.**
e) **No patient folders may be removed from the premises or be inaccessible.**
f) Please provide the research assistant/field worker with a copy of this letter as verification of approval.
g) Should you at any time require photographs of your subjects, please obtain the necessary indemnity forms from our Public Relations Office (E45 OMB or ext. 2187/2188).
h) Should you require additional research time beyond the stipulated expiry date, please apply for an extension.
i) Please discuss the study with the HOD before commencing.
j) Please introduce yourself to the person in charge of an area before commencing.
k) On completion of your research, please forward any recommendations/findings that can be beneficial to use to take further action that may inform redevelopment of future policy / review guidelines.
l) Please contact Michelle Riley (Patient Fees) at ext. 2276 to ascertain if there will be charges for conducting the Research and to obtain a quote or to discuss charges
m) Kindly submit a copy of the publication or report to this office on completion of the research.
n) At no time should any posters encouraging patients to partake in research, be displayed within a clinical area.
o) Please adhere to ALL COVID-19 regulations and Groote Schuur Hospital policies.

I would like to wish you every success with the project.

Yours sincerely

DR BERNADETTE EICK
CHIEF OPERATIONAL OFFICER
Date: 24 November 2021

C.C. Mr L. Naidoo, Prof. J Parkes, Dr. H Aziz, Prof. J Lazarus

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Appendix 4.4

Sample early thematic coding (sample themes, subthemes and categories)

All participant information has been redacted.

		Private patients	Government patients
THEME 1: Post-treatment experience (5 sub [or descriptive] themes)			
Subthemes	**Categories**		
a): Activity limitation		/I think what happened initially was the fact that...the first three or two weeks I was stuck. First week you're in bed and walking around a little bit. Second week, you're sitting outside, doing small walks./	
b): Post-surgery discomfort		/The post-surgery discomfort was clearly because it was surgery and invasive. I would say the first two weeks specifically, but the first week was the worst. And obviously until the catheter was out, the catheter added a level of discomfort for obvious reasons. Then once the catheter was out, the discomfort was really around the abdomen because of the invasive surgery./	
c): Treatment complications	Sexual (erectile) dysfunction	/I mean it's non-existent still at the moment. There is no intercourse because I can't get an erection at this stage; half, maybe. / /I usually have frustrations and obviously sexually is the one. I take medications…which sort of help and I'm hoping that things will normalize. They say it can take a year or more. And then actually another thing is the leaking. / /Okay. look, I certainly did not enjoy the fact that after operation, I suffered more from erectile dysfunction. It was there before the operation, but I could manage to get erections and achieve an orgasm and have penetrative sex. After the operation, they couldn't save the nerves on both sides. So, it meant that I had a uni-lateral prostatectomy. They could only save the nerves on one side. And that pretty much prevented me from that point onwards of achieving a full erection. That was a big change for me. I haven't been happy about that, but I just got to live with it. / /Erection hasn't been what it was before the operation. Physical size of erection is a lot less than what it was before the operation. And obviously, Fortune you know, your orgasms are the same, but you just don't have the mix, there is no semen obviously. / /Well, I don't have any [sexual] function at all. Because of the seriousness of my cancer, ... there was no nerve sparing. Any function that was left was destroyed by the radiation therapy and the anti-deprivation therapy. / /Because I had reasonably extensive surgery, there are sort of erectile dysfunction issues because they couldn't spare all the nerves. So, you know, if it had been picked up earlier, that wouldn't have been as much of a problem. /	/Well I must say that it had a real dramatic impact on my life, negatively. You know I do like to console myself and say, well, if it wasn't for this, you would have died. One of the doctors told me that in the post-radiotherapy session I would lose my ability to have an erection and ejaculation would be dry. And I said, you know, at the time I'm an old man, I was and I am older now and you know it wouldn't be significant but regrettably in the real world I find that to a woman that is something significant and I'm sort of like working on finding an alternative./ /My sex life is not so go anymore. [...] My erection is not good anymore./
	Urinary incontinence/bladder dysfunction	/...the radiation therapy in particular impacts the bowel function. If I need to go to the toilet, I can't delay it. There's a weakness to the system as a result of the radiation therapy. As far as the bladder is concerned, occasionally I might have a small mishap. /	

		/It has changed a bit because obviously having the prostate removed has its own negative impact. You can't be away from a toilet for too long a time. So, you got to plan for that, not drink too much fluid in the morning. / /The leakage was an issue for a while, about 12 weeks; well, they've got less and less and less. I went to see [a PT] after the operation, and she gave me some exercises to do.... and I kind of felt I needed to get rid of the pads as quickly as possible. It took me about four or five weeks to go off them. And then after, it was fine. Once every five, six months, if you had a lot of alcohol or a lot of coffee, there might be like three or four drops. But that's the worst effect I had after the operation./	
	Weight gain		/I was gaining a little bit of weight after the treatment and the injections they gave me…/
d): Recovery		/Well, [my week] has changed drastically since I've had the surgery. Obviously the first week after the surgery I was recovering— post surgery recovery which was uncomfortable but there was steady progress every day. Three weeks after surgery, I was booking a holiday. Three weeks after surgery, I came back to work. I didn't quite work a half day; I probably work to three quarter day. And four weeks after surgery, I went on holiday. I felt strong enough to go on holiday. So, I drove the vehicle myself. And it was probably six-to-eight-hour drive, and I took part in a lot of physical activity, and I served four weeks after the prostatectomy very successfully. And... now recovering very well. And I was very pleased with myself./ /After the operation, it took me a good month or two to feel strong because the operation so hit me physically quite hard. I didn't feel sort of good and well and whole for about two months. /	
e): Repriori tization		/...they say that cancer changes people. ...it changed your outlook on life. So, from just knowing I have the cancer certainly changed my outlook on life. It certainly changed my attitude towards work. I'm a partner in a company; ...but I realized I needed to adjust my lifestyle in terms of work to more focus on family; you know, less time at work. After analyzing it, I realized that the amount of time I was spending at work was actually not practical time or useful. It was really just to be here [at the office]. I felt it was more of a guilt having to be here at office, so that changed. I spend more time doing a variety of things, extra curricula activities. I like restoring an old Land rover, so I spend more time doing that now. I spend more time with the family. I go home to walk with my wife every evening. I go home early before it gets dark. I spend less time at the office, and I get less angry. / /...being forced to sit on one spot, and not running around and doing whatever I wanted to do makes one [to] analyze [things]. ....you're forced to sit, you're forced to lie in bed, you're forced to sit in the sun on a chair getting vitamin D..... And when you're forced to do all that, you can either use it positively or negatively, and I am fortunate to be the kind of person that uses it positively in analyzing and changing my life, my	/Um… staying healthy, staying well. I'm not gonna be healthy I know that. I'm a diabetic. I'm well enough to get up in the morning and look after myself, wash myself. That's all that's important now as you get older, I can't read anymore because of my eyes are bad. So I get books that you put in the machine and it play the books for you! So you get a library called, South African library for the blind in Grahams town and they do that… and send it to you…but I'm gonna have to stop that too because…/ /...I don't worry where money comes from because we don't have money, but I worry about is the is the electricity gon' be on, is the water on, is the washing machine working, you know those are the things now./

