Prostate Cancer and Physical Rehabilitation: An Exploratory Scoping Review

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Contents

PREFACE

This report is an initial exploratory scoping review prepared for Prof. Jeremy Millar, Victoria Prostate Cancer Outcomes Registry, Monash University, Victoria, Australia. Support for this report was provided by La Trobe University, Department of Public Health Participatory Field Placement Internship program (PHE3PFP).

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ABSTRACT

Introduction: This scoping literature review explores the literature that exists pertaining to physical rehabilitation strategies that aide in the recovery of the complications arising from radical prostatectomy (RP) as a result of prostate cancer. **Aim / Purpose:** The aim of this report was to identify literature exploring the role of physical rehabilitation regarding prostate cancer before and after RP, the effectiveness of these strategies, and how men who experience RP are educated about the impacts of RP, plus the benefits of physical rehabilitation to relieve these impacts. In addition, this scoping review aims to understand gaps within the literature. **Method:** To conduct this scoping review, a modified framework from Arksey and O'Malley (2005) was utilised, namely: (i) identifying the research question, (ii) developing inclusion and exclusion criterion, (iii) identifying relevant studies for study selection, (iv) charting the data, and (v) collating, summarising and reporting the results. **Results:** Six key themes were identified throughout the literature; (i) androgen deprivation therapy (ADT) and exercise, (ii) pelvic floor muscle training (PFMT), (iii) urinary incontinence (UI), (iv) erectile and sexual dysfunction, (v) resistance training and physical activity, (vi) and bone health. **Discussion:** It was found that many post-operative complications can arise from RP strategies on how these can be mitigated. It is important that men are aware of this research and how they can have the best health outcomes after the surgery. However, many issues remain unaddressed warranting the need for further research. **Conclusion:** This scoping review indicates the growing concerns within the clinical and wider community regarding the complications associated with prostate cancer treatments, such as RP's. The literature identified for this scoping review, explored the effectiveness of physical rehabilitation strategies in alleviating the associated complications.

Keywords: Prostate Cancer, Physical Rehabilitation, Radical Prostatectomy

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INTRODUCTION

In Australia, prostate cancer is the second most common cancer diagnosed in men, with around one in six Australians being diagnosed before the age of 85 years (Cancer Council, 2020). The Australian Institute of Health and Welfare (AIWH) (2020) estimates approximately 16741 men have been diagnosed with prostate cancer this year alone in Australia. This is a decrease from 22146 people in 2019 and estimates around 3152 Australians have died this year as a result of this disease (AIHW, 2020).

Prostate cancer and its treatment can be effective but may result in physical and psychological challenges for patients, often impacting their quality of life (QoL). As a result, there is an increasing interest in pre- and post-operative radical prostatectomy (RP) physical rehabilitation as a way to mitigate these impacts. This literature scoping review seeks to understand what literature exists regarding physical rehabilitation strategies pre and post-RP, and in particular, the understanding that men have about these post-RP physical rehabilitation strategies and whether these approaches are efficacious.

Prostate Cancer and its Treatment

The prostate is a small, walnut-shaped gland that is located below the bladder and is near blood vessels, nerves and muscles that control the function of the bladder, bowel and penile erections. Prostate cancer is a condition where the cells located within the prostate gland begin to grow in an abnormal or uncontrolled way (Cancer Council Victoria, 2020).

In recent years, there has been an increased interest in exploring the different treatment options available to men following a prostate cancer diagnosis (Cancer Council, 2020). Active surveillance is a treatment implemented to monitor the progression of cancer when it is small, growing slowly or has a limited probability of spreading to other areas of the body. Radiation therapy (radiotherapy) involves using radiation from x-rays to destroy the cancer cells located within the prostate gland and surrounding tissue. This treatment aims to reduce the size of cancer as well as alleviate some of the adverse symptoms associated (Cancer Council, 2020). Androgen deprivation therapy (ADT) is a hormone treatment that uses drugs to slow down or stop the production of testosterone within the testicles when the cancer is in an advanced stage. The aim of ADT is to slow down the progression and growth of the cancer and is often offered in combination with radiotherapy, chemotherapy or surgery. ADT is also an option when other treatments are not suitable (Cancer Council, 2020). Chemotherapy is only available when other

treatment options have proven to be ineffective or the cancer has spread to other areas of the body.

If the cancer is localised, a surgical procedure known as a prostatectomy may be an option. This procedure involves removing part or all the prostate. A RP involves removing the entire prostate as well as surrounding tissues, seminal vessels and lymph nodes. This procedure can be done via an incision in the lower abdomen or perineum, using a laparoscope (instrument utilised for viewing) or a robotic system. An important part of this procedure is health care professionals aim to protect the nerves important in controlling the bladder and penile erections (National Cancer Institute, 2020).

Physical Rehabilitation

Physical rehabilitation, also known as physiotherapy, is becoming increasingly recognised as an integral part of prostate cancer recovery, particularly preceding or following RP surgery. Physiotherapy applies physical techniques, movements and exercises to individuals experiencing adverse effects of a disability, illness or injury. Physiotherapy aims to improve movement, alleviate pain and enhance the QoL of clients (Chartered Society of Physiotherapy, 2018). A comprehensive understanding of what prostate cancer is and how it can affect men is important when analysing the treatment and rehabilitation options that are available to men who have been diagnosed with prostate cancer.

Physical Rehabilitation and Prostate Cancer

Given the issues of life expectancy and reduced QoL for men following RP, there is an increasing interest in identifying the gaps, unanswered needs and gathering valuable information to develop a deeper understanding on what treatment and measures improve health outcomes, particularly those utilising physical rehabilitation, also known as physiotherapy. Limited literature exists on the long-term effects of prostatectomy and QoL of those living with prostate cancer. O'Shaughnessy and Laws (2010) identifies the need for high quality and easily available research into the social, psychological, and informational support needed for men following a prostatectomy.

Monash University Prostate Cancer Outcomes Registry

This scoping review will be conducted in collaboration with the Monash University Prostate Cancer Outcomes Registry. The Prostate Cancer Outcomes Registry gather information about treatments and outcomes of those who have been diagnosed with prostate cancer in Victoria (Monash University, 2020). This data is collected to provide better care and health outcomes for men who have been diagnosed with prostate cancer. The sponsor specific to this research project is Professor Jeremy Miller, who is the Clinical Lead for the Monash University Prostate Cancer Outcomes Registry.

PURPOSE / AIMS

The overall purpose of this scoping literature review is to identify literature exploring the role of rehabilitation regarding prostate cancer including before and after a prostatectomy and recognise gaps in this existing literature. The precise aims are to understand what physical rehabilitation treatments are available, how effective they are, and how they can positively impact QoL in terms of bone health, psychosocial wellbeing, sexual function and urinary incontinence (UI). Additionally, this report will explore the effect of exercise pre- and post-prostatectomy, in particular, pelvic floor exercises and resistance training to discover the transformations of a successful rehabilitation.

Given the issues of life expectancy and QoL for men who have undergone a prostatectomy, there is an increasing interest in post-operative RP rehabilitation. A scoping literature review will be conducted to provide an analysis for identifying gaps, unanswered needs, and gathering valuable data to provide a reference point for important rehabilitation questions and measures in increasing the QoL in these men.

This review will investigate what literature exists regarding physical rehabilitation strategies post-RP and in particular what men are told about these post-operative physical rehabilitation strategies and whether these approaches work.

METHOD

A scoping review framework modified from Arksey and O'Malley (2005) was utilised to map the research area utilising a predetermined process of: (i) identifying the research question, (ii) developing inclusion and exclusion criterion, (iii) identifying relevant studies for study selection, (iv) charting the data, and (v) collating, summarising and reporting the results (p. 22).

According to Mays et al. (2001), the aim of scoping reviews or scoping studies is "to map rapidly the key concepts underpinning a research area and the main sources and types of evidence available, and can be undertaken as stand-alone projects in their own right, especially where an area is complex or has not been reviewed comprehensively before" (p. 194). A key strength of using a scoping review approach as opposed to other styles of literature reviews (e.g. systematic, meta-analysis, etc.) is to identify gaps in existing literature where limited research has been conducted (Arksey & O'Malley, 2005). Scoping reviews have previously been regarded as invaluable for exploratory studies where there has been limited or restricted information, and as such, is an appropriate way to explore the literature relating to post-operative outcomes following RP (Penson et al., 2005).

(i) Identifying the research question

The research question was developed using the PICO (Population, Intervention, Comparison, Outcome) technique (Fineout-Overholt & Johnston, 2005) (refer to Table 1). The key question for this scoping review is:

> What literature exists regarding post-operative radical prostatectomy and physical rehabilitation?

Table 1

PICO research question development

Population	**Intervention/ Exposure**	**Comparison**	**Outcome**
Men with Prostate Cancer/ Prostatectomy	Physical rehabilitation	Those who do not utilise physical rehabilitation	This review of the literature is seeking a record of *all* outcomes.

(ii) Inclusion and exclusion criterion for study selection

By utilising a scoping review framework modified from Arksey and O'Malley (2005), resources including peer-reviewed literature, books and webpages were searched. The inclusion criteria implemented during the database search stage included (i) articles including the term "prostate cancer" and "physical rehabilitation" (or any of their variants; see Table 2), (ii) peer-reviewed literature, (iii) articles published between 2010 and 2020, (iv) articles written in English and (v) articles affiliated with Australia (database permitting). Articles not affiliated with Australia could not be sorted automatically on MEDLINE (OVID) thus this criterion was not implemented on this database. Articles were then screened by the scoping review authors

to determine their relevance in answering the research question. In this stage, resources were only included if they referred to both "prostate cancer" and "physical rehabilitation" (or any of their variants; see Table 2). Resources were excluded if they focussed on cancers other than prostate cancer.

(iii) Identifying relevant studies

The PICO strategy (Fineout-Overholt & Johnston, 2005) was utilised to identify specific search elements, synonyms and key database search terms to identify relevant literature (refer Table 2). All available databases were used for this search: MEDLINE (OVID), CINAHL (EBSCO), Scopus (Elsevier) and Google Scholar.

Table 2 displays the PICO elements, related synonyms and database search terms with the full list of terms utilised (untruncated and truncated). When creating the search terms, Boolean operators, truncations and wildcards were used (e.g., "*", "OR") to obtain as many relevant search results possible. These search terms were then utilised to produce a database search strategy (refer Table 3).

