Patient perspectives of vigorous intensity aerobic interval exercise prehabilitation prior to radical cystectomy: a qualitative study

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Abstract

Purpose: Pre-operative cardiopulmonary fitness is increasingly being recognised as an important factor influencing post-operative recovery outcomes in cancer patients. The aim of this study was to explore patient perspectives of pre-operative high intensity aerobic interval exercise before radical cystectomy (RC). ***Materials and Methods:*** Focus groups involving a purposive convenience sample of patients with bladder cancer (N=14; mean age ± SD: 72.3 ± 6.0 y) were undertaken in a hospital education department. Data was analysed using Framework analysis.

Results: Participants identified physical (e.g. fitness) psychological (e.g. preparing for their operation) and social (e.g. peer support) benefits of the programme. Key motivational factors for engaging in exercise prehabiliation were identified as social support, previous exercise experience and objective measures of progression. The need for clear information from healthcare providers to ensure that patients are adequately prepared for sessions was highlighted. ***Conclusions:*** This qualitative study provides new insights into the perspectives and experiences of patients with bladder cancer regarding participation in pre-operative vigorous intensity aerobic exercise. The study yielded novel perceptions on the physical, psychological and social health benefits accruing from the exercise programme and patient views on programme design features, which are important for informing future interventions and implementation strategies.

Keywords: Qualitative, bladder cancer, exercise, prehabilitation, physical activity

Introduction

Bladder cancer is the tenth most common cancer in the UK and the eighth most common cancer in men [1]. It is usually slow to develop and is most common in older people over 60 years [2]. Bladder cancer is a heterogeneous disease, with 70% of patients presenting with non-muscle invasive (NMI) tumours confined to the bladder, and 30% presenting with muscle invasive disease (MIBC), in which the cancer has spread beyond the inner lining of the bladder to the muscle wall, and this is associated with a high risk of death from distant metastases [3]. Initial treatment for superficial NMI disease is usually transurethral resection of the bladder tumour and chemotherapeutic agents. The standard treatment for MIBC is radical cystectomy (RC), involving complete removal of the bladder. In men, this typically also includes removal of the prostate and seminal vesicles and in women, removal of the uterus and sometimes the ovaries and part of the vagina. Radical cystectomy is associated with high rates of morbidity (19-64%) and mortality (0.8-8.3%) [4-7].

Pre-operative cardiopulmonary fitness is increasingly being recognised as an important factor influencing post-operative recovery outcomes [8] and can be assessed by a cardiopulmonary exercise test (CPET) prior to surgical treatment [9]. Studies have provided evidence of the utility of pre-operative CPET variables for risk stratification of surgical patients, including those undergoing RC [10, 11]. Furthermore, a growing body of evidence suggests that exercise training can improve pre-operative cardiopulmonary fitness and may reduce the risk of post-operative complications after major abdominal surgery [12]. For example, Jensen *et al.* [13] showed that a 2-week home-based programme of pre-operative muscle strengthening exercises and endurance training was feasible and resulted in improvements in muscle power in bladder cancer patients prior to RC. However, the paucity of high quality prehabilitation trials has been highlighted [14] and the role of exercise prehabilitation in promoting psychological health benefits [15] and in establishing a strong platform for post-operative rehabilitation [14] and longer-term quality of life is poorly understood. Whilst

exercise has been suggested to be beneficial on some physical and psychological outcomes, whether this is feasible for bladder cancer patients has been questioned [16].

Wynter-Blyth & Moothy [8] argued that prehabilitation represents a shift away from the impairment driven, reactive model of care towards a proactive approach that enables patients to become active participants in their care. An important challenge for exercise prehabilitation programmes however, is the short time-window between decision for surgery and RC. Targets set by NHS England dictate that following general practitioner referral for a suspected cancer, patients are to be investigated within 31 days and treated within 62 days, resulting in a time-window between decision to operate and surgery of 31 days (though this can vary due to medical decisions and availability of operating slots). This means there is a need to optimise the pre-operative exercise stimulus and potential advantage of vigorous intensity aerobic interval exercise has been highlighted [17]. Interval training enables patients to undertake aerobic (endurance) exercise at a higher intensity than would be possible for continuous exercise at the same intensity.