		attitude. So, the physical impairment and discomfort just made me sit and reflect. / /I think, Fortune, remaining positive. I've talked to my traders, male friends, and colleagues about have they been checked for prostate problems? Do they check their PSAs annually, you know with either the doctor or urologist? Because it's so prevalent literally in men 40 upwards, you know. So, I remained positive. Fortunately, you know, it was contained— the prostate didn't penetrate the cells. I was all cleared. Because the surgery— My Doc had to cut some of the nerves, just in case, the cancer had spread. But when it was analyzed, the cancer hadn't penetrated to the wall of the prostate. So, I was blessed with that. I think just remaining positive about what has happened about my treatment. And just share this with males, male friends, people I've come across, you know, even my son that's 27, telling him, look to always have his "prostate" done when he gets older, from 30-35. You know, I think it's just keeping active and remaining positive. / /Not really, you know. Literally when I was diagnosed and during the treatment, I had quite a lot of concern for the future but now it doesn't bother me very much. / /My priorities are to look after my health because I'm also a Parkinson's disease sufferer which I've had for 10 years. Obviously to keep my business going. I've good people to take care of the offices in Cape Town so the business is running on time. I've got to look after my health as well. So, my priority has changed a bit to look after my health./ /I'm not someone that dwells on these things. Look if my PSA was still climbing and I was having to consider radiation and stuff, then it would occupy my mind. But thank goodness, right now, I've moved on, you know; and I'm happy to give advice to anyone that asked. But for me personally, I've had bike crashes and shattered capitalism, broken asset. You know, I'm used to things going wrong with my body, either self-induced, or, or otherwise. So, it's not— you know, I don't linger on these things once sorted out, and I'm more or less functional again. It's sort of history and I move on. So, you know that's just me. /	
Autonomy		/I think it's to try and not use [pads] as much as possible. Don't be a baby and a dummy. I'm thinking the mental part of it is very important in terms of controlling the leaking, yeah. If you don't wear it, you know it's going to be a problem if you don't think about it. Whereas if you're wearing it, you can almost forget about it. If you know what I mean. You get lazy, you get lazy in other words, whereas if you don't, it makes you think about it, it makes you exercise your 'Kegel' more. I think that's quite important. That I've only just realized on my own. I would say two months after my surgery I started realizing that I was using it because it was easy and then I thought, okay, now I'm actually just getting lazy. Let's try without. And the weekends, I don't use it if I'm at home. / /I went to see [a PT] after the operation, and she gave me some exercises to do.... /	

		/I went to [the PT] she gave me all the exercise. [She] work with the doctor who did the operation. He strongly recommends that "you" go to her, that she trains you how to have the second set of muscles take over from the functions which is basically stopping the flow. /	
THEME 2: Physical Activity Post-Treatment (5 sub [descriptive] themes)			
a): Nature			
	Incidental PA lifestyle	/Well, it's not an exercise program specifically. But...I'm a busy person. I'm not hyperactive but I'm busy. It's not that I go to the gym to exercise, but I'm busy around the house and that's exercise. I'm busy with the old Land rover I'm restoring, that's exercise.... I surf a lot and that's obviously a lot of exercise. / /I've always exercised. And I carried on. Not quite as I used to, say, 20 years ago. I used to run marathons, I used to do things like that. But my job is a physical job so that just carries on. And I... you know, things like walking and maybe sort of exercises at home might carry on with./ /Exercise has always been part of that, but not in any, let's call it, excessive way. Some people ride bikes every day; some people climb the mountain every day. I don't do that. But it is sort of part of my life- one way or another I will be doing something which exercises my muscles. /	/I am always busy every day of the week. I do the sweeping of the garden, I clean the pool, I cut my own grass, I do my own washing, I do my own ironing and then exercise 5 times a day./
	Purposeful PA	/Well, I try and gym two or three times a week, if possible. Definitely twice a week, sometimes three times a week, I do gym. I do my walks, where possible, you know, an hour's long, three or four or five kilometres walks, where possible, or hikes over the weekend with my wife. / /I gym twice a week. I cycle, mountain biking, with my wife over weekends when we can. I do a lot of walking with her. I do an average of five kilometers a day walking, and then we go for hikes in our mountains./ /I've always exercised since I was 35...and for the last maybe 40 years, I've exercised continuously. I've never stopped. / /My wife and I are both keen on exercise. As I said, we exercise 5 to 6 days of the week. If we go on the long hiking trip to Cedaberg, we hike every day, 5 to 6, maybe 4 of 5 hours of hiking. / /I do sports. there's been a slack a little bit because of COVID. But generally speaking, I train about three to four times a week; I do mountain bike races. So, I'm relatively fit. / /I've always been fit and active. And I continue to be fit and active. I just came back from a ride half an hour ago. I ride a couple of times a week. I go to gym a couple of times a week. I'm not excessive because I do see my cardiologist every year, and the discussion I had with him is that I see quite a lot of my friends who are quite competitive, sort of age group wise, and they're getting the heart, the atrial fibrillation and all sorts of things. And my cardiologist is saying, "Look, when you get beyond 60 or so, and you push yourself too much, then	/I've got the lists here from the Biokineticist. There are a whole lot of programs that I have, some from the previous trainer and I progress to a biokineticist. I had never known the existence of a biokineticist. The exercises, if I could group them, there's like a group of flexibility exercises which for me is very important because I'm not very flexible. I have never really done exercises. I've been a workaholic, to be honest with you. All my qualifications and degrees, I got part-time so I was really busy. But now I'm focused on myself. So I have my flexibility which I see a big improvement since I'm here, especially here that I'm in Johannesburg. So that's flexibility. The other one is like balance exercises because, Uhm, old people tend to stumble and fall and break their hips and die. So it is good to improve your reflexes, I have discovered, so that you can steady yourself. I can stand on one leg now and pick up my other leg and stand for 60 seconds. That is for me big improvement. And then I think the third one is a little bit of like a light weight that is appropriate for my age. Nothing that is very heavy, just exercising muscles that have been used before, you know, like sitting on a box and then bracing yourself, doing it 10 times and then going up and down without lifting yourself physically off the box, just by the stretch of your legs./ /I used to do the Canadian air force exercise. It's a little book called Canadian air force exercise. It's mainly for the air force but you can do it at home. I used to do push up. I have