Table 2

PICO element, related synonyms and database search terms

PICO Element	Synonyms	Database Search Terms
Men with Prostate Cancer/ Prostatectomy	- Prostatic neoplasms - Prostate cancer - Prostatectomy - Prostate cancer patient - Cancer of the prostate gland - Glandular cancer - Incontinence - Sexual function	"Prostatectom*" "Prostat* cancer*" "Prostat* neoplasm*" "Prostat* carcinoma*" "Prostate gland*" "Glandular cancer*" "Glandular carcinoma*"
Physical rehabilitation	- Physical rehabilitation - Rehabilitate - Rehabilitation - Physical Therapy - Physical Recovery - Physiotherapy - Occupational therapy - Exercise physiologist - Exercise	"Physical Rehab*" "Physical Treatment*" "Physical Therap*" "Physical Recover*" "Physiotherap*" "Occupational therap*" "Exercise physiolog*" "Exercis*"

Table 3

Database search strategy

Population		Intervention
Prostatetom* OR "prostat* cancer*" OR "prostat* neoplasm*" OR "prostat* carcinoma*" OR "prostate gland*" OR "glandular cancer*" OR "glandular carcinoma*"	AND	"Physical rehab*" OR "physical treatment*" OR "physical therap*" OR "physical recover*" OR physiotherap* OR "occupational therap*" OR "exercise physiolog*" OR exercis*

(iv) Charting the data

An initial search was conducted on MEDLINE (OVID), CINAHL (EBSCO) and Scopus (Elsevier) utilising the search strategy outlined in Table 3, and returned 838, 25 and 213 results respectively (total n = 1076) (see Appendix 1). Duplicates were then removed (n = 240), leaving 860 articles and resources. These resources (n = 836) were then screened to determine their relevance in answering the research question. While the inclusion criteria were implemented in the database searches, some resources outside of the inclusion criteria were returned (e.g. literature published before 2010) and these resources were retained during the screening stage and were kept if they were found to be relevant. The titles and abstracts were screened for literature to only be included if it related to both “prostate cancer” and “physical rehabilitation” (or any of their variants; see Table 2). To effectively seek a record of all relevant outcomes relating to prostate cancer, any literature addressing cancers other than prostate cancer was removed. Due to time constraints, resources deemed as *most* relevant in answering the research question were eventually selected and 25 key articles (n = 25 were included in this scoping review. These key articles aided the identification and documentation of key themes arising within the literature which were manually identified and coded by the authors.

Following the search and screening stages, a hand search was conducted to obtain any additional relevant resources or ‘grey literature’. References and names of authors identified as being significant in answering the research question were searched for on Google and Google Scholar. The literature was included if both “prostate cancer” and “physical rehabilitation” (or any of their variants; see Table 2) were noted, with a total of 5 additional resources identified at this stage.

Following database searching and hand searching for literature, 30 resources were chosen for inclusion in this systematic review. Details and abstracts of final articles deemed valid for thematic analysis were combined at Appendix B. Final articles were thematically

coded, with good agreement between authors. Each theme is identified and numerically coded in Appendix B and described within the results section.

RESULTS

(v) Collating, summarising and reporting the results

Key themes

Six main themes were identified within the literature: (1) androgen deprivation therapy (ADT) and exercise, (2) pelvic floor muscle training (PFMT), (3) urinary incontinence, (4) erectile dysfunction/ sexual dysfunction, (5) resistance exercise training/ physical activity and (6) bone health (see Figure 1). Table 3 lists the research authors and the associated themes within their work.

Figure 1

Key themes identified within the literature

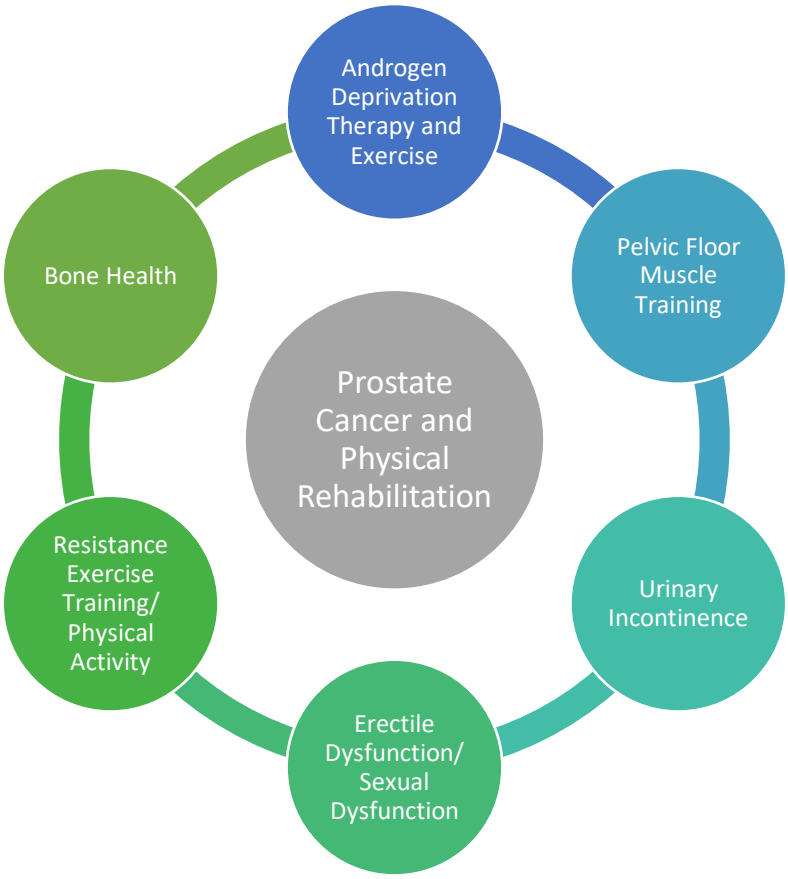

Table 4

Themes identified within the literature

Author/s (Year)	1	2	3	4	5	6
Alibhai, Breunis, & Timilshina et al. (2015)	✓					
Aydin Sayilan, & Özbaş (2018)		✓	✓			
Bigaran, Zopf, & Gardner et al. (2020)	✓					
Boisen, Krägeloh, & Shepherd et al. (2016)	✓				✓	
Buffart, Newton, & Chinapaw et al. (2015)					✓	
Cormie, Newton, & Spry et al. (2013)						✓
Cormie, Newton, & Taaffe et al. (2013)	✓			✓		
Emanu, Avildsen, & Nelson et al. (2016)				✓		
Galvão, Spry, & Denham et al. (2014)	✓					
Galvão, Taaffe, & Cormie et al. (2011)	✓				✓	✓
Galvão, Taaffe, & Spry et al. (2018)	✓					✓
Gentili, McClean, & Hackshaw-McGeagh et al. (2019)	✓					
Grossmann, Hamilton, & Gilfillan et al. (2011)	✓					✓
Heydenreich, Puta, & Gabriel et al. (2020)		✓	✓			
Hirschhorn, Kolt, & Brooks (2014)		✓	✓			
Lin, Yu, & Lin et al. (2012)		✓		✓		
Mardani, Pedram, & Mazaheri et al. (2020)	✓				✓	
Milios, Ackland, & Green et al. (2020)		✓		✓		
Milios, Ackland, & Green et al. (2019)		✓	✓			
Mundell, Daly, & Macpherson et al. (2017)	✓					✓
Narayan, Harrison, & Cheng et al. (2020)	✓					✓
Nilssen, Mørkved, & Overgård et al. (2012)		✓	✓			
Østergren, Kistorp, & Bennedbæk et al. (2016)	✓			✓		✓
Park, Kim, & Nam et al. (2012)		✓	✓		✓	
Prota, Gomes, & Ribeiro et al. (2012)		✓		✓		
Santa Mina, Guglietti, & Alibhai et al. (2014)			✓	✓	✓	
Serdà & Marcos-Gragera (2014)		✓	✓			
Shephard (2017)					✓	
Yoshida, Matsunaga, & Igawa et al. (2019)		✓	✓			
Zhang, Strauss, & Siminoff (2007)		✓		✓		
Total:	13	12	9	8	7	7

Note: Themes are: (1) androgen deprivation therapy and exercise, (2) pelvic floor muscle training, (3) urinary incontinence, (4) erectile dysfunction and sexual dysfunction, (5) resistance exercise training and physical activity, and (6) bone health. Abstracts for each article are provided in Appendix 2.

Summary of Themes

Androgen Deprivation Therapy and Exercise

Within the literature, the theme of androgen deprivation therapy (ADT) and exercise was identified as the most commonly discussed in relation to post-operative RP and physical rehabilitation. ADT is a widely used hormone treatment with approximately 50% of men utilising the treatment at some point after their diagnosis (Meng et al., 2002). Treatments last approximately 2 to 3 years. The aim of ADT is to control cancer cells through the reduction of androgen levels in the body, though this can typically affect cancer cells and the blood vessels that supply them (Cancer Institute NSW, 2017).

Across the literature, it was noted that ADT is commonly associated with producing adverse effects, negatively affecting the QoL and health of patients with prostate cancer (Alibhai et al., 2015; Bigaran et al., 2020; Cormie et al., 2013b; Galvão et al., 2011; Galvão et al., 2014; Galvão et al., 2018; Gentili et al., 2019; Grossmann & Gilfillan, 2011; Mundell et al., 2017; Narayan et al., 2020; Østergren et al., 2016). Adverse effects discussed within the literature included: poorer QoL and psychological well-being, sexual dysfunction, fatigue, anaemia, poorer bone health, muscle loss, weight gain and poorer cardiometabolic health. More specifically, in the study by Alibhai et al. (2015), ADT was associated with persistent and clinical declines in both objective and self-reported physical function across three years of treatment. Self-reported QoL measures and self-reported daily functioning remained stable throughout the study, though changes in self-reported physical function declined amongst ADT users, hence the exploration of physical activity in alleviating the associated declines (Alibhai et al., 2015). In following the study's minimum clinically important difference between the baseline and 36 months of follow-up, when compared with prostate cancer controls and healthy controls, ADT users reported higher proportions of worsening over time in 7 out of 8 measures (87.5%) (Alibhai et al., 2015). While most declines eventually stabilise, improvements beyond 6 months of use are rare, with lower extremity functions likely to worsen over time (Alibhai et al., 2015).

While numerous adverse effects are associated with ADT, when combined with physical activity, these effects can be mitigated and act as a facilitator for an improved health and well-being (Boisen et al, 2016). In particular, a paper exploring the attitudes towards exercise among men undergoing ADT following a prostate cancer diagnosis by Gentili et al. (2019) found patients reporting regular light exercise, such as walking or cycling, as being an effective approach to counterbalance the adverse effects associated with ADT. However, with

this study utilising both male and female interviewers, relevant information may have been withheld by patients when interviewed by the female due to difficulties in disclosing information to someone of the opposite sex (Gentili et al., 2019). An additional study targeting exercise in prostate cancer patients undergoing ADT, also noting adverse effects of ADT, found that supervised exercise training for long-term prostate cancer survivors was more effective than the provision of educational materials in mitigating the adverse effects of ADT (Galvão et al., 2014). To continually improve the health and well-being of prostate cancer patients, Galvão et al. (2014) were able to maintain these benefits in the long-term through a 12-month follow-up with a home-based program. Although Galvão et al. (2014) found that the provision of long-term programs were effective, in a more recent study by Gentili et al. (2019), adherence to exercise programs and recommendations were low.

A common limitation found within the theme was that the research into the impact of ADT on body image was limited. While frequently listed as an adverse effect of ADT, there is a lack of research looking at how exercise can potentially counterbalance this, and other, adverse effects to improve QoL. Limitations to variety and number of participants were present, as each paper was restricted to a specific geographical location. This limited the variety of participants within each paper and precluded the ability to apply within the general population.

Throughout the literature, it is clear that ADT has several strong effects on the QoL of its users. As suggested within the literature, the combination of ADT and exercise should be thoroughly considered by clinicians to ensure any potentiality of lessening these adverse effects can be fulfilled.