Banerjee *et al.* [18] showed that bladder cancer patients respond well to pre-surgical vigorous intensity aerobic interval exercise, with improvements in cardiopulmonary fitness variables being reported that could have important implications for post-operative morbidity and need for high dependency unit inotropic support. Investigating the perceptions and experiences of patients who engage in this type of prehabilitative adjunctive cancer treatment can enrich the data gleaned from quantitative studies to help facilitate improved cancer care [19]. The aim of this qualitative study was to investigate the perspectives and experiences of bladder cancer patients that participated in a programme of vigorous intensity aerobic interval exercise prior to RC [18].

Materials and Methods

Study details

A sub sample of participants was recruited from a feasibility study exploring vigorous intensity aerobic interval exercise prior to RC. Details of the feasibility study and intervention have been previously published elsewhere [18]. Briefly, a total of 60 patients were randomised (1:1) to exercise or control following a CPET performed shortly after decision to operate. The exercise group was offered twice-weekly pre-operative supervised vigorous intensity aerobic interval exercise on a cycle ergometer (Monark 824E; Varberg, Sweden) in addition to standard treatment. Following a 5-10 min warm-up against light resistance (50 W), the aim was for patients to perform 6 x 5 min intervals at a target perceived exertion of 13-15 on the Borg Scale [20] ('somewhat hard' to 'hard', equating to 70-85% predicted maximum heart rate based on 220-age), with 2.5 min interpolated active rest intervals against light resistance (50 W). They were instructed to maintain a steady pedalling cadence of 50-60 rev·min^{-1} during the aerobic intervals and the exercise programme was progressed as patients adapted by gradually adding more load to the flywheel to maintain the target perceived exertion. Immediately following the aerobic intervals, patients serperformed a 'cool-down' against low resistance (50 W). The controls received standard treatment only. A repeat CPET was undertaken before surgery and post-operative recovery outcomes were recorded. None of the patients recruited to the pre-operative exercise study were meeting current physical activity guidelines of a minimum of 150 min of moderate intensity physical activity per week [21].

Participant recruitment

Patients were recruited for the pre-operative exercise study [18] from the Urology Department at the Norfolk and Norwich University Hospitals National Health Service (NHS) Foundation Trust, United Kingdom, between 2012 and 2014. The aim was to be as inclusive as possible so that the

results of the study would have broad applicability. Patients with bladder cancer listed for RC via the multi-disciplinary team were included in the study and eligibility was not limited by choice of surgical technique. Patients who were fit to exercise and met all other inclusion criteria were given medical clearance to participate in the intervention study by one of four consultant urologists, who were blind to treatment allocation (exercise or control). The standard treatment (after patients have met with the consultant urologist) involves pre-assessment with an anaesthetist, contact with an oncology and stoma nurse and information leaflets from the British Association of Urological Surgeons (BAUS) website. This is followed by admission to the ward on the day of surgery.

The qualitative investigation was part of the original study and it was included in the original consent form when patients agreed to participate in the trial. All patients in the intervention group (N=30) were approached at least six weeks after their surgery and asked to participate in a focus group. Of these, 14 participants (13 males and 1 female) agreed to participate and were recruited within 6 months of participating in the pre-operative exercise programme. The pre-operative exercise programme took place in an exercise facility at the University of East Anglia, close to the treating hospital. Their characteristics are presented in Table 1. Participants either had muscle invasive bladder cancer treated with chemotherapy, or non-muscle invasive bladder cancer treated with Bacillus Calmette-Guerin (BCG), an immunotherapy drug. Ethical approval was granted by the East of England Regional Ethics Committee. Informed consent was obtained from all individual participants included in the study.