		this can be an [issue].” So, I'm not a fanatical sports fan, but I just do, you know, an hour and half; two, three, four times a week with moderate exercise. So, it covers that question. /	to lie on my side, my arm up and one leg up. I have books on that you know and when I travel I do my exercise. It’s very interesting./ /Yes, I have a sheet of exercises or things to do, to stretch, leg lifts up, arms lift up, [...] hold on the back of a chair, to drop down to one knee but not touch to the ground and the other leg straight, and then you would do exercises with your arms up in the air, sideways, forwards, and bend forward and way back. Twist your arm things like that./
b): Exercise enablers			
	Previous exercise lifestyle	/I've always exercised since I was 35...and for the last maybe 40 years, I've exercised continuously. I've never stopped. / /I think the pre-op “physical” is as important as the post op. I was surprised that— and no one said that I couldn’t, but I was surprised that I could actually do a push up. And it didn't feel pressure where I thought it would. / /I've always been doing that on my own. From when I was young, I was always very active playing various sport. I really enjoy doing squash. I did many cycle tours. So, I’ve always been a fit and active person, you know, all my life. You know, from exercise, obviously playing squash, hikes, walks. / /I had a gym membership...just to keep fit. So, I'm not overweight. I have a reasonable weight. I had a gym membership, and I went to gym, not every day but once or twice a week maximum. / /I've always kept active, from riding bicycles to— I used to run marathons but I've got a lot of arthritis so I had to stop because my knees wouldn't run anymore. And I've been pedaling; I've done ... marathons, I've cycle.. So I've always been fit and active. And I continue to be fit and active. I just came back from a ride half an hour ago. I ride a couple of times a week. I go to gym a couple of times a week. I'm not excessive because I do see my cardiologist every year, and the discussion I had with him is that I see quite a lot of my friends who are quite competitive, sort of age group wise, and they're getting the heart, the atrial fibrillation and all sorts of things. And my cardiologist is saying, “Look, when you get beyond 60 or so, and you push yourself too much, then this can be an [issue].” So, I'm not a fanatical sports fan, but I just do, you know, an hour and half; two, three, four times a week with moderate exercise. So, it covers that question. /	
	Spousal support	/I gym twice a week. I cycle, mountain biking, with my wife over weekends when we can. I do a lot of walking with her. I do an average of five kilometers a day walking, and then we go for hikes in our mountains. / /days, we go for a walk in the nearby nature reserve on the mountain, at most days. / /My wife and I are both keen on exercise. As I said, we exercise 5 to 6 days of the week. If we go on the long	

		hiking trip to Cedaberg, we hike every day, 5 to 6, maybe 4 of 5 hours of hiking. /	
	Timely reminders	/I've just got an alarm that goes off at half past six every evening on my phone, and that reminds me because I'm very low scope. I don't remember things. So, when that goes off, I do a few minutes of Kegel exercises, and I have absolutely no problems now. / /There are people, and your no doubt aware that we've got a sort of an email group which people share their sort of experiences and stories on it. There are people of which I'm not one of, where they do remember to do these things. And every day when they brush their teeth for six o'clock, every morning, anyway, they are able to keep to a routine. With COVID I lost mine; anyway, I've never been able to stick to routine, which is why I use the phone. So, for people like me, it works for me. Let's put it that way. /	
c): Perceived exercise benefits			
	Cope better with PCa	/Anybody who after diagnosis of cancer, if you're not exercising already should very seriously think about that. Because it not only helps with your fitness and recovery, but it also helps with your mental calmness; it helps you cope with the disease much better, in my opinion. / /You know, normally if you're diagnosed, you're going to get operated on fairly soon, you know, within a month or two. And, for reasons of general health even if you didn't have prostate cancer and especially when you're getting older, just keep active because, boy if you don't use it, you lose it. I think any male that is not keeping himself reasonably physically fit— you have to do something about it. /	
	Sense of validation	/...what I found was, I was encouraged every time I could do a push up. I thought, hey, no one said I could do push-ups. But I can do that. And so that's suddenly the encouragement, hey, I'm actually getting back to normality. I'm not such an invalid. /	
	Improve general wellbeing	/If I'm not feeling strong and healthy, it interferes with my surfing and then I don't work. So, that's why I'm healthy. /I just think your overall fitness, whether it be pelvic floor exercises or anything else. Just an overall fitness. I just think that any exercise in that area would be beneficial to anybody, you know, that is not on, or hasn't been on one. / /For anybody that does not exercise, that's really crazy because exercise makes all the difference to your quality of life... I mean, it's I think— I don't think really it should just be confined to prostate cancer. Anybody should be exercising at least three or four times a week. / /I do as much stuff as I did 10 or 20 years ago. If I wasn't doing it, my whole outlook on life would be different. It just gives you a totally different view on everything. I think for me it does. I would just look for tall a building to jump off if I couldn't exercise. /	
	Improve recovery	/Every single day, especially after the two weeks, I was getting stronger and more flexible. I was stretching my abdomen, arch my back, backwards. After two weeks, I	