Pelvic floor muscle training (PFMT)

Another strong theme that emerged from the literature is the effect that pelvic floor muscle training (PFMT) has on UI, erectile dysfunction (ED) and the QoL of men following RP (Lin et al., 2012; Milios et al., 2020; Prota et al., 2012; Zhang et al., 2007). The Pelvic floor muscles (PFM) are located at the bottom of the pelvis and are responsible for supporting the bowel and bladder. Normally, these muscles contract when an individual coughs, sneezes or laughs to prevent urine leakage. It is extremely common for men to experience weakness in these muscles after surgery, resulting in leakage and the inability to form an erection (Continence Foundation of Australia, 2020). Research shows utilising high-intensity PFM exercises for a longer duration than our standard practices before and following RP has proven to be effective in strengthening these muscles, allowing for faster return of UI (Yoshida et al., 2019; Zhang et

al., 2007; Milios et al., 2020; Aydin Sayilan et al., 2018). PFMT is a physical exercise regime which aims to strengthen the PFM by contracting or squeezing these muscles while coughing, sneezing, getting up or urinating. These urge control techniques allow for faster return in urinary function as these exercises target endurance, strength and control (Sydney Local Health District, 2020).

UI can have a detrimental effect on a man's physical and psychological wellbeing, work, leisure activities and relationships. A study by Zhang et al. (2007) aimed to highlight the effects a support group, combined with PFM exercises, had on QoL and UI. In this study, psychologists were assigned to motivate and encourage participants to complete all high-intensity PFM exercises. The results of this study showed that more members of the control group (85%) required the use of a pad or specialised brief at three months, compared with only 50% of the support group (Zhang et al., 2007). Furthermore, those in the control group expressed the poorer QoL and social outcomes compared with the support group. A major limitation to this study was the sample size, with only 29 participants completing the trial.

A study by Milios et al. (2020) aimed to highlight the impacts PFMT has on sexual function, UI and the QoL of men after undergoing RP. This was a randomised controlled trial (RCT) which involved the intervention group beginning high-intensity PFM exercises five weeks prior to surgery, while the control group only completed moderate-intensity exercises post-RP. The most significant observation highlighted within the study was those in the intervention group experienced a faster return to UI compared to the control group. Although participants experienced improvements in urinary function, the results pertaining to ED were not strong enough to be applied to the general population due to having a small sample size and the short duration of the program.

In another RCT by Milios et al. (2019), the authors examined a pre-operative PFMT program to better understand the benefits it has on UI, ED and QoL following a prostatectomy. This training program showed a positive benefit, with the authors stating that: "Our results indicate clear outcomes of less leakage, reduced time to return to continence and improved QoL in patients who received more intensive PFMT, utilising standing postures, compared to the comparator control protocol. This finding is in keeping with some previous studies which indicate that PFMT of longer duration prior to surgery, or higher frequency and/or intensity, is more likely to be beneficial" (Milios et al., 2019, p. 7).

Yoshida et al. (2019) developed a study to understand the benefits that completing PFMT exercises have on UI and QoL following a robotic-assisted RP. The results showed that

pre-operative PFMT impacted earlier continence in participants, resulting in improved QoL (Yoshida et al., 2019). These results were directly compared with the previously reported findings on a study developed by Nilssen et al. (2012). The aim of this randomised clinical study was to highlight if post-operative PFMT has a significant influence on men experiencing a greater QoL following RP. The most notable observation from this study was that even though PFMT aided in improving urinary function, these exercises did not have a significant influence on enhancing the QoL.

Throughout the literature, many studies have been able to confirm that completing high-intensity PFMT as a form of physical rehabilitation, does aid in faster recovery of UI and better QoL outcomes following RP. However, further investigation is necessary to explore the effects PFMT has on improving ED.

Urinary incontinence

Urinary incontinence (UI) can be another major complication after RP. As defined by the International Continence Society, UI is any involuntary leakage of urine (Abrams et al., 2002). Many articles discuss the complications of UI after prostatectomy and the challenges it can cause for individuals in their daily lives, which can lead to social and mental health issues (Serdà and Marcos-Gragera., 2014; Park et al., 2012). However, there are some suggested rehabilitation strategies which for individuals suffering from UI, can help lead them to better outcomes in an attempt to increase the overall QoL for those affected personally and those close to them.

Across the literature, many authors stated PFMT can assist with post-operative impacts concerning UI (Milios et al., 2019; Aydin Sayilan et al., 2018; Hirschhorn et al., 2014). The articles state that PFMT can have positive health outcomes and enhance post-surgical measures of PFM function and improve QoL outcomes related to incontinence. Muscle trunk training could also be important to counteract the effects of UI. A prospective randomised controlled trial from Heydenreich et al. (2020) found an increased rate of recovery of continence after RP, with continence significantly improving in the intervention group engaging in standard PFM exercises and oscillating rod therapy. Another study conducted by Park et al. (2012) with a 12-week exercise intervention also focused on UI health outcomes. In this study, 49 participants over the age of 65 completed the end of the study follow-up. After the 12-week exercise intervention, all physical functions were reported to be more improved in the exercise group than in the control group, in particular continence rate, which was reported as being 73.1% in the exercise group compared to 43.5% in the control group. These studies present an important

insight into the benefits of physical therapies in reducing UI, however, they are limited by a self-reporting methodology, relatively small sample size and demographic, which reduces generalisability to the broader population.

Serdà and Marcos-Gragera (2014) summarise that progressive rehabilitation in UI is particularly important establishing that improvement in early continence definitively leads to better QoL outcomes. This supporting evidence demonstrates the important role physical rehabilitation has on prostate cancer pre- and post-prostatectomy regarding urinary incontinence.

Erectile and sexual dysfunction

Erectile and sexual dysfunction was another theme seen frequently within the literature. Many studies have indicated it is extremely common for men to experience ED post-RP, resulting in lower QoL outcomes and sexual participation (Emanu et al., 2016; Milios et al., 2020; Lin et al., 2012). In males, there is a complex neurovascular bundle located either side of the prostate which is responsible for controlling erectile function. During a prostatectomy, it is common for these nerves to be damaged, resulting in erectile and sexual dysfunction (Prostate Cancer Foundation of Australia, 2020). ED is characterised as the inability to develop or maintain an erection hard enough to participate in sexual activity or penetration (Prostate Cancer Foundation of Australia, 2020). The prevalence rate of ED after surgery is widely debated, however, multiple studies have indicated up to 85% of men can experience this unpleasant complication, often causing greater distress to QoL than UI (Emanu et al., 2016; Milios et al., 2019). Although common, there is currently limited research highlighting the benefits of physical rehabilitation exercises, such as the effects PFMT can have on erectile and sexual function following surgery.

A study by Prota et al. (2012) aimed to understand the benefits pelvic floor biofeedback training (PFBT) has on men after undergoing RP, such as effects it has on faster recovery rates in UI and potency (ability to form an erection). In this study, 52 men were prospectively randomised to a treatment or control group which assessed the number of pads utilised following surgery. For three months, the treatment group received PFBT in combination with home exercises, while the control group only acquired verbal instructions on how to contract the PFM. The authors found that: “At 12 months postoperatively, 47.1% (8/17) of the subjects in the treated group were considered potent, as opposed to 12.5% (2/16) in the control group” (Prota et al., 2012, p. 176). Furthermore, the findings of this study suggest those with improved UI and potency are more likely to participate in increased sexual activities.

The observations also agree with the results reported by Lin et al. (2012) who explored the prevalence of ED and whether completing early PFM exercises can aid in improving sexual function post-RP. The findings of this study show that at months six and 12, the experimental group experienced significant improvements in erectile function, while the control group showed no improvement (Lin et al., 2012). Additionally, those in the experimental group reported faster recovery rates in erectile function compared to the control group at these time points.

The results are inconsistent with Milios et al. (2020), but there may be a variety of reasons for this. In this study, the sample size was relatively small, and the training program was only offered over a 12-week period. While this article was unable to confirm PFMT aids in improving ED, other studies supporting this argument were identified and discussed thoroughly. Milios et al. (2020) hypothesise if the trial had of been extended for a longer duration these results may have been significantly different.

Further research in this area would be crucial in developing a deeper understanding on which physical rehabilitation interventions are the most effective in managing ED following RP.

Resistance exercise training and physical activity

The positive benefits resistance exercise and physical activity have on RP rehabilitation was a common theme seen within the literature. Many articles state that engaging in regular physical activity leading up to RP can decrease the risk of health concerns and issues for an individual following a prostatectomy (Santa Mina et al., 2014; Mardani et al., 2020; Shepard, 2017).

Santa Mina et al. (2014) explain that preoperative physical activity can positively influence surgical outcomes. In the study, 509 men underwent RP, where 46% of participants who met the physical activity guidelines (150 min of moderate-intensity or 75 min of vigorous-intensity physical activity per week) before the treatment recorded better health outcomes such as UI, erectile function, and overall QoL. In a more recent study, Mardani et al. (2020) describe similar findings, with an exercise program proving the post-operative benefits of exercise training with those who have been diagnosed with prostate cancer and have participated in treatment sessions within the past 3–12 months. This exercise program included aerobic, resistant, flexible, and PFM exercises. This study included 36 participants in the control group and 35 participants in an intervention group, and it was found that the intervention group who completed the exercise program had reduced complications from their treatment and improved

QoL. This group also reported reduced fatigue, insomnia, constipation, diarrhoea, urinary, bowel, and hormonal treatment-related symptoms in comparison to the control group after intervention.

Resistance training is a type of physical rehabilitation that demonstrates long term benefits for those with prostate cancer within the literature. In a study by Buffart et al. (2015) 50 participants in the intervention group completed a resistance exercise training regime that included the chest press, seated row, shoulder press, triceps extension, leg press, leg extension, leg curl, and abdominal crunches; the control group of 50 participants did not complete the training. Results showed that this 6-month home-based exercise maintenance program was able to prevent a decline in QoL and improve lower body functional performance for men who completed the exercise program. Boisen et al. (2016) also presents a guideline of what constitutes enough physical activity for cancer survivors in America and quotes that the American Cancer Society recommends that cancer survivors should be including resistance (strength) training exercises at least twice per week (Rock et al., 2012).

Resistance training exercise and physical activity have demonstrated benefit for reducing complications for those with prostate cancer and RP, however, these interventions have been shown to reduce the risk of developing prostate cancer in the first instance. Shephard (2017) describes a 10-30% risk reduction of developing prostate cancer when men have engaged in regular physical activity. However, Shephard later reports that there is limited literature with conclusive proof of an association between regular physical activity and a low risk of prostate cancer, although there are several studies finding significate benefit of physical activity in terms of disease development, progression, and therapy (Shepard, 2017). This proves the need for more extensive research on the role physical activity plays in the risk reduction of prostate cancer in men.

A limitation of the literature on resistance training and physical activities' effect on prostate cancer is the willingness of those with prostate cancer to be able to complete the necessary exercise to receive tangible results. A study by Galvão et al. (2014) demonstrated that supervised resistance and aerobic exercises are more effective than printed educational material about physical activity. Results identified increased improvements in cardiorespiratory fitness, physical function, muscle strength, and self-reported physical functioning in the group completing the supervised exercise training trial, as compared with the control group (Galvão et al., 2014).

It is clear with adequate access, education and supervision, that resistance training and physical exercise can have great health benefits for complications before and after prostatectomy, as well as overall fitness and QoL benefits.

Bone health

Another common theme found across the literature was that of bone health. Commonly associated with being an adverse effect of ADT, bone health for prostate cancer patients is generally linked with bone mineral density and bone metastases. Bone mineral density is measured by a bone mineral density test, with the test providing a bone mineral density score to determine risk factors for fractures and measure responses to osteoporosis treatment (National Institute of Health Osteoporosis and Related Bone Diseases, 2018). Bone metastases, or secondary bone cancer, refers to when cancer started in one part of the body, but has spread, or metastasised, to another bone in the body (Cancer Council NSW, 2020). This is significant for prostate cancer patients as the bone is the third most frequent site of metastasis (Coleman, 2001), with bone metastases occurring in approximately 80% of individuals with advanced prostate cancer (Small et al., 2003).