Data collection

Three focus groups (60-75 minutes), each including 4-5 participants, were undertaken in a seminar room within a hospital education department by KS. There was an observer (JS) present at the focus groups. The place of the interview was deliberately distinct from where participants had attended exercise sessions in an attempt to avoid either negative or positive associations with a particular site

or building. Participants were not reimbursed for their time or travel but were given free car parking permits to attend the focus groups. All participants were briefed about the purpose of the discussion (i.e. to elicit their views and experiences of engaging in the pre-operative exercise programme) and the same semi-structured *a priori* topic guide was used to introduce areas for open discussion, rather than coerce participants into specific answers (Table 2). All focus groups were audio recorded for later transcription. There is debate within the literature regarding the number of focus groups and participants, with no consensus on how to approach this [22]. Three focus groups have been cited to have the potential to capture 80-90% of themes within a study [23].

Data analysis

Focus group recordings were transcribed verbatim, before two independent researchers (KSk and JN) read and analysed the transcripts using Framework analysis [24]. Framework analysis is a type of thematic analysis [25] that uses interrelated steps to facilitate the management of qualitative data and analysis [26]. This method is credible as it demonstrates a clear audit trail of the data analysis process [27]. The two researchers familiarised themselves with the transcripts and coded them independently to develop a coding framework. Following this, ideas were compared and codes discussed to develop the coding framework. For the most part, the codes generated were similar and after several meetings the final themes were agreed, which ensured that the different perspectives were considered and discussion captured to refine results. The emergent themes were then discussed with co-authors and the final themes refined. NVivo 10 (QSR International Pty Ltd., Victoria, Australia) was used to organise the data into framework matrices. Participant initials were used to protect identity.

Results

The findings are presented under three key themes which contextualise the perceptions and experiences of participants in the study. Direct quotes with reference to participant initials and focus

group are presented to illustrate the key themes: (i) Motivational factors; (ii) Perceived benefits of participation; (iii) Perceptions of programme design.

Motivational Factors

Motivation to initiate participation

Participants were introduced to the study by a healthcare professional (HCP), often their doctor. The relationship patients had with their HCP played an important role in their decision to take part. This was articulated by participants as trusting the knowledge of their HCP and, at times, wanting to please the HCP and not question their judgement.

> *"If a medical person says get fit and you'll possibly have a better outcome after the operation then I think I'll do it"* (P01; FG1, male, 77, non-muscle invasive disease treated with BGC, above the group mean BMI)

Many patients had participated in exercise in the past, for example, playing golf (P4; FG1, male, 69, muscle invasive bladder cancer treated with chemotherapy, under the mean BMI), bowls (P03; FG1, male, 79, non muscle invasive bladder cancer treated with BCG, under the mean BMI), regular walking (P14; FG3, female, 72, non muscle invasive bladder cancer, treated with BCG, under the mean BMI), walking the dog (P07; FG2, male, 66, non muscle invasive bladder cancer treated with BCG, BMI) and having a physically active job (P02; FG1, male, 64, muscle invasive treated with chemotherapy, over the mean BMI and P01; FG1, male, 77, non muscle invasive bladder cancer treated with BGC, over the mean BMI). Whilst some participants had a history of being physically active, at the time of the study none of them were meeting current physical activity guidelines. Motivation for many patients was underpinned by the goal of wanting to improve fitness because of the potential for positive impact on post-operative recovery. Participants discussed doing

anything they could to help generate better outcomes following surgery. For some, this was strongly influenced by past experience of participating in (and knowledge of the health benefits of) exercise.

> *"I think it's something that you can do to help yourself when there's not much else you can do, but you did feel you were trying to do something to make it more successful"* (P14; FG3, female, 72, non-muscle invasive disease treated with BCG, below the group mean BMI)

Motivation to maintain participation

Receiving appropriate supervision, objective measures of fitness improvements and support from HCP and family members were strong motivational factors for maintaining participation. Prior exercise experience gave some participants the confidence to push themselves during the exercise sessions. In addition, a number of participants anticipated (and/or experienced) objective improvements in cardiopulmonary fitness during the exercise programme, which motivated them to continue attending. Others found the ability to monitor exercise intensity particularly motivating, especially when improvements in fitness were noticed over the course of the study.