		was starting to do a push up or two which I could do successfully. So, the discomfort was disappearing, but it was just abdominal discomfort. By the fourth week, I had no discomfort. I could do physical exercise. I could run; I could surf without having a problem with that. / /I think what is important and what helped me personally-- I mean, I was surfing. And surfing is like swimming, it's energy sapping. It involves a huge range of motions. And you need strength. I was surfing four weeks to the day. Exactly four weeks after my operation and I felt strong, I felt good, and I felt healthy. I think one of the keys to that speedy recovery was being healthy before the operation. / /...I would say to push on getting a range of exercises. That will get the patients or the recovering person to surprise themselves. That's encouraging; and to get back to normality as quickly as possible. / /Before my operation, I intensified my exercise so that when I went in for my operation, for my initial prostatectomy, I was very fit. That had a massive benefit. I was out of hospital the day after my operation and the day after that, I was already walking in [Kirstenbosch], to give you some idea on my level of fitness. And I've maintained that. At the moment we walk, I would say, 5 to 6 days of the week...including hiking trips to places like Cedarberg and what have you. / /I was really fit before I went into the operation. And six weeks later, I did a bicycle race. So, it's a relatively seamless changeover for me to the new format. /	
	Mitigate treatment complications	/And if I did find myself dribbling a bit due to incontinence, it was because I hadn't been doing my exercises. / /… I did [the Kegel exercises] fairly regularly but pre-op, and with the result that post-op, once the catheter was removed, I was completely [fine], I mean, I bet you didn't need to wear any pads afterwards. So, I was pretty much fully in control of my bladder. / /I think absolutely essential, especially as I said a minute ago about [the PT's] thing. That is very critical because it's the difference between being incontinent post-op or being in control of your bladder. So that is of huge importance. /	
d): post-treatment exercise barriers			
	Ageing	/I found that as I've gotten older, I don't really want to do the running and that sort of stuff anymore. But I've always kept fit and healthy. / /I think levels of fitness from when you were maybe 45, maybe 50 has changed. You don't have the stamina— what I did have when I was 45, 42 or when I was maybe 50. So, I don't have that physical stamina. But certainly I think from an exercise point of view, for my age, 68, I think I'm a lot fitter than quite a few people. I know people who are now in my age group that sometimes don't do that much exercise. /	/I get cramps in my legs you know, so I will sit and wiggle my foot around, to the left, to the right; turn to the left, turn to the right. And then I will lift my foot from the ground up and lay on the ground and back up not high but high enough that I can hold it up and sometimes I dance. I dance with myself in the kitchen and that's it. I don't do…, it's not safe for me to walk- there's a lovely walk along here from the garage up the road right to Westgate Village, it is right between houses and it's not safe. There are people living along there, and

			you can't- and when you white, they all think you got money./ /I don't walk anymore and also I can't cross roads anymore cause the cars don't stop. I'm scared to cross the road.../
	Comorbidities	/...in the mornings I just take too long to get going with my Parkinson's. It has nothing to do with my prostate cancer— that's just my Parkinson's disease. It takes a bit too long before my medication kicks in to get going. I'm trying new medication now for that, so I think that still helps a bit. / /Parkinson's is standing in my way at the moment because it takes too long to get dressed to go for a walk. By the time I'm dressed to go for a walk, and then come back and have a shower and get dressed for work, the whole day will be gone.... / /...with the Parkinson's it is a bit difficult to have an exercise programme because not every day is the same. Some days, I have very good highs, and some days I have very bad lows, you know, so it's a bit difficult. / /Not because of prostate cancer but because of Parkinson's. I have a moving disorder, dyskinetic. I also have stiffness because of Parkinson's. Depending on where my medications...the movement is purely because of Parkinson's not because of prostate. /I used to run marathons but I've got a lot of arthritis so I had to stop because my knees wouldn't run anymore. / /I've got quite a lot of issues, health issues. I've got ankylosing spondylitis, which is an … thing; I've got hemochromatosis which is sort of iron overload; also, quite a bit of arthritis. /	
	Fear of adverse events	/As a patient, post-op, especially the first couple of weeks, you don't do it because you're scared of tearing something, you're scared of something happening. / /I think it was recommended six weeks before I got back on my bike. And I have been known to be a bit reckless in the past. I for once listened to the doctor's orders because of the urethra that had been stitched together. I didn't want to rupture that and cause a whole lot of problems. / /I will...repeat, leave it enough time, because there's someone and I can't remember who it was that I heard of the other day that I think week four after the operation, they went cycling and they ended up with all sorts of complications. So, give it enough time to heal. And because that urethra, it goes up right, I mean it's very exposed when you're sitting on a saddle, and if that hasn't healed properly, and it ruptures or, God forbid, I mean, I can't think of it. Anyway, one is quite tender there. Your perineum or whatever it's called is fairly tender, so I don't think you want to sit on a saddle too soon. But I think if you_, whatever the doctor recommends. In my case, it was six weeks and moderately building up. /	

	Inequalities (safety concerns/unsafe neighborhood)	/I was going to school where we had to exercise and I'm in a society where it is the damn thing. But I can understand probably 80% of the population in South Africa doesn't approach life quite that way. And getting regular exercise is very difficult, if not impossible. / / It's difficult for me as a privileged Whitey to sort of put myself in the position of someone who's living in a township, let's say, or something like that, where you're almost don't go outside because you couldn't for reasons of safety and security. /	/The area now that we live in? With all kinds of things that can affect you, you know crime, you can't just get up and walk like in the old days for 5 or 6 kilometres. It is difficult because the possibility is there that around the next corner you'd get robbed, you'd get mugged. It's a totally different thing I would say, you know, than the earlier years. If you go to the media you will see all the crimes that are happening here. There are gangsters, there are guns in the area. The police are not performing the way they should perform. It's a huge impact on us as a community. For example, a normal person, who doesn't have a car, must wake up in the morning, walk from where he lives, and takes a bus to work, you know, he can easily get killed./ /I don't walk anymore and also I can't cross roads anymore cause the cars don't stop. I'm scared to cross the road.../ /...when you get older it's not safe on the streets. I've been knocked down twice. Last time it was the 14th of 2020, the year before last, say 2020. Now I've got a numb leg it gets numb because of that. And I had a concussion I didn't know where I was but I remembered. The person who knocked me down, I walked in the road, coming home… I saw a car coming towards me and when the car seems to slow down, and then they changed, and I stepped forward. I didn't see anybody hoot; I didn't hear the car… Nothing. I couldn't feel the car hitting me, the next thing I know was lying on the ground./
	Inhibitory messaging	/ [The] doctor might say, oh, you got to be careful of a hernia. But I would say to work on core muscles as soon as possible. ... I think there's not enough emphasis on focusing on what you can do. As a patient, post-op, especially the first couple of weeks, you don't do it because you're scared of tearing something, you're scared of something happening. / /I'm not excessive because I do see my cardiologist every year, and the discussion I had with him is that I see quite a lot of my friends who are quite competitive, sort of age group wise, and they're getting the heart, the atrial fibrillation and all sorts of things. And my cardiologist is saying, "Look, when you get beyond 60 or so, and you push yourself too much, then this can be an [issue]." / /I wasn't advised on the sporting side of things other than [I] asked the question and he said, Look, six weeks so just take it easy. And I listened to that. /	
	New complications	/… for reasons that no one can quite explain, I had a blockage. I had to be re-catheterised. ... I wasn't quite as continent after the second catheter was removed. But after the first catheter came out, I was fine. And I do, not as I do Helen Shore's exercises…./	
	Poor exercise awareness	/I think exercise can be good, specifically for pelvic floor. That's all exercise will do; it won't help anything else. It won't help the erectile dysfunction and so/	