Throughout the literature, skeletal complications including low bone mineral density and bone metastases as a result of prostate cancer treatment were noted, with high concerns for patients regarding fragility fractures (Cormie et al., 2013a; Galvão et al., 2011; Galvão et al., 2018; Grossmann et al., 2011; Østergren et al., 2016). For prostate cancer patients, the presence of bone metastases has excluded their participation in exercise interventions, being a relative contradiction to the supervised exercise programs recommended to these individuals (Galvão et al., 2018). In a review by Grossmann et al. (2011) regarding bone and metabolic health in non-metastatic prostate cancer patients receiving ADT, bone fractures and bone mineral density were commonly discussed as impacts of ADT. Bone mineral density declines within months of commencement of ADT, with the greatest bone mineral density loss occurring at approximately 12 months (Grossmann et al., 2011), though longer durations of ADT treatment can result in increased risks of this (Grossmann et al., 2011; Narayan et al., 2020).

As exercise programs have been recommended to prostate cancer patients to improve bone health (Galvão et al., 2018), adherence to these exercise programs is crucial. As such, in a study conducted by Galvão et al. (2018) exploring how exercise preserved physical function in prostate cancer patients with bone metastases, an attendance rate of 89% was recorded, with no exercise-related adverse events occurring or skeletal fractures. Reasons for missed sessions were merely due to medical appointments, travel, and social commitments, hence

demonstrating the program was well tolerated, with high attendance and compliance from the participants (Galvão et al., 2018).

A common limitation found within this theme was that patients with bone metastases were often excluded from studies due to concerns of fragility, presenting limited information for these patients. While bone health is a prevalent theme concerning prostate cancer and physical rehabilitation, literature focusing on bone health itself is limited as the theme frequently overlaps with ADT. Although several concerns of fragility are presented within the literature, within the limited studies identified, safety and efficacy of physical activity in men with prostate cancer and bone metastases were deemed effective, though the topic still requires further investigation to allow clinicians to make thorough considerations.

DISCUSSION

Many articles regarding post-operative RP's and physical rehabilitation were found. Common topics arising from the literature sourced included (i) the adverse effects ADT has on QoL and how physical rehabilitation can mitigate these effects, (ii) the pre- and post-operative benefits of high-intensity PFMT, (iii) resistance training and physical exercise (iv) urinary and sexual dysfunction that can become a major complication after RP, and finally (v) bone health.

There is currently limited research available outlining which rehabilitation strategies are the most effective in the recovery of urinary and erectile function. Multiple studies have explored and confirmed that pre- and post-operative high-intensity PFMT has proven to be effective in improving UI and QoL following RP. However, further investigation is needed to explore the effects these exercises have on ED (Milios et al., 2019; Yoshida et al., 2019).

Another common theme throughout the literature was ADT, with several adverse effects impacting the quality of life of its users. However, when combined with exercise, these adverse effects can be mitigated. Bone health was another common theme identified in the literature, with a high focus on bone mineral density and bone metastases, though the literature on bone health alone was limited as the theme was frequently linked with being an adverse effect of ADT. The literature regarding bone metastases patients have been limited, as these patients were often excluded from studies due to concerns of fragility, though some studies have deemed physical activity programs for these patients as safe and efficacious (Cormie et al., 2013a; Galvão, 2011). Furthermore, the literature indicates that participating in physical activity can significantly reduce health complications. Mardani et al. (2020) explain individuals who engage in specific exercise programs can reduce complications from RP such as physical,

social and emotional functioning. Since several issues remain unaddressed, further research is warranted to investigate which physical interventions are the most effective in overcoming these adverse reactions while enhancing QoL outcomes.

Limitations

A major limitation of this research project was the limited time constraints. Time spent on searching through databases was restricted so there was insufficient time to search other databases and produce more extensive and reliable results. Similar themes emerging in the literature also had to be combined through writing our results to cover as much data as possible. Another limitation of our research was the exclusion of some data. Our database searches consisted only of articles between the years of 2010 and 2020, so any literature produced before 2010 was not taken into consideration in our report. We were also unable to use non-English articles which also would have excluded a variety of different studies that may be useful in discovering the effectiveness of rehabilitation strategies for men undertaking RP.

After examining all the articles that were acquired through database searching, it was found that there were numerous gaps in the literature. Further research on the impact prostate cancer and RP can have on family, friends, and other loved ones close to the individual with the disease would be advantageous in gaining more of an idea of the broader effect it can have. It was also noted that there was not enough large scale RCT's investigating the effects of PFMT, more specifically regarding ED where results were discussed to have had different results if trials had been for a longer duration (Milios et al., 2020).

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

It is clear that prostate cancer and its treatments can be effective, though there are growing concerns surrounding the complications associated with these treatments. Many complications following RP and prostate cancer treatments were noted throughout the literature, namely the adverse effects of ADT, UI and ED. However, the literature demonstrated how physical rehabilitation strategies can be effective in alleviating these complications. For instance, the literature identified physical activity, or exercise, as a potential approach in mitigating the adverse effects associated with ADT. Additionally, high-intensity PFMT was identified as an effective approach in facilitating a faster recovery from UI and improved QoL outcomes following RP. Though several issues regarding physical rehabilitation and prostate cancer have

either not been addressed, or have had limited research, consequently recommendations for future research can be explored.

Key Recommendations

i) Further research involving large scale RCT's with durations longer than 12 weeks to investigate all prostate cancer rehabilitation strategies to determine which strategies are most effective in aiding recovery.

ii) Further research on the impact prostate cancer and RP can have on family, friends, and other loved ones close to the individual

iii) Inclusion of bone metastases patients in future studies to gain a deeper understanding of the safety and efficacy of physical rehabilitation strategies for these patients.

iv) Ensuring prostate cancer patients and health care professionals have updated knowledge on the effectiveness of physical rehabilitation strategies to overcome the common adverse reactions associated with prostate cancer treatments.

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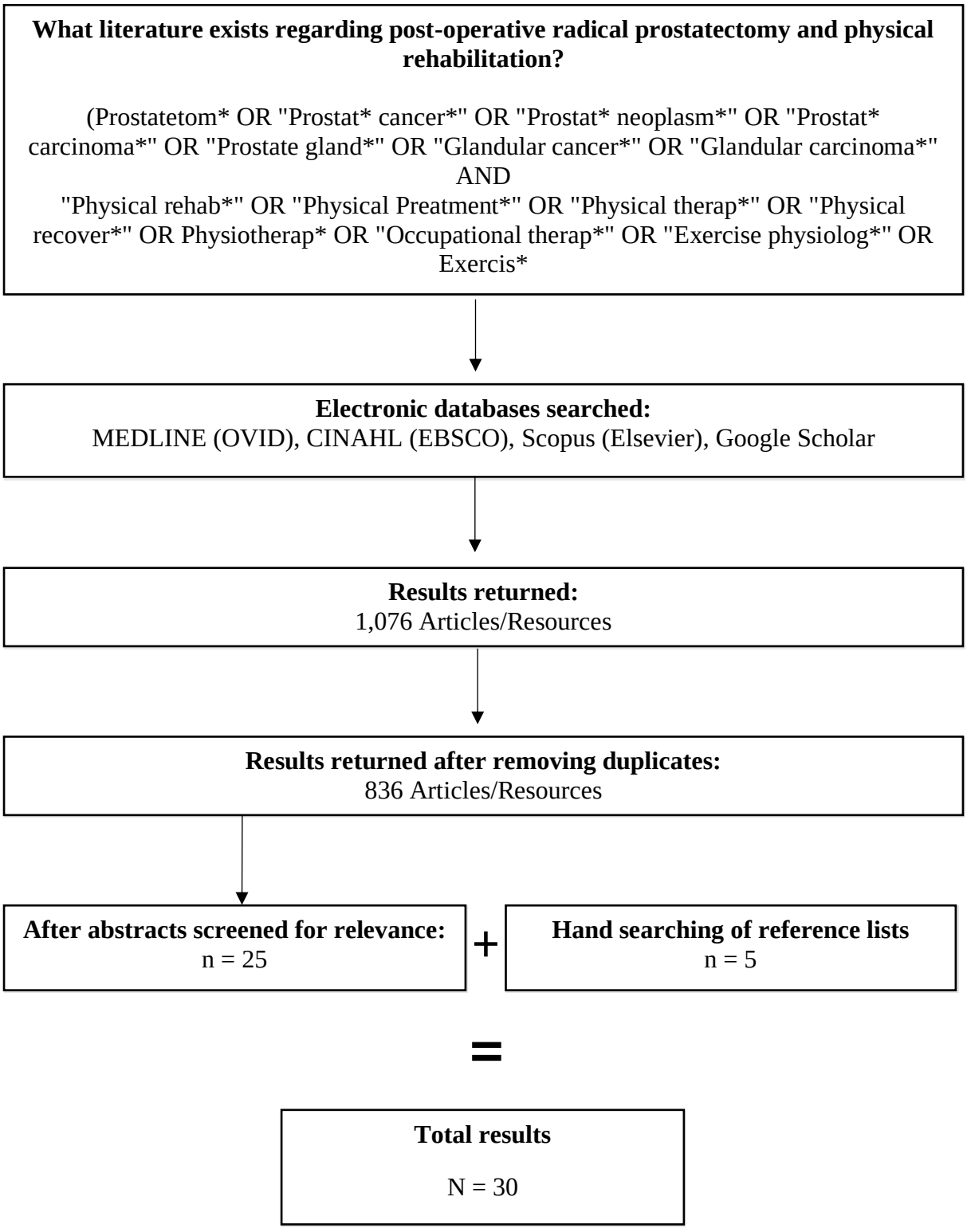
APPENDIX 1

Search Strategy



APPENDIX 2

Literature and Thematic Coding

Article no.	Author/s (Year), Title	Brief summary	Thematic coding
1	Alibhai, Breunis & Timilshina et al. (2015) Long-term impact of androgen-deprivation therapy on physical function and quality of life.	BACKGROUND: This study examined the impact of androgen-deprivation therapy (ADT) on physical function and quality of life (QOL) over 36 months., METHODS: Eighty-seven men with nonmetastatic prostate cancer (PC) who were starting continuous ADT and 2 control groups (86 PC controls without ADT and 86 healthy controls), matched by age and education, were enrolled. Physical function was assessed with the 6-minute walk test (6MWT), grip strength, and Timed Up and Go (TUG) test. QOL was measured with the 36-Item Short Form Health Survey of the Medical Outcomes Study. Subjects were assessed at the baseline and at 3, 6, 12, 18, 24, 30, and 36 months. Mixed effects regression models were fitted with adjustments for baseline covariates., RESULTS: The 6MWT distance improved initially and then stabilized in both control groups but remained unchanged for ADT users (P = .0030). Grip strength remained stable in control groups but declined sharply in the ADT group by 3 months and then remained stable to 36 months (P = .0041). TUG scores declined gradually in the ADT group over 36 months but were unchanged in control groups (P = .0008). Aggregate physical QOL declined in ADT users over time but remained stable in control groups (P = .0001). Aggregate mental QOL was stable in all groups. Declines seen in the first year of ADT use generally persisted over 36 months and were independent of age., CONCLUSIONS: Previously noted physical side effects over the first 12 months of ADT persisted or continued to worsen over an additional 2 years with no evidence of recovery. Exercise interventions to counteract these declines may be warranted.	1
2	Aydin Sayilan & Özbaş (2018) The effect of pelvic floor muscle training on incontinence problems after radical prostatectomy.	The aim of the current study was to determine the effect of pelvic floor muscle exercises (PFME/Kegel) training administered to patients scheduled for robot-assisted radical prostatectomy on postprocedural incontinence problems. This study was a randomized controlled trial. Pelvic floor muscle exercises were applied to the procedure group three times a day for 6 months. No exercises were applied to the control group. Incontinence and quality-of-life assessments of the 60 patients in the experimental and control groups were performed on months 0 (10 days after removal of the urinary catheter), 1, 3, and 6 through face-to-face and telephone interviews. Total Incontinence Consultation on Incontinence-Short Form scores, which provide an objective criterion for the evaluation of individuals with incontinence problems, decreased over time. This decrease was statistically highly significant in the third and sixth months. Pelvic muscle floor exercises are suitable for patients experiencing incontinence after radical prostatectomy.	2,3