> *"....you could see yourself getting better each week"* (P14; FG3, female, 72, non-muscle invasive disease treated with BCG, below the group mean BMI)

However, not everyone who participated in the exercise sessions experienced objective evidence of improved fitness, which they found disappointing.

> *"I was a bit disappointed actually because having done the initial test and then gone through all the exercises the results were almost exactly the same..... he said the problem is you were already fairly fit before you started and so he said that sometimes*

happens" (P06; FG2, male, 78, non-muscle invasive disease treated with BCG, at the group mean BMI)

Family members also provided encouragement to participate in the pre-operative exercise programme and this ethos of encouragement was continued post-surgery. Some spouses or a family member accompanied participants to the exercise training facility (and even took part) and others encouraged participants to undertake exercise at home.

In addition, the importance of supervised exercise provision before surgery was a key aspect of participants maintaining attendance at the exercise programme. Support received, and relationships built with exercise instructors were discussed, and indicated the importance of social support in this context.

"…the encouragement of the people making you go on a bit more, a bit more that was a big help, cos I was ready to say I can't do anymore, but they just geed you on" (P12; FG3, male, 82, muscle invasive disease treated with chemotherapy, below the group mean BMI)

Motivation for post-operative self-directed exercise and physical activity

Whilst postoperative exercise was not part of the intervention, this was discussed within focus groups. A number of participants expressed a commitment to maintaining self-directed exercise following recovery from RC. However, the importance of supervision was also apparent in discussions about motivation for self-directed exercise after surgery. In particular, there was uncertainty about when to take part in exercise post-operatively and this was related to a lack of knowledge on what is perceived to be safe and realistic. Some participants mentioned they were

able to keep up some walking but few had future goals of engaging in vigorous intensity exercise again.

> *"I tend to try to walk every day at least half a mile"* (P03; FG1, male, 79, non-muscle invasive disease treated with BCG, below the group mean BMI)

Barriers to post-operative exercise associated with the effects of surgery were also reflected upon. Some patients highlighted the experience of difficulties exercising outside because of feeling the cold more after surgery. Others had concerns about managing their stoma bag during exercise.

> *... losing weight you lose your meat and you get colder quicker* (P03; FG1, male, 79, non-muscle invasive disease treated with BCG, below the group mean BMI)

> *" It's interesting listening to people's comments because I thought I was the only one that got cold you know"* (P01; FG1, male, 77, non-muscle invasive disease treated with BGC, above the group mean BMI)

> *"No"* (P03; FG1, male, 79, non-muscle invasive disease treated with BCG, below the group mean BMI)*."... "No, freezing"* (P02; FG1, male, 64, muscle invasive disease treated with chemotherapy, above the group mean BMI)… *"I was as well, really cold"* (P03; FG1, male, 79, non-muscle invasive disease treated with BCG, under below the group mean BMI)"

Perceived benefits of participation

Discussions about the perceived benefits of taking part in the programme were centred around the experience of improvements in physical fitness, enhanced mental preparation prior to surgery and

the opportunity to spend time with other patients, share experiences and benefit from a support system.

Physical Benefits

Most participants perceived there would be an improvement in their physical fitness and this was linked to the idea that they might recover faster. Some participants considered themselves to be physically fit prior to starting the intervention and many felt that their cardiopulmonary (aerobic) fitness and strength improved as a result of the exercise sessions. Some participants also made comments about recovering quicker after exercise sessions due to their physical fitness improvements and some participants experienced weight loss.

> *"I thought it was very beneficial… I couldn't have done it, had the op without...because the test of my heart rate and everything was better after the exercises"* (P12; FG3, male, 82, muscle invasive disease treated with chemotherapy, below the group mean BMI)

Psychological Benefits

Participation in the exercise intervention also led to psychological benefits in some patients, including improvements in sleep (with less interrupted sleep), and having more confidence and a stronger sense of readiness for the operation and future recovery. They felt that having the exercise classes gave them something positive to do in the window before surgery. Alongside this, being involved in preparing for their operation gave them a sense of control and ability to take an active role in their care. Helping patients to become mentally prepared for the operation was viewed as a key benefit of the programme.