		/You don't need to do anything more than walking... It's low impact, it's cheap; anybody can do it. / /I don't think it's of much use to me. I don't know if there's any proof that regular exercise would have prevented prostate cancer. ...[I] don't think there is enough proof about that. I know it's genetic because my dad died of prostate cancer, my brother has been diagnosed with prostate cancer. So, it's a family thing. You know, I'm not sure if exercise before, if that would help. If there are studies available that proves that, that would assist or motivate me to get onto an exercise program. /	
	Cancer-related fatigue		/When you're doing something, when you work hard or like do something in your garden, you can't do it like you did it before. You're weaker than before. You're getting tired. You get easily tired, sou see?/ /Um well I get very tired very quickly so I gave up./
	Work/time constraints	/...you know getting home after 7pm obviously stops you from the afternoon exercise... /	/I work a full day. Okay all people work a full day but in the afternoon, you get home you're so tired, and then there are a few things at home that need attention, your family. You must also make time to do your religious things./ /The fact is that I already have a full day, from the morning, 5 o'clock till the afternoon, 4 o'clock, and you've got your own things to do./ /[...] ...but the time is a problem. Like I said I'm still active in working. My day starts very early in the morning. By the time you finish in the afternoon, who still wants to go out after a hectic day at work? It is difficult if you have a 9 to 5 job in the city./ /But the main thing again is the time. I have to go to work earlier in the morning, like 5 o'clock, so I have to wake up earlier than 5 o'clock. And how much time do I have? Say, half an hour or 20 minutes, not much of a time you know. Maybe over the weekend, you've got one hour, two hours, say one hour on Sunday to do something different, you know./
Creating excuses		/You know, there is always an excuse— you'll always find an excuse not to do [something] /	
Cost			/...and money. If someone will pay for your gym or subsidize [the cost], it will help./
e): Referral paths			
	Physical therapy	/They recommended therapy, physical therapy...and that was specifically to deal with the leaking, the incontinence. / /I think, and I don't know what they are, you would have to speak to the physios, but ...I would say to push on getting a range of exercises. That will get the patients or the recovering person to surprise themselves. That's encouraging; and to get back to normality as quickly as possible. /	

		/I went to see [a PT] after the operation, and she gave me some exercises to do.... / /I went to [the PT]…she gave me all the exercise. [She] works with the doctor who did the operation. He strongly recommends that "you" go to her, that she trains you how to have the second set of muscles take over from the functions which is basically stopping the flow. / /The other thing was the physio, which was essential, which she's got ehm— I've forgotten what the name is, but I'm sure other guys you've spoken to would have mentioned her. She's got rooms in Weinberg. With her help and advice, and if one follows pelvic floor exercises, Kegel exercises, the incontinence thing, I think you'll be much okay. I imagined they are here and there. Not everyone's okay, but certainly for me, and I wasn't that religious about doing the exercises. But I understood what they were doing. And if I did find myself dribbling a bit due to incontinence, it was because I hadn't been doing my exercises. /	
	Exercise	/Nobody recommended exercise as such. I would have been surprised had they recommended because most doctors don't really go into a full post-operation discussion. / /Look, I've always been doing that on my own. From when I was young, I was always very active playing various sport. I really enjoy doing squash. I did many cycle tours. So, I've always been a fit and active person, you know, all my life. / /I wasn't advised on the sporting side of things other than [I] asked the question and he said, Look, six weeks so just take it easy. And I listened to that. /	/No. I just read some books. [...] I read through the encyclopedia volumes of the health department section. Whenever I had a problem with something, I consult my medical books. I look it up and then carry on whatever advice that I discover there./ /No, absolutely, no one not at the hospital in any case. I did ask and enquire, and I tried to do a bit of reading on the internet but it becomes dangerous when you start to read and pick up knowledge, it wouldn't help. In fact, I often thought when people get radiotherapy or chem, somebody should have...said, you know, now that you have the treatment this what you should do and not do. Simple things like that would have been immensely helpful for anybody./
THEME 3: Thoughts regarding the future program (7 sub [or descriptive] themes)			
a): Being part of a group		/Although I am part of the prostatectomy group. I don't take part in anything. One of the reasons, rightly or wrongly, I don't know. I don't want to fall into a trap of feeling sorry for myself and I don't want to be dragged down by people feeling sorry for themselves. I find that very irritating. It's an irritation. I'm a cancer survivor. I'm a prostate cancer survivor. I still want to be part of that group. But I don't want to get dragged into it. It's not my identity. My identity is recovering from it with confidence and just getting on with my life in a healthy way. That's my identity. And not the fact that I'm a cancer survivor or a member of that group. I don't want that featuring in my life. / /We are on a group. So, this is a very, very positive thing. Before the operations, you are sent 10- or 15-people's names— the doctor sent it to you confidentially, obviously, to be able to talk to them about their experiences, the experience you are going to go through because there's a lot of questions we have. That helps tremendously; and also to check the quality of the operation and the person who does the operation. Then	/Group exercise so that I can meet other people that got the sickness. I'm talking about other people with cancer/

		afterwards, you get put onto your group and we are now 60, 70, 80 people on that group, asking any questions, practical experiences, what happened. And you find that people ask not the strangest question, but something's which you have never thought of. That's a very valuable forum where you can ask any question which bugs you. And then you find out some people had really, really good experiences and some people were struggling. A common denominator to me is definitely the physical thing— the sexual abilities is the thing which comes up very frequently. /	
b) Individualised programme			/I suppose it all depends on one's personal condition— like I really needed personal attention. I had to force my budget to accommodate the cost of a trainer. It's difficult for a pensioner. [...] ...I think people have different needs depending on their physical condition or how they have neglected their bodies or not neglected them. For example, I found that when the biokineticist gives me exercise, sometimes he will ask, If you're doing the exercise, where do you feel the tension? And then if I point at the wrong place he'd say, No, you're doing something wrong, twist your arm or something like that. Initially, he'll make sure the people are targeting the correct place on their bodies./
c): Dealing with your treatment		/I think the recovery after cannot work properly without a change in lifestyle before. I think they go together. What you put in, what happens before your prostatectomy, or even your diagnosis is important— as important as how you deal with it afterwards, in my opinion. And I think that's what got me to such a speedy recovery.... /	
e): Building self-efficacy		/Sometimes they don't even have the right motivation. Because they don't know what to believe or not to believe, there's not enough motivation.... I think the program will motivate people once they are diagnosed, to a healthier lifestyle. I think I can't emphasize more what a healthy lifestyle, what a difference it makes. /	
f): Increase health literacy		/...the program would be hugely beneficial, hugely, because I think people don't— there's a lot of information out there on what to do...but I don't think people know what to believe or not to believe. / /Yes, as I told you, if you go to Groote Schuur Hospital, [...] there is a social worker that speaks to the men about prostate cancer. And I always sit in with the social worker saying to the other men what prostate cancer is about. /	
g}: Not interested in the program		/For me, personally, I don't think I'd be looking for it or wanting to engage in that. Of course, the nerve sparing, the erectile nerves are not working, and I don't believe exercise, would help that. /	
h): Optimistic about the programme			/Well, I would welcome it. In fact, I would like to ask you if I could come and see you when I come to Cape Town because I'm not sure if you are saying that there is a benefit from exercise for people who had prostate cancer. If you are saying that, which I really was not aware of, then I really would like to see if I can start some of those things that would be in your program which is more relevant for me. [...] I am not really sure about exercises that have any