3	Bigaran, Zopf, & Gardner et al. (2020) The effect of exercise training on cardiometabolic health in men with prostate cancer receiving androgen deprivation therapy: a systematic review and meta-analysis.	Background: Growing evidence suggests that men exposed to androgen deprivation therapy (ADT) have an increased risk of cardiovascular disease. While exercise has shown to attenuate some adverse effects of ADT, the effects on cardiometabolic health have not been systematically evaluated. Objective: To evaluate the effect of exercise on cardiometabolic health in men with prostate cancer (PCa) receiving ADT. Methods: A systematic literature search of MEDLINE, EMBASE, CINHAL, SCOPUS, WEB OF SCIENCE and SPORTSDICUS from database inception to April 2020 was performed. A quantitative synthesis using Cohens d effect size and a meta-analysis using random-effects models were conducted. Results: Overall, fourteen randomised controlled trials (RCTs) and four non-randomised studies were included. Eleven RCTs (n = 939 patients) were included in the meta-analysis. Exercise training improved the 400-m-walk test (MD −10.11 s, 95% CI [−14.34, −5.88]; p < 0·00001), diastolic blood pressure (−2.22 mmHg, [−3.82, −0.61]; p = 0.007), fasting blood glucose (−0.38 mmol/L, [−0.65, −0.11]; p = 0.006), C-reactive protein (−1.16 mg/L, [−2.11, −0.20]; p = 0.02), whole-body lean mass (0.70 kg, [0.39, 1.01]; p < 0.0001), appendicular lean mass (0.59 kg, [0.43, 0.76]; p < 0.00001), whole-body fat mass (−0.67 kg, [−1.08, −0.27]; p = 0.001), whole-body fat percentage (−0.79%, [−1.16, −0.42]; p < 0.0001), and trunk fat mass (−0.49 kg, [−0.87, −0.12]; p = 0.01), compared to usual care. No significant effects on systolic blood pressure or blood lipid metabolism were detected. Conclusions: In a small subset of evaluated studies, exercise may favourably improve some but not all markers of cardiometabolic health. Future exercise intervention trials with cardiometabolic outcomes as primary endpoints are needed to confirm these initial findings.	1
4	Boisen, Krägeloh & Shepherd et al. (2016) A cross-sectional comparison of quality of life between physically active and underactive older men with prostate cancer.	Men with prostate cancer experience many side effects and symptoms that may be improved by a physically active lifestyle. It was hypothesized that older men with prostate cancer who were physically active would report significantly higher levels of quality of life (QOL) as assessed by the WHOQOL-BREF and the WHOQOL-OLD. Of the 348 prostate cancer survivors who were invited to participate in the present postal survey, 137 men returned the questionnaires. Those who were physically active had significantly lower prostate specific antigen (PSA) scores and higher social participation than those insufficiently active. These findings offer some support for the benefits of physical activity (PA) within the prostate cancer population in managing the adverse side effects of their treatments on aspects of their QOL. Future research should more closely examine what types of PA best promote improvements in varying aspects of QOL and psychological well-being for prostate cancer survivors.	1,5

5	Buffart, Newton & Chinapaw et al. (2015) The effect, moderators, and mediators of resistance and aerobic exercise on health-related quality of life in older long-term survivors of prostate cancer.	BACKGROUND: The current study examined effects, moderators (for whom), and mediators (working mechanisms) of 12 months of exercise on health-related quality of life (HRQoL) in older long-term survivors of prostate cancer. METHODS: In total, 100 men aged 71.7 years (standard deviation, 6.4 years) were randomly assigned to 6 months of supervised aerobic and resistance exercise followed by 6 months of a home-based exercise maintenance program (EX group) or printed education material regarding physical activity for 12 months (PA group). Assessments took place at baseline and after 6 and 12 months. Generalized estimating equations were used to study the effects of EX versus PA on HRQoL at 6 and 12 months, adjusting for baseline HRQoL. The authors examined potential socio-demographic and clinical moderators by adding interaction terms, and potential physical and psychological mediators using the product-of-coefficients test. RESULTS: At 6 months, significant beneficial effects were found for global QoL, physical function, and social function in the EX group compared with the PA group. For physical function, beneficial effects were sustained at 12 months. Moderation analyses demonstrated larger effects of EX versus PA for patients who were married, started exercising sooner after their diagnosis, and previously used bisphosphonates. Changes in lower body functional performance significantly mediated the effect of EX on global QoL, physical function, and social function. No mediating effects on HRQoL were found for aerobic fitness, physical activity, fatigue, distress, or falls self-efficacy. CONCLUSIONS: Aerobic and resistance exercise appears to have beneficial effects on HRQoL among older, long-term survivors of prostate cancer. Effects were moderated by marital status, time since diagnosis, and use of bisphosphonates, and were mediated by lower body functional performance. Cancer 2015;121:2821-30. VC	5
6	Cormie, Newton & Spry et al. (2013) Safety and efficacy of resistance exercise in prostate cancer patients with bone metastases.	BACKGROUND: Due to concerns of fragility fracture, exercise is a perceived contraindication for prostate cancer patients with bone metastases. These patients experience significant functional impairment and muscle atrophy, which may lead to an increased likelihood of skeletal complications (i.e., pathological fracture, bone pain) and/or falls. Safe resistance exercise prescription may counteract this effect. The aim of this feasibility trial was to determine the safety and efficacy of resistance exercise by prostate cancer survivors with bone metastatic disease., METHODS: Twenty men with established bone metastases secondary to prostate cancer were randomly assigned to a 12-week resistance exercise program in which exercise prescription was based on the location of bone lesions (n=10) or usual care (n=10). Outcomes included safety and tolerance of the exercise program, physical function, physical activity level, body composition, fatigue, quality of life and psychological distress. Outcomes were compared between groups using analysis of covariance adjusted for baseline values., RESULTS: Participants had significant disease load with 65% of participants presenting with two or more regions affected by bone metastases and an average Gleason score of 8.2+/-0.9. Five participants (exercise=2; usual care=3) did not complete the intervention, three of which were due to advancing disease (exercise=2; usual care=1). No adverse events or skeletal complications occurred during the supervised exercise sessions. The exercise program was well tolerated as evidenced by high attendance (83%) and compliance rates (93%), and the ability of the participants to exercise at an intensity within the target range for cancer survivors (rating of perceived exertion =13.8+/-1.5). The change in physical function (muscle strength ~11%;	6

		submaximal aerobic exercise capacity ~5% and ambulation ~12%), physical activity level (~24%) and lean mass (~3%) differed significantly between groups following the intervention, with favorable changes in the exercise group compared with the usual care group. No significant between-group differences were observed for fatigue, quality of life or psychological distress., CONCLUSIONS: This initial evidence involving a small sample size suggests that appropriately designed and supervised resistance exercise may be safe and well tolerated by prostate cancer patients with bone metastatic disease and can lead to improvements in physical function, physical activity levels and lean mass. Future trials involving larger sample sizes are required to expand these preliminary findings.	
7	Cormie, Newton & Taaffe et al. (2013) Exercise therapy for sexual dysfunction after prostate cancer	Sexual dysfunction is one of the most common, distressing and persistent adverse effects of prostate cancer treatment, and has a profound effect on quality of life for the patient and his partner. Current health-care provisions are inadequate to address the demand for the management of sexual dysfunction, with approximately half of prostate cancer survivors reporting unmet sexual health-care needs. Management strategies predominately involve pharmacological interventions to address the direct physiological effects of prostate cancer treatment on erectile function. However, the aetiology of sexual dysfunction is multifaceted and considerable physiological and psychological adverse effects of prostate cancer treatments, which are not addressed by pharmacological intervention, contribute to sexual dysfunction. Exercise has established efficacy for improving many of these factors in men with prostate cancer, including changes in body composition (especially to counteract body feminization), fatigue, physical function, risk of comorbid conditions, depression, anxiety and quality of life. Emerging evidence indicates that exercise also has a positive effect on sexual desire and sexual activity in men with prostate cancer.	1,4
8	Emanu, Avildsen & Nelson et al. (2016) Erectile dysfunction after radical prostatectomy: prevalence, medical treatments, and psychosocial interventions	PURPOSE OF REVIEW: This review will discuss erectile dysfunction in prostate cancer patients following radical prostatectomy. It will focus on the prevalence and current treatments for erectile dysfunction as well as the emotional impact of erectile dysfunction and the current psychosocial interventions designed to help patients cope with this side effect. RECENT FINDINGS: Although there is a large discrepancy in prevalence rates of erectile dysfunction after radical prostatectomy, several recent studies have cited rates as high as 85%. The concept of 'penile rehabilitation' is now the standard of practice to treat erectile dysfunction following radical prostatectomy. However, many men avoid seeking help or utilizing erectile dysfunction treatments. This avoidance is related to the shame, frustration, and distress many men with erectile dysfunction and their partners experience. Recent psychosocial interventions have been developed to facilitate the use of treatments and help men cope with erectile dysfunction. These interventions have shown initial promise, however, continued intervention development is needed to reduce distress and improve long-term erectile function outcomes. SUMMARY: Erectile dysfunction is a significant problem following prostate cancer surgery. Although there are effective medical treatments, the development of psychosocial interventions should continue to evolve to maximize the assistance we can give to men and their partners.	4