"It gives you a lift doesn't it, it obviously helps you if they tell you that you've improved that you know your health has improved to that extent you feel satisfied" (P03; FG1, male, 79, non-muscle invasive disease treated with BCG, below the group mean BMI)

"The main thing was that you feel as if you're doing something to prepare yourself for the big day rather than sitting and waiting for it" (P09; FG2, 68, male, muscle invasive disease treated with chemotherapy, at the group mean BMI)

Social benefits

The benefits of being part of a peer group that could offer support to each other were also highlighted. Participants felt that everyone shared similar experiences and that they were able to relate to, and encourage each other. They shared a range of experiences both pre and post operation, discussing the benefits of group interaction.

"I think if everyone is in for the same thing you can all push each other along" (P02; FG1, male, 64, muscle invasive disease treated with chemotherapy, above the group mean BMI)

Perceptions of Programme Design

Overall, participants were positive about the exercise programme structure and design and their relationship with (and support received from) the exercise instructor. Participants commented that they found sessions enjoyable, helpful and interesting. However, participants also expressed thoughts about the challenges encountered in attending supervised exercise sessions. Key challenges included travel and parking, comfort of the bike seat and receiving limited information on what to wear on the first day.

"It's a 40 minute drive for us... that's the only thing it takes up a large part of your day" (P14; FG3, female, 72, non-muscle invasive disease treated with BCG, below the group mean BMI)

"I don't want to get back on a bike thank you at the moment particularly the one with it's seat" (P01; FG1, male, 77, non-muscle invasive disease treated with BGC, above the group mean BMI)

"Terrible wasn't it" (P02; FG1, male, 64, muscle invasive disease treated with chemotherapy, above the group mean BMI)

Discussion

This study is the first to explore patient perspectives of pre-operative high intensity aerobic interval exercise before RC. Our findings provide new insights into motivational factors influencing the decision to participate in, and maintain adherence to, exercise prehabilitation and post-operative self-directed exercise. In addition, our focus groups yielded novel perceptions on the physical, psychological and social health benefits accruing from the programme, and views on exercise programme design features, which are important for informing future interventions and implementation strategies.

Encouragement from HCP and family members were important motivational factors. The important role of physician prompting in recruitment of patients to clinical trials has been previously reported [28-30]. The role that family members can play in supporting patients to take an active part in their treatment and adjust to life after a bladder cancer diagnosis have previously been recognised [31,32]. Although lack of time and/or knowledge have been reported as important barriers to providing lifestyle advice amongst HCP [33], our results suggest that (where possible) strategies to

engage these patient support structures should be built into future exercise prehabiltiation programmes. Other key factors motivating participants to engage in exercise prehabilitation included previous exercise experience and a desire to improve physical fitness before surgery, because of the potential impact on post-operative recovery outcomes. Consistent with the latter, objective measures of exercise progression (reflecting physiological adaptations to the programme) were important motivational factors influencing programme adherence. Task (exercise) self-efficacy and outcome expectancies (experiencing a positive behavioural outcome) have been identified as important factors influencing motivation for health behaviour change [34] and these factors are consistent with the focus group recollections of our participants. This includes the role of previous exercise competences and the importance of objective progression measures in maintaining motivation to continue exercise during the intervention.

The exercise prehabilitation programme was designed to prepare bladder cancer patients for RC and did not include any support for post-operative exercise. However, the role of pre-operative exercise in establishing a strong platform for post-operative rehabilitation has been identified [14] and was an issue discussed during focus group sessions. A number of participants expressed a commitment to maintaining self-directed exercise following surgery, whereas others expressed a lack of motivation and confidence to engage in post-operative exercise and a need for continued supervision. Impending cancer surgery has recently been shown to be a powerful motivating factor for pre-operative exercise in colorectal and lung cancer patients [35], and for smoking cessation/alcohol reduction in patients with bladder cancer [36], but lack of post-operative support can mean that patients with