			correlation with feeling better prostate cancer. So I would welcome to see you at your convenience when I'm back in Cape town./
i):Cost			/I won't be able to afford anything because I'm a pensioner./
j): Delivery mode/service location			
	Online program	/I've seen some very good exercise programs that my wife has been following during lockdown which is online. In your own time—you don't have to get the gym; you can just use some basic floor equipment. We do have an exercise bicycle in our house; we have proper spinning exercise bicycle. I intend to get involved in that in the very near future. Some online exercise programs would probably be more beneficial to me at the moment. /	
k): Program components			
	Education	/From the group that I'm a part of, quite a lot of men in the group do exercise. I would say that from my experience, a lot of contemporaries of my age are not exercising optimally. So, I think an education program would be very important. And really important to the post operative or the preoperative, we need to be certain the benefit that has...to maintain postoperatively on an ongoing basis. /	
	Kegel exercise	/…obviously, you know, all the men, after robot-assisted [surgery], generally high percentage, we have leaks, you know what I mean. if your bladder is full and you can't quite make a toilet and you're holding on, when you're traveling, you could have a slight little leak. So, any Kegel exercises that can strengthen your bladder muscles around it so you can just control it. /	
	Physical exercises - beyond pelvic floor training	/Push-ups and planking are good for your core muscles. I'm not sure. I'm not a medical expert. [The] doctor might say, oh, you got to be careful of a hernia. But I would say to work on core muscles as soon as possible. ... I think there's not enough emphasis on focusing on what you can do. As a patient, post-op, especially the first couple of weeks, you don't do it because you're scared of tearing something, you're scared of something happening. So, planking and push-ups and not just your pelvic floor exercises. That's important. Just try and push to do new exercises/ /Given that the average age of the men is probably in their 60s and upwards— I would say that your main component would be walking program, where people should try start walking from as quickly as possible at least five days a week and try and build it up to point where they are...walking for an hour more, for five days of the week. / /I think whatever exercise they can get, even if it's just walking, walking is as good as anything. And that's what [the PT] suggested we do. In fact, the soon as you are up and about, with your catheter bag on, start walking. Don't sit in a chair and feel sorry for yourself. Get up and walk; up and down steps is always good. Get your heart rate up, because that all that speed up the healing process because it obviously gets your blood circulating. /	

		/walking is something I think most people can do. And brisk walking, not the ambling along to the cafe and back, but, you know, take a bit of time to go for a longer walk and get your breathing going. I think that would be a good measure. I mean, I know what my heart rates doing every minute of the day, but actually because I just am used to measuring it, which I don't do anymore. But I know what 60 feels like, I know what 100 feels like, I know what 150 feels like. I would want to get my pulse rate up to at least 100 and hold it there for 10, 15 minutes, and you can do that with a brisk walk, especially if you're not very fit. Find some steps below something. /	
	Professional support	/I think you mentioned something which is crucial. It's got to be right. So, I, myself have a lot of questions. I went to see the doctor twice afterwards. And I posed some of the questions to him. I'll elaborate in a minute. So, I think being able to have support is a crucial thing. / /The physiotherapist helps a lot; I think crucial is the physiotherapists because you need to have some training. If you want to do it blind, I mean, highly likely you'll struggle. / /...there's a big psychological component to it. So, what I'm saying is both the doctor and the physiotherapist gave me some peace of mind. Typical question I had was— I had internal stitches, so, I was worried that with the training the stitches will pull. And if I did the exercises, which the physiotherapist gave me, it will upset something internally. So, just because we're not medical people, and it's kind of blind spot. So, what I'm saying to you is one have quite a bit of questions afterwards, and one needs to be able to ask those questions. / /…the Kegel exercises are not that difficult; once you understand what they are, that they're not difficult exercises to do. And [the PT] goes into a whole lot more. You can go and have erectile dysfunction consultations with which— you know, I didn't worry with that. The Kegel exercises are in my book; absolutely key to a successful recovery. /	I think that it is essential that initially there should be supervision. I really, I really watch some of the young people that come here that have no trainer. I'm not here long but certainly in Cape Town, and you know, they clearly don't know /what they're doing in terms of getting benefit from a particular exercise. [...] I was exercising...even with the trainer, he never said to me, now you breathe in and when you release that muscle you breathe out and vice versa. And that cost me two years of pain and suffering when my neck collapsed because I wasn't aware that even though I was doing the exercising, I was not strengthening the correct muscle by putting emphasis on my neck. I was thinking of that kind of education given the experience that I had./
	Sexual rehabilitation	/You know, sexual rehabilitation is quite a useful thing for somebody who has that. Fortunately, my wife is a medical doctor, so you know I've been very lucky in that sense; but I think for someone who doesn't have that facility, that would be a very useful thing to have. /	
	Skills transfer	/The second thing is the physical support to training you on what to do afterwards. And the third thing is being able to do what you want to do with the knowledge, after you've acquired the knowledge, being able to do that. /	
	Action planning	/So that a typical thing which I valued a lot was that the physiotherapist gave me, like stick figures, the exercises in a visual format. So, I'm thinking if you want to transmit that to somebody else, it's quite easy to do that. A short description of, let's say planking or whatever other exercise we were doing. So, an information sheet where— this is the exercise you need to do, this is the goal, and then what I call stick figures—which will demonstrate it [nicely] for any person. /	
	Visual aids	/So that a typical thing which I valued a lot was that the physiotherapist gave me, like stick figures, the exercises in a visual format. So, I'm thinking if you want to	

		transmit that to somebody else, it's quite easy to do that. A short description of, let's say planking or whatever other exercise we were doing. So, an information sheet where— this is the exercise you need to do, this is the goal, and then what I call stick figures—which will demonstrate it [nicely] for any person. /	