9	Galvão, Spry & Denham et al. (2014) A multicentre year-long randomised controlled trial of exercise training targeting physical functioning in men with prostate cancer previously treated with androgen suppression and radiation from TROG 03.04 radar	Background Long-term prostate cancer (PCa) survivors are at increased risk for comorbidities and physical deconditioning. Objective To determine the effectiveness of a year-long randomised controlled trial of exercise training in PCa survivors >5 yr postdiagnosis on physical functioning. Design, setting, and participants Between 2010 and 2011, 100 long-term PCa survivors from Trans-Tasman Radiation Oncology Group 03.04 Randomised Androgen Deprivation and Radiotherapy previously treated with androgen-deprivation therapy and radiation therapy were randomly assigned to 6 mo of supervised exercise followed by 6 mo of a home-based maintenance programme (n = 50) or printed educational material about physical activity (n = 50) for 12 mo across 13 university-affiliated exercise clinics in Australia and New Zealand. Intervention Supervised resistance and aerobic exercise or printed educational material about physical activity. Outcome measurements and statistical analysis The primary end point was a 400-m walk as a measure of cardiovascular fitness. Secondary end points were physical function, patient-reported outcomes, muscle strength, body composition, and biomarkers. Analysis of covariance was used to compare outcomes for groups at 6 and 12 mo adjusted for baseline values. Results and limitations Participants undergoing supervised exercise showed improvement in cardiorespiratory fitness performance at 6 mo (-19 s [p = 0.029]) and 12 mo (-13 s [p = 0.028]) and better lower-body physical function across the 12-mo period (p < 0.01). Supervised exercise also improved self-reported physical functioning at 6 (p =.006) and 12 mo (p = 0.002), appendicular skeletal muscle at 6 mo (p = 0.019), and objective measures of muscle strength at 6 and 12 mo (p < 0.050). Limitations included the restricted number of participants undertaking body composition assessment, no blinding to group assignment for physical functioning measures, and inclusion of well-functioning individuals. Conclusions Supervised exercise training in long-term PCa survivors is more effective than physical activity educational material for increasing cardiorespiratory fitness, physical function, muscle strength, and self-reported physical functioning at 6 mo. Importantly, these benefits were maintained in the long term with a home-based programme with follow-up at 12 mo. Clinical trial registry The effect of an exercise intervention on cardiovascular and metabolic risk factors in prostate cancer patients from the RADAR study.	1
10	Galvão, Taaffe & Cormie et al. (2011) Efficacy and safety of a modular multi-modal exercise program in prostate cancer patients with bone metastases: a	BACKGROUND: The presence of bone metastases has excluded participation of prostate cancer patients in exercise intervention studies to date and is also a relative contraindication to supervised exercise in the community setting because of concerns of fragility fracture. However, this group of patients often have developed significant muscle atrophy and functional impairments from prior and continuing androgen deprivation that is exacerbated by subsequent and more intensive interventions such as chemotherapy. The aim of this study is to determine the efficacy and safety of a modular multi-modal exercise program in prostate cancer patients with bone metastases., METHODS/DESIGN: Multi-site randomized controlled trial in Western Australia and New South Wales to examine the efficacy and safety of a modular multi-modal physical exercise program in 90 prostate cancer survivors with bone metastases. Participants will be randomized to (1) modular multi-modal exercise intervention group or (2) usual medical care group. The modular multi-modal exercise group will receive a 3-month supervised exercise program based on bone lesion location/extent. Measurements for primary and secondary endpoints will take place at baseline, 3 months (end	1,5,6

	randomized controlled trial.	of the intervention) and 6 months follow-up., DISCUSSION: Delaying or preventing skeletal complication and improving physical function for men with bone metastases would provide clinically meaningful benefits to patients. However, exercise programs must be designed and executed with careful consideration of the skeletal complications associated with bone metastatic disease and cumulative toxicities from androgen deprivation such as osteoporosis and increased risk of fractures. The results from this study will form the basis for the development of a specific exercise prescription in this patient group in order to alleviate disease burden, counteract the adverse treatment related side-effects and enhance quality of life.	
11	Galvão, Taaffe & Spry et al. (2018) Exercise preserves physical function in prostate cancer patients with bone metastases.	PURPOSE: The presence of bone metastases has excluded participation of cancer patients in exercise interventions and is a relative contraindication to supervised exercise in the community setting because of concerns of fragility fracture. We examined the efficacy and safety of a modular multimodal exercise program in prostate cancer patients with bone metastases., METHODS: Between 2012 and 2015, 57 prostate cancer patients (70.0 +/- 8.4 yr; body mass index, 28.7 +/- 4.0 kg.m) with bone metastases (pelvis, 75.4%; femur, 40.4%; rib/thoracic spine, 66.7%; lumbar spine, 43.9%; humerus, 24.6%; other sites, 70.2%) were randomized to multimodal supervised aerobic, resistance, and flexibility exercises undertaken thrice weekly (EX; n = 28) or usual care (CON; n = 29) for 3 months. Physical function subscale of the Medical Outcomes Study Short-Form 36 was the primary end point as an indicator of patient-rated physical functioning. Secondary end points included objective measures of physical function, lower body muscle strength, body composition, and fatigue. Safety was assessed by recording the incidence and severity of any adverse events, skeletal complications, and bone pain throughout the intervention., RESULTS: There was a significant difference between groups for self-reported physical functioning (3.2 points; 95% confidence interval, 0.4-6.0 points; P = 0.028) and lower body muscle strength (6.6 kg; 95% confidence interval, 0.6-12.7; P = 0.033) at 3 months favoring EX. However, there was no difference between groups for lean mass (P = 0.584), fat mass (P = 0.598), or fatigue (P = 0.964). There were no exercise-related adverse events or skeletal fractures and no differences in bone pain between EX and CON (P = 0.507)., CONCLUSIONS: Multimodal modular exercise in prostate cancer patients with bone metastases led to self-reported improvements in physical function and objectively measured lower body muscle strength with no skeletal complications or increased bone pain.	1,6
12	Gentili, McClean & Hackshaw-McGeagh et al. (2019) Body image issues and attitudes	Background: Androgen deprivation therapy (ADT) is an established treatment for prostate cancer (PCa), but its side-effects can affect body appearance and function- ing. However, research into the impact of ADT on body image is limited. Exercise can help patients to counterbalance some side-effects, potentially improving body image too. However, adherence to exercise recommendations is low. Therefore, we explored body image after ADT and attitudes towards exercise. Methods: Twenty two semi-structured interviews were conducted with PCa patients receiving ADT (Mage = 67.9 years old, SD = 9.99). Results: Participants expressed appearance dissatisfaction focusing on body feminization. Participants exercised to counterbalance ADT side-effects and improve mood. Exercise also helped	1

	towards exercise amongst men undergoing androgen deprivation therapy (ADT) following diagnosis of prostate cancer.	them to re-establish a sense of control over their body and experience a sense of achievement. However, some men described being worried that their appearance and physical performance would be judged by others, so they often exercised alone or gave up exercise. Time management and fatigue were also identified as exercise barriers. Conclusion: These findings highlight the need to further investigate body image concerns and exercise barriers in PCa patients undergoing ADT. These results could also inform support groups and health care professionals on the topic. However, further research should explore the most effective and acceptable ways to provide sup- port to PCa patients on body image issues.	
13	Grossmann, Hamilton & Gilfillan et al. (2011) Bone and metabolic health in patients with non-metastatic prostate cancer who are receiving androgen deprivation therapy.	Androgen deprivation therapy (ADT) in men with prostate cancer increases the risk of osteoporotic fractures, type 2 diabetes and, possibly, cardiovascular events. There is considerable uncertainty about the risk-benefit ratio of ADT in non-palliative treatment; the benefits of ADT in treating non-metastatic prostate cancer need to be carefully weighed against the risks of ADT-induced adverse events. Baseline assessment of bone health at the initiation of ADT should include measurement of bone mineral density (BMD) by dual energy x-ray absorptiometry and, in men with osteopaenia, a thoracolumbar spine x-ray. General measures to prevent bone loss, including regular physical activity, as well as ensuring calcium and vitamin D sufficiency, should be instituted routinely. All men with a previous minimal trauma fracture should receive pharmacological therapy unless contraindicated; for those who have not sustained a minimal trauma fracture, treatment is advised if the BMD T score is <= - 2.0, or if the 10-year risk of a major osteoporotic fracture exceeds 20%. Men with prostate cancer who are receiving ADT should be closely monitored for weight gain and diabetes; intensive lifestyle intervention is recommended to prevent ADT-induced weight gain and insulin resistance. Management of the metabolic sequelae of ADT includes optimal reduction of cardiovascular risk factors, with particular attention to weight, blood pressure, lipid profile, smoking cessation, and glycaemic control.	1,6
14	Heydenreich, Puta & Gabriel et al. (2020) Does trunk muscle training with an oscillating rod improve urinary	Objective: To investigate the effect of a new therapeutic approach, using an oscillating rod to strength the pelvic floor and deep abdominal musculature and to speed up recovery of continence after radical prostatectomy. Design: Prospective randomized controlled clinical trial. Setting: Inpatient uro-oncology rehabilitation clinic. Subjects: Ninety-three (intervention group (IG)) and ninety-one patients (control group (CG)) with urinary incontinence after prostatectomy were examined. Intervention: All patients were randomly allocated to either standard pelvic floor muscle exercises and oscillating rod therapy (IG) or standard pelvic floor muscle exercises and relaxation therapy (CG). Main outcome measures: Urinary incontinence (1- and 24-hour pad test) was assessed, and health- related quality of life (HRQL; Functional Assessment of Cancer Therapy-Prostate (FACT-P) questionnaire) was measured	2,3

	incontinence after radical prostatectomy? A prospective randomized controlled trial.	for all patients before and after three weeks of treatment. Results: One hundred and eighty-four patients (mean (SD) age: 64.1 (6.94) years) completed the study. The IG showed a significant reduction in urinary incontinence (1-hour pad test: P = 0.008, 24-hour pad test: P = 0.012) and a significant improvement of HRQL (P = 0.017) compared with CG. Continence was significantly improved in both groups (1-hour pad test: 22.6–8.5 g (IG) vs. 23.0–18.1 g (CG)/24-hour pad test: 242.9–126.7 g (IG) vs. 237.6–180.9 g (CG)).	
15	Hirschhorn, Kolt & Brooks (2014) A multicomponent theory-based intervention improves uptake of pelvic floor muscle training before radical prostatectomy: a 'before and after' cohort study.	OBJECTIVE: To assess the effect of a multicomponent theory-based intervention, incorporating patient information guides, an evidence summary, audit and feedback processes and a provider directory, in the provision/receipt of preoperative pelvic floor muscle training (PFMT) among patients undergoing radical prostatectomy., SUBJECTS AND METHODS: Over an 18-month period (9 months before and 9 months after the intervention), we measured the provision/receipt of preoperative PFMT using surveys of patients undergoing radical prostatectomy at one public hospital (n = 32) and two private hospitals (n = 107) in Western Sydney, Australia, as well as practice audits of associated public sector (n = 4) and private sector (n = 2) providers of PFMT. Self-report urinary incontinence was assessed 3 months after radical prostatectomy using the International Consultation on Incontinence Questionnaire - Urinary Incontinence Form (ICIQ-UI Short Form)., RESULTS: There was a significant increase in the proportion of survey respondents receiving preoperative PFMT post-intervention (post-intervention: 42/58 respondents, 72% vs pre-intervention: 37/81 respondents, 46%, P = 0.002). There was a corresponding significant increase in provision of preoperative PFMT by private sector providers (mean [sd] post-intervention: 16.7 [3.7] patients/month vs pre-intervention: 12.1 [3.6] patients/month, P = 0.018). Respondents receiving preoperative PFMT had significantly better self-report urinary incontinence at 3 months after radical prostatectomy than those who did not receive preoperative PFMT (mean [sd] ICIQ-UI Short Form sum-scores: 6.2 [5.0] vs 9.2 [5.8], P = 0.002)., CONCLUSIONS: The intervention increased the provision/receipt of preoperative PFMT among patients undergoing radical prostatectomy. Additional component strategies aimed at increasing the use of public sector providers may be necessary to further improve PFMT receipt among patients undergoing radical prostatectomy in the public hospital system.	2,3
16	Lin, Yu & Lin et al. (2012) Effects of early pelvic-floor muscle exercise for sexual dysfunction in radical	Background: Sexual dysfunction is common after radical prostatectomy (RP). Although pelvic-floor muscle exercise (PFME) has been recommended for sexual dysfunction, the optimal time for starting exercises after this surgery and the effects of exercise still need to be examined. Objectives: The present study was intended to explore the prevalence of sexual dysfunction and to assess the efficacy of PFME in sexual dysfunction following RP. Methods: Participants were randomly distributed into an experimental group (n = 35) or a control group (n = 27). The experimental group took part in PFME as part of regular daily activities after catheter removal post-RP. The control group was taught the exercise in the third month after RP. We followed up the participants at 1, 3, 6, 9, and 12 months. Results: All of the patients experienced a severe degree of sexual dysfunction after receiving RP. A t test showed a significant difference	2,4

	prostatectomy recipients	in the sexual function mean score between the experimental and control groups at 6 and 12 months. A mixed-model analysis indicated that, after a controlled surgical approach, there was a significant difference in group effect. The experimental group's sexual function was better than the control group's sexual function. Conclusion: This study demonstrates that early PFME is an effective intervention for sexual dysfunction in prostatectomy patients. The results can help healthcare providers to include this intervention in patients' discharge plans. Implications for Practice: Patient sexual dysfunction after an RP is common. Nurses should evaluate and manage patients' sexual dysfunction and promote the early return of patients' potency.	
17	Mardani, Pedram & Mazaheri et al. (2020) Effect of the exercise programme on the quality of life of prostate cancer survivors: A randomized controlled trial.	Aim: The aim of this study was to investigate the effect of the exercise programme on the quality of life of prostate cancer (PCa) survivors. Methods: A randomized controlled, parallel trial was conducted from April 2017 to January 2018 on 80 PCa survivors. They were randomly assigned to intervention and control groups (n = 40 in each group). The exercise programme was designed based on the self-management approach (SMA). The intervention group participated in a 12-week exercise programme consisting of one session of group exercise and three sessions of individual exercise per week using exercise facilities in the community. Data were collected using the quality of life questionnaires and the follow-up checklist. Results: In the intervention group, statistically significant improvements in physical, role, emotional, social and sexual functions were reported. Also, the patients in this group reported reduced fatigue, insomnia, constipation, diarrhoea, urinary, bowel and hormonal treatment-related symptoms in comparison with before the exercise pro- gramme ($p < 0.05$). Conclusions: Nurses are suggested to plan for improving the participation of PCa survivors in exercise programmes using exercise facilities in the community in order to reduce the complications of treatment and improve their quality of life.	1,5
18	Milios, Ackland & Green (2020) Pelvic floor muscle training and erectile dysfunction in radical prostatectomy: A randomized controlled trial investigating a non-invasive addition to	Introduction: Pelvic floor muscle (PFM) training for postprostatectomy incontinence is considered a first line approach to rehabilitation, but PFM training for erectile dysfunction (ED) after surgery is less well known. With more than 1.4 million new cases diagnosed globally per year, there is a need for non-invasive options to assist sexual dysfunction recovery. Aim: Commencing preoperatively and using both fast and slow twitch fibre training performed in standing postures, new protocols were developed to address clinical presentations with aims to reduce ED and impact on quality of life (QoL). Comparisons with “usual care” PFM training, prerehabilitation and postrehabilitation were then assessed. Methods: A randomised controlled trial of 97 men undergoing radical prostatectomy (RP) were allocated to either a control group (n ¼ 47) performing “usual care” of 3 sets/d PFMT or an intervention group (n ¼ 50), performing 6 sets/d in standing, commencing 5 weeks before RP. Outcome measures: Participants were assessed preoperatively and at 2, 6, and 12 weeks after RP using the Expanded Prostate Cancer Index Composite for Clinical Practice, International Index of Erectile Function-5, and real time ultrasound measurements of PFM function. Results: At all time points, there was a significant difference ($P< 0.05$) between groups; however, the only time point where this difference was clinically relevant was at 2 weeks after RP, with the intervention group reporting less distress in the Expanded Prostate Cancer Index Composite for Clinical Practice QoL outcome. Secondary measures of EPIC-EF	2,4

	penile rehabilitation.	and real time ultrasound PFM function tests demonstrated improvement over all time points in both groups with lower bothersome scores in the intervention group. Conclusions: Early PFM training reduces early QoL impact for postprostatectomy ED, with faster return to continence enabling earlier commencement of penile rehabilitation. While our 12-week protocol and sample size was not powerful enough to demonstrate conclusive benefits of early PFM training for ED, PFM intervention after RP over longer times has been supported by others. Milios	
19	Milios, Ackland & Green (2019) Pelvic floor muscle training in radical prostatectomy: a randomized controlled trial of the impacts on pelvic floor muscle function and urinary incontinence.	Background: Pelvic floor muscle training (PFM) training for post-prostatectomy incontinence (PPI) is an important rehabilitative approach, but the evidence base is still evolving. We developed a novel PFM training program focussed on activating fast and slow twitch muscle fibres. We hypothesized that this training, which commenced pre-operatively, would improve PFM function and reduce PPI, when compared to a control group. Methods: This randomized trial allocated 97 men (63 ± 7y, BMI = 25.4, Gleason 7) undergoing radical prostatectomy (RP) to either a control group (n = 47) performing low-volume rehabilitation, or an intervention group (n = 50). Both interventions commenced 5 weeks prior to surgery and continued for 12 weeks post-RP. Participants were assessed pre-operatively and at 2, 6 and 12 weeks post-RP using 24 h pad weights, International Prostate Symptom Score (IPSS), Expanded Prostate Cancer Index Composite for Clinical Practice (EPIC-CP) and real time ultrasound (RTUS) measurements of PFM function. Results: Following RP, participants in the control group demonstrated a slower return to continence and experienced significantly more leakage ($p < 0.05$), measured by 24 h pad weight, compared to the intervention group, suggesting an impact of the prehabilitation protocol. PFM function measures were enhanced following RP in the intervention group. Secondary measures (IPSS, EPIC-CP and RTUS PFM function tests) demonstrated improvement across all time points, with the intervention group displaying consistently lower "bothersome" scores. Conclusions: A pelvic floor muscle exercise program commenced prior to prostate surgery enhanced post-surgical measures of pelvic floor muscle function, reduced PPI and improved QoL outcomes related to incontinence. Trial registration: The trial was registered in the Australia New Zealand Clinical Trials Registry and allocated as ACTRN12617001400358. The trial was registered on 4/10/2017 and this was a retrospective registration.	2,3
20	Mundell, Daly & Macpherson et al. (2017) Cognitive decline in prostate cancer patients undergoing ADT: a potential	Androgen deprivation therapy (ADT) is an effective and widely prescribed treatment for prostate cancer (PCa), but it is associated with multiple treatment-induced adverse effects that impact on various musculoskeletal and cardiometabolic health outcomes. Emerging research has shown that ADT is also associated with cognitive impairment, which has been linked to a loss of independence, increased falls and fracture risk and greater use of medical services. The aim of this review is to outline the evidence related to the effect of ADT use on cognitive function, and propose a role for exercise training as part of usual care to prevent and/or manage cognitive impairments for PCa survivors on ADT. The following results have been obtained from this study. ADT has been shown to adversely affect specific cognitive domains, particularly verbal memory, visuomotor function, attention and executive function. However, current clinical guidelines do not recommend routine assessment of cognitive function in these men. No studies have examined whether exercise training can preserve or improve cognitive function in these men,	1,6

	role for exercise training.	but in healthy adults', multimodal exercise training incorporating aerobic training, progressive resistance training (PRT) and challenging motor control exercises have the potential to attenuate cognitive decline. In conclusion, as treatment with ADT for men with PCa has been associated with a decline in cognition, it is recommended that cognitive function be routinely monitored in these men and that regular exercise training be prescribed to preserve (or improve) cognitive function. Assessment of cognition and individualised exercise training should be considered in the usual treatment plan of PCa patients receiving ADT.	
21	Narayan, Harrison & Cheng et al. (2020) Improving research for prostate cancer survivorship: A statement from the Survivorship Research in Prostate Cancer (SuRECaP) working group.	Survivorship care for patients with prostate cancer requires careful consideration of unique disease-specific factors, including the prolonged natural disease history, the potential for competing health risks, and the consequences of long-term androgen deprivation therapy. However, current prostate cancer survivorship research is unfortunately limited by the lack of a robust supportive evidence base, variability in the definitions and measurement of survivorship outcomes, and a heavy reliance on expert opinion. As a result, the conduct of quality prostate cancer survivorship research is of increasing importance for patients, medical providers, and other key stakeholders. This manuscript harmonizes a path forward for improving prostate cancer survivorship by defining prostate cancer survivorship and survivorship research, as well as by highlighting key research priorities and cooperative mechanisms for survivorship studies within prostate cancer, with a particular focus on men with advanced disease.	1,6
22	Nilssen, Morkved & Overgard et al. (2012) Does physiotherapist-guided pelvic floor muscle training increase the quality of life in patients after radical prostatectomy? A	Objective. The aim of this study was to study the effect of postoperative physiotherapist-guided pelvic floor muscle training (PFMT) on health-related quality of life (HRQoL) parameters in patients treated with radical prostatectomy (RP). Material and methods. A prospective randomized controlled trial was conducted at St. Olavs Hospital, Trondheim University Hospital, Norway. Eighty-five men were randomized into two intervention groups (A and B). patients in group A (n = 42) were offered physiotherapist-guided PFMT (in groups or by DVD) once weekly throughout the first 12 months after RP, while those in group B (n = 43) trained on their own. HRQoL data were assessed using the University of California, Los Angeles Prostate Cancer Index (UCLA-PCI) and the Short Form-12 (SF-12) health survey. The physical component summary (PCS) and mental component summary (MCS) scores of the SF-12 plus the urinary, sexual and bowel function and bother of the UCLA- PCI make up the eight quality of life outcomes used in this study. Data were obtained preoperatively (baseline), 6 weeks, and 3, 6 and 12 months postoperatively. Results. Eighty patients completed at least one follow-up assessment, 38 in group A and 42 in group B, giving a dropout rate of 5.9%. The overall response rates were 96% at baseline, 83% at 6 weeks, 90% at 3 months, 88% at 6 months and 68% at 12 months. No statistically significant difference in HRQoL was found between groups A and B. Conclusions. Even though physiotherapist-guided training of the pelvic floor muscles after RP improved	2,3