Appendix 5.1

Discrete Choice Experiment— Survey (Block) I

Task 1

	Alternative A	**Alternative B**	
Service/Program	Supervised exercise program **PLUS** education/counselling	Counselling/Education	
Delivery structure	Individual and group-based	Group-based	
Setting	Community Centre (Local gym)	Home	
Service personnel	Technology-assisted (mHealth)	Former PCa patient now cancer exercise couch	
Service operation	12wks 1x/wk; 2hr/session Operates Weekends only	8wks 2x/wk; 2hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A ○	Alternative B ○	None ○

Task 5

	Alternative A	**Alternative B**	
Service/Program	Supervised exercise program **PLUS** education/counselling	Unsupervised exercise **PLUS** counselling	
Delivery structure	Alone	Individual and group-based	
Setting	Community Centre (Or Local Gym)	Hospital	
Service personnel	Technology-assisted (mHealth)	Former PCa patient now cancer exercise couch	
Service operation	12wks 2x/wk; 1hr/session Operates Mon-Thurs	12wks 1x/wk; 2hr/session Operates Weekends only	
Of the two alternatives, which one would you choose?	Alternative A ○	Alternative B ○	None ○

Task 6

	Alternative A	**Alternative B**	
Service/Program	Unsupervised exercise **PLUS** counselling	Supervised exercise program **PLUS** education/counselling	
Delivery structure	Alone	Individual and group-based	
Setting	Home	Community Centre (Or Local Gym)	
Service personnel	Physiotherapists (or other exercise specialists)	Former PCa patient now cancer exercise coach	
Service operation	12wks 1x/wk; 2hr/session Operates Weekends only	12wks 2x/wk; 1hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Block 1 Task 8

	Alternative A	**Alternative B**	
Service/Program	Unsupervised exercise **PLUS** counselling	Supervised exercise program **PLUS** education/counselling	
Delivery structure	Group-based	Alone	
Setting	Hospital	Home	
Service personnel	Physiotherapists (or other exercise specialists)	Former PCa patient now cancer exercise coach	
Service operation	12wks 2x/wk; 1hr/session Operates Mon-Thurs	12wks 1x/wk; 2hr/session Operates Weekends only	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 12

	Alternative A	**Alternative B**	
Service/Program	Unsupervised exercise **PLUS** counselling	Counselling/Education	
Delivery structure	Alone	Group-based	
Setting	Hospital	Home	
Service personnel	Technology-assisted (mHealth)	Former PCa patient now cancer exercise coach	

Service operation	12wks 1x/wk; 2hr/session Operates Weekends only	12wks 2x/wk; 1hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A ○	Alternative B ○	None ○

Task 16

	Alternative A	**Alternative B**	
Service/Program	Unsupervised exercise **PLUS** counselling	Supervised exercise program **PLUS** education/counselling	
Delivery structure	Individual and group-based	Group-based	
Setting	Home	Hospital	
Service personnel	Technology-assisted (mHealth)	Physiotherapists (or other exercise specialists)	
Service operation	8wks 2x/wk; 2hr/session Operates Mon-Thurs	12wks 1x/wk; 2hr/session Operates Weekends only	
Of the two alternatives, which one would you choose?	Alternative A ○	Alternative B ○	None ○

Task 20

	Alternative A	**Alternative B**	
Service/Program	Counselling/Education	Unsupervised exercise **PLUS** counselling	
Delivery structure	Alone	Group-based	
Setting	Home	Community Centre (Or Local Gym)	
Service personnel	Former PCa patient now cancer exercise coach	Technology-assisted (mHealth)	
Service operation	12wks 1x/wk; 2hr/session Operates Weekends only	12wks 2x/wk; 1hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A ○	Alternative B ○	None ○

Task 21

	Alternative A	**Alternative B**	
Service/Program	Counselling/Education	Unsupervised exercise **PLUS** counselling	
Delivery structure	Group-based	Alone	
Setting	Home	Community Centre (Or Local Gym)	
Service personnel	Physiotherapists (or other exercise specialists)	Former PCa patient now cancer exercise coach	
Service operation	12wks 2x/wk; 1hr/session Operates Mon-Thurs	12wks 1x/wk; 2hr/session Operates Weekends only	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 22

	Alternative A	**Alternative B**	
Service/Program	Unsupervised exercise **PLUS** counselling	Counselling/Education	
Delivery structure	Individual and group-based	Group-based	
Setting	Community Centre (Or Local Gym)	Hospital	
Service personnel	Physiotherapists (or other exercise specialists)	Technology-assisted (mHealth)	
Service operation	8wks 2x/wk; 2hr/session Operates Mon-Thurs	12wks 2x/wk; 1hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Appendix 5.2

Discrete Choice Experiment— Survey (Block) 2

Task 2

	Alternative A	**Alternative B**	
Service/Program	Unsupervised exercise **PLUS** counselling	Counselling/Education	
Delivery structure	Group-based	Alone	
Setting	Home	Hospital	
Service personnel	Former PCa patient now cancer exercise coach	Physiotherapists (or other exercise specialists)	
Service operation	12wks 2x/wk; 1hr/session Operates Mon-Thurs	8wks 2x/wk; 2hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 3

	Alternative A	**Alternative B**	
Service/Program	Counselling/Education	Supervised exercise program **PLUS** education/counselling	
Delivery structure	Alone	Individual and group-based	
Setting	Hospital	Home	
Service personnel	Former PCa patient now cancer exercise coach	Physiotherapists (or other exercise specialists)	
Service operation	12wks 1x/wk; 2hr/session Operates Weekends only	8wks 2x/wk; 2hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 4

	Alternative A	**Alternative B**	
Service/Program	Supervised exercise program **PLUS** education/counselling	Counselling/Education	
Delivery structure	Group-based	Individual and group-based	
Setting	Hospital	Home	

Service personnel	Former PCa patient now cancer exercise coach	Physiotherapists (or other exercise specialists)	
Service operation	8wks 2x/wk; 2hr/session Operates Mon-Thurs	12wks 1x/wk; 2hr/session Operates Weekends only	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 7

	Alternative A	**Alternative B**	
Service/Program	Supervised exercise program **PLUS** education/counselling	Unsupervised exercise **PLUS** counselling	
Delivery structure	Group-based	Alone	
Setting	Community Centre (Or Local Gym)	Home	
Service personnel	Former PCa patient now cancer exercise coach	Technology-assisted (mHealth)	
Service operation	8wks 2x/wk; 2hr/session Operates Mon-Thurs	12wks 2x/wk; 1hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 10

	Alternative A	**Alternative B**	
Service/Program	Supervised exercise program **PLUS** education/counselling	Counselling/Education	
Delivery structure	Individual and group-based	Alone	
Setting	Home	Hospital	
Service personnel	Physiotherapists (or other exercise specialists)	Technology-assisted (mHealth)	
Service operation	12wks 1x/wk; 2hr/session Operates Weekends only	8wks 2x/wk; 2hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 13