	randomized clinical study.	postoperative urinary incontinence significantly compared to those patients receiving standard care/training, this was not reflected in better outcome in HRQoL parameters.	
23	Østergren, Kistorp & Bennedbæk et al. (2016) The use of exercise interventions to overcome adverse effects of androgen deprivation therapy.	Androgen deprivation therapy (ADT) induces severe hypogonadism and is associated with several adverse effects that negatively affect health and quality of life in patients with prostate cancer. ADT changes body composition characterized by an increase in fat mass and a reduction in muscle mass and strength. Insulin sensitivity is also diminished and population-based studies indicate an increased risk of diabetes mellitus and cardiovascular disease in men receiving ADT. Particularly the first 6 months of treatment seem to hold an additional risk of new cardiovascular events for patients with already existing cardiovascular disease. In this initial phase of ADT, metabolic changes are also most prominent. In addition, ADT increases the rate of bone loss and fracture risk. Currently available evidence supports the use of exercise interventions to improve physical function and mitigate ADT-induced fatigue. Some studies also indicate that exercise might moderate ADT-related changes in body composition. However, beneficial effects of exercise interventions on other ADT-related conditions have not been conclusively proven. Trials investigating the effects of ADT on fracture risk and development of diabetes mellitus and cardiovascular disease are still warranted. Furthermore, studies investigating safety and effects of physical activity in men with bone metastases are lacking.	1,4,6
24	Park, Kim & Nam et al. (2012) Recovery of overall exercise ability, quality of life, and continence after 12-week combined exercise intervention in elderly patients who underwent radical prostatectomy: a randomized controlled study	OBJECTIVE To examine the changes from a combined exercise intervention after radical prostatectomy (RP) in elderly patients with prostate cancer, because randomized controlled trials addressing exercise intervention after RP have been lacking. METHODS From May 2009 to May 2010, all patients who underwent laparoscopic RP were assessed for eligibility. A total of 66 patients were randomized to an exercise or a control group. The exercise group received a combined exercise intervention (resistance, flexibility, and Kegel exercises) twice a week for 12 weeks, and the control group received only Kegel exercises. The primary outcome was physical function, and the secondary outcomes were continence status and quality of life after the exercise intervention. RESULTS A total of 49 patients completed follow-up to the end of study. After the 12-week exercise intervention, except for grip strength, all physical functions were better in the exercise group than in the control group. The 24-hour pad test results (12.2 g in the exercise group, 46.2 g in the control group) and continence rate (73.1% in exercise group, 43.5% in the control group) recovered more promptly in the exercise group. On a questionnaire study using the International Consultation on Incontinence questionnaire, Beck Depression Inventory, and Medical Out- comes Study 36-item short-form health survey, only the exercise group showed improvement at the last follow-up visit. CONCLUSION A 12-week combined exercise intervention after RP results in improvement of physical function, continence rate, and quality of life. These results could help with prompt recovery of daily activities.	2,3,5

25	Prota, Gomes & Ribeiro et al. (2012) Early postoperative pelvic-floor biofeedback improves erectile function in men undergoing radical prostatectomy: a prospective, randomized, controlled trial	Erectile dysfunction (ED) and urinary incontinence are common complications following radical prostatectomy (RP). Although pelvic-floor biofeedback training (PFBT) may improve urinary continence following RP, its effects on the recovery of potency are unknown. Fifty-two patients selected for RP were prospectively randomized for a treatment group (n¼26) receiving PFBT once a week for 3 months and home exercises or a control group (n¼26), in which patients received verbal instructions to contract the pelvic floor. Erectile function (EF) was evaluated with the International Index of Erectile Function-5 (IIEF-5) before surgery and 1, 3, 6 and 12 months postoperatively. Patients were considered potent when they had a total IIEF-5 score 420. Continence status was assessed and defined as the use of no pads. Groups were comparable in terms of age, body mass index, diabetes, pathological tumor stage and neurovascular bundle preservation. A significant reduction in IIEF-5 scores was observed after surgery in both groups. In the treatment group, 8 (47.1%) patients recovered potency 12 months postoperatively, as opposed to 2 (12.5%) in the control group (P¼0.032). The absolute risk reduction was 34.6% (95% confidence interval (CI): 3.8--64%) and the number needed to treat was 3 (95% CI: 1.5--17.2). A strong association between recovery of potency and urinary continence was observed, with continent patients having a 5.4 higher chance of being potent (P¼0.04). Early PFBT appears to have a significant impact on the recovery of EF after RP. Urinary continence status was a good indicator of EF recovery, with continent patients having a higher chance of being potent.	2,4
26	Santa Mina, Guglietti & Alibhai et al. (2014) The effect of meeting physical activity guidelines for cancer survivors on quality of life following radical prostatectomy for prostate cancer.	Purpose Recent literature has shown that preoperative physical activity (PA) can positively influence surgical outcomes. It is unknown whether the effect of meeting PA guidelines for cancer survivors can impact quality of life following radical prostatectomy for prostate cancer. Methods We reviewed our institutional database of prostate cancer outcomes and included patients that underwent radical prostatectomy and completed the Godin–Shephard Leisure Time Exercise Questionnaire (GLTEQ), the Patient-Oriented Prostate Utility Scale (PORPUS), the International Prostate Symptom Score (IPSS), and the five-item International Index of Erectile Function (IIEF). Participants were categorized as meeting or not meeting the American College of Sports Medicine physical activity guidelines for cancer survivors (150 min of moderate intensity or 75 min of vigorous intensity PA per week). Radical prostatectomy outcomes were measured preoperatively and at 6 and 26-weeks postoperatively. Results From June 2008 to August 2012, 509 men underwent curative, nerve-sparing radical prostatectomy for prostate cancer and completed the GLTEQ, of whom 46 % met the PA guidelines. Prior to surgery, men that met the PA guidelines reported higher quality of life (p <0.001) and erectile function (p =0.049) than men that did not meet the guidelines. Quality of life at all postoperative timepoints was higher for men that met the PA guidelines after adjusting for age, preoperative body mass index, and surgical approach (p =0.02). Men that met the PA guidelines were 19 % less likely to be incontinent at 6 weeks postoperatively (p =0.028). Conclusion PA volume may be a useful marker at predicting postoperative recovery of quality of life and urinary incontinence following radical prostatectomy. Implications for Cancer Survivors Cancer survivors should be encouraged to meet PA guidelines prior to surgery in an effort to attenuate the decline in HRQOL and facilitate recovery.	3,4,5

27	Serdà & Marcos-Gragera (2014) Urinary incontinence and prostate cancer: a progressive rehabilitation program design.	Purpose: To design and implement a rehabilitation program based on pelvic floor muscle training (PFMT) to improve the urinary incontinence (UI). Methods: This study is based on a randomized clinical trial. The sample was formed by 66 participants with prostate cancer. The intervention groups were randomized into an experimental group (EG) and a control group (CG). The variables studied are: waist perimeter, variables related to the evolution of UI, muscular strength, and quality of life (QoL). Measurements were taken in order to evaluate changes in both groups. A statistical analysis was conducted using the Student–Fisher t-test, the Mann–Whitney–Wilcoxon test, and the chi-square test. Findings/Conclusions: After 24 weeks an improvement was identified in the EG compared with the CG, in waist perimeter (p .001), variables related to the UI symptom, intensity, frequency, difficulty and limitation of activity (p .0001). A correlation between UI and QoL was observed (p=.039). Clinical relevance: The improvement in QoL is mediated indirectly by the improvement in the UI symptom.	2,3
28	Shephard (2017) Physical activity and prostate cancer: an updated review.	Prostate cancer affects a major proportion of older men, and effective preventive measures are few. Earlier suggestions of 10–30% risk reduction from vigorous physical activity thus merit further analysis. This narrative review updates information on associations between physical activity and prostate cancer, seeking activity pat- terns associated with maximal risk reduction. Systematic searches of Ovid/MEDLINE and PubMed databases from 1996 to June 2016 have linked the terms prostate neo- plasms/prostate cancer with occupation, occupational title, sedentary job or heavy work, exercise, physical activity, sports, athletes, physical education/training or aerobic fit- ness. Combining these searches with findings from earlier reviews, 85 analyses were captured, although three were repeat analyses of the same data set. Seven analyses reported increased risk, and a further 31 showed no clear relationship. However, 24 analyses found a trend to diminished risk, and 21 a significant decrease (10–30% or more) in at least some subject subsets. Benefit was seen more consistently in occupational than in leisure studies, usually with adolescence or the early 20 s as the optimal age for preventive activity. In general, benefit showed a dose–response relationship, with vigorous activity required for maximal effect. Furthermore, several recent observational studies have indicated that physical activity is beneficial in preventing disease recurrence and improving survival following the diagnosis and treatment of prostate cancer. Despite continued research, conclusive proof of an association between regular physical activity and a low risk of prostate cancer remains elusive. However, reports that exercise exacerbates risk are few, and despite issues around controls, covariates, and co-morbidities, an impressive number of studies have now found significant benefit, suggesting that regular physical activity is important in terms of disease development, progression, and therapy. Given also the many other health benefits of an active lifestyle, it can be recommended as a potentially useful measure in the prevention of prostate cancer.	5

29	Yoshida, Matsunaga & Igawa et al. (2019) May perioperative ultrasound-guided pelvic floor muscle training promote early recovery of urinary continence after robot-assisted radical prostatectomy?	Aims: The efficacy of perioperative pelvic floor muscle training (PFMT) for continence recovery after robot-assisted radical prostatectomy (RARP) remains unclear. Visualization of the bladder neck and urethra using transperineal ultrasound (US) may promote self-recognition of urethral closure during PFM contraction. This study aimed to examine whether transperineal US-guided PFMT promotes early recovery of post-RARP incontinence. Methods: This prospective cohort study included 116 men undergoing RARP. All men were offered to undergo transperineal US-guided PFMT, and 36 men agreed. The protocol consisted of biofeedback PFMT using transperineal US before RARP and 1-month after RARP with verbal instruction of PFMT immediately after urethral catheter removal. The remaining 80 patients received verbal instruction for PFMT alone. Continence recovery was defined as the number of days requiring a small pad (20 g) per day by self-report. Results: No differences were observed in demographic or peri-operative parameters between the two groups except the longer operative time in the US-guided PFMT group. The mean time until continence recovery was significantly shorter in the US- guided PFMT group (75.6 ± 100.0 days) than in the verbal-PFMT group (121.8 ± 132.0 days, P = 0.037). Continence recovery rates within 30 days were 52.8% (19/36) and 35.4% (28/80) in the US-guided PFMT and verbal-PFMT groups, respectively (P = 0.081). US-guided PFMT was associated with better postoperative continence status (adjusted hazard ratio [95% confidence interval]: 0.550 [0.336- 0.900], P= 0.017). Conclusions: The results showed that transperineal US-guided PFMT perioperatively was associated with early recovery of urinary continence after RARP.	2,3
30	Zhang, Strauss & Siminoff (2007) Effects of combined pelvic floor muscle exercise and a support group on urinary incontinence and quality of life of postprostatectomy patients.	To examine the effect of combined pelvic floor muscle exercise (PFME) and a support group on postprostatectomy urinary incontinence and quality of life. Pilot study of a randomized, controlled clinical trial. Two metropolitan hospitals in northeastern Ohio. 29 men with postprostatectomy urinary incontinence. The participants learned PFME through biofeedback and were randomized to the control group (n = 15) or the support group (n = 14). The control group practiced PFME at home, whereas the support group attended six biweekly group meetings facilitated by a health psychologist. Assessment of urinary incontinence and quality of life was conducted at baseline and three months. Urinary incontinence and disease-specific quality of life. Eighty-six percent of the support group participants versus 46% of the control group participants practiced PFME four to seven days per week. The support group had a lower rating of urinary incontinence based on a 0- to 10-point visual analog rating scale than the control group (X = 3.2 versus 4.7), and fewer support group participants used pads (50%) than control group participants (85%) at three months. The support group also scored significantly lower on the severity of incontinence problems than the control group at three months, especially in relationship with spouse and social outing, despite no group difference in these areas at baseline. The study provided promising evidence regarding the effect of the proposed intervention on adherence to PFME, urinary incontinence, and quality of life. Reports regarding nursing practice are lacking with respect to PFME. This study suggests that practicing PFME in a group with patients with incontinence who have undergone prostatectomy can be a useful nursing intervention.	2,4