	Alternative A	**Alternative B**	
Service/Program	Counselling/Education	Supervised exercise program **PLUS** education/counselling	
Delivery structure	Individual and group-based	Group-based	
Setting	Community Centre (Or Local Gym)	Hospital	
Service personnel	Former PCa patient now cancer exercise coach	Physiotherapists (or other exercise specialists)	
Service operation	12wks 2x/wk; 1hr/session Operates Mon-Thurs	8wks 2x/wk; 2hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 17

	Alternative A	**Alternative B**	
Service/Program	Counselling/Education	Unsupervised exercise **PLUS** counselling	
Delivery structure	Individual and group-based	Alone	
Setting	Hospital	Community Centre (Or Local Gym)	
Service personnel	Technology-assisted (mHealth)	Physiotherapists (or other exercise specialists)	
Service operation	8wks 2x/wk; 2hr/session Operates Mon-Thurs	12wks 2x/wk; 1hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 18

	Alternative A	**Alternative B**	
Service/Program	Supervised exercise program **PLUS** education/counselling	Counselling/Education	
Delivery structure	Alone	Group-based	
Setting	Hospital	Community Centre (Or Local Gym)	
Service personnel	Physiotherapists (or other exercise specialists)	Technology-assisted (mHealth)	

Service operation	12wks 2x/wk; 1hr/session Operates Mon-Thurs	8wks 2x/wk; 2hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 19

	Alternative A	**Alternative B**	
Service/Program	Supervised exercise program **PLUS** education/counselling	Unsupervised exercise **PLUS** counselling	
Delivery structure	Alone	Individual and group-based	
Setting	Home	Hospital	
Service personnel	Technology-assisted (mHealth)	Former PCa patient now cancer exercise coach	
Service operation	8wks 2x/wk; 2hr/session Operates Mon-Thurs	12wks 2x/wk; 1hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Appendix 5.3

Discrete Choice Experiment— Survey (Block) 3

Task 9

	Alternative A	**Alternative B**	
Service/Program	Unsupervised exercise **PLUS** counselling	Supervised exercise program **PLUS** education/counselling	
Delivery structure	Alone	Individual and group-based	
Setting	Hospital	Home	
Service personnel	Physiotherapists (or other exercise specialists)	Technology-assisted (mHealth)	
Service operation	12wks 2x/wk; 1hr/session Operates Mon-Thurs	12wks 1x/wk; 2hr/session Operates Weekends only	
Of the two alternatives, which one would you choose?	Alternative A ○	Alternative B ○	None ○

Task 11

	Alternative A	**Alternative B**	
Service/Program	Counselling/Education	Unsupervised exercise **PLUS** counselling	
Delivery structure	Group-based	Alone	
Setting	Hospital	Community Centre (Or Local Gym)	
Service personnel	Physiotherapists (or other exercise specialists)	Technology-assisted (mHealth)	
Service operation	12wks 1x/wk; 2hr/session Operates Weekends only	8wks 2x/wk; 2hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A ○	Alternative B ○	None ○

Task 14

	Alternative A	**Alternative B**	
Service/Program	Supervised exercise program **PLUS** education/counselling	Counselling/Education	
Delivery structure	Alone	Group-based	
Setting	Home	Community Centre (Or Local Gym)	

Service personnel	Technology-assisted (mHealth)	Physiotherapists (or other exercise specialists)	
Service operation	12wks 2x/wk; 1hr/session Operates Mon-Thurs	12wks 1x/wk; 2hr/session Operates Weekends only	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 15

	Alternative A	**Alternative B**	
Service/Program	Unsupervised exercise **PLUS** counselling	Counselling/Education	
Delivery structure	Group-based	Individual and group-based	
Setting	Home	Hospital	
Service personnel	Former PCa patient now cancer exercise coach	Technology-assisted (mHealth)	
Service operation	8wks 2x/wk; 2hr/session Operates Mon-Thurs	12wks 2x/wk; 1hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 23

	Alternative A	**Alternative B**	
Service/Program	Supervised exercise program **PLUS** education/counselling	Counselling/Education	
Delivery structure	Group-based	Alone	
Setting	Community Centre (Or Local Gym)	Home	
Service personnel	Technology-assisted (mHealth)	Physiotherapists (or other exercise specialists)	
Service operation	12wks 1x/wk; 2hr/session Operates Weekends only	12wks 2x/wk; 1hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 24

	Alternative A	**Alternative B**	
Service/Program	Unsupervised exercise **PLUS** counselling	Supervised exercise program **PLUS** education/counselling	
Delivery structure	Individual and group-based	Group-based	
Setting	Hospital	Community Centre (Or Local Gym)	
Service personnel	Former PCa patient now cancer exercise coach	Physiotherapists (or other exercise specialists)	
Service operation	8wks 2x/wk; 2hr/session Operates Mon-Thurs	12wks 1x/wk; 2hr/session Operates Weekends only	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 25

	Alternative A	**Alternative B**	
Service/Program	Counselling/Education	Supervised exercise program **PLUS** education/counselling	
Delivery structure	Group-based	Alone	
Setting	Community Centre (Or Local Gym)	Hospital	
Service personnel	Technology-assisted (mHealth)	Former PCa patient now cancer exercise coach	
Service operation	12wks 1x/wk; 2hr/session Operates Weekends only	8wks 2x/wk; 2hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 26

	Alternative A	**Alternative B**	
Service/Program	Supervised exercise program **PLUS** education/counselling	Unsupervised exercise **PLUS** counselling	
Delivery structure	Alone	Individual and group-based	
Setting	Community Centre (Or Local Gym)	Hospital	

Service personnel	Former PCa patient now cancer exercise coach	Technology-assisted (mHealth)	
Service operation	12wks 2x/wk; 1hr/session Operates Mon-Thurs	8wks 2x/wk; 2hr/session Operates Mon-Thurs	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None

Task 27

	Alternative A	**Alternative B**	
Service/Program	Counselling/Education	Unsupervised exercise **PLUS** counselling	
Delivery structure	Individual and group-based	Group-based	
Setting	Community Centre (Or Local Gym)	Home	
Service personnel	Physiotherapists (or other exercise specialists)	Technology-assisted (mHealth)	
Service operation	8wks 2x/wk; 2hr/session Operates Mon-Thurs	12wks 1x/wk; 2hr/session Operates Weekends only	
Of the two alternatives, which one would you choose?	Alternative A	Alternative B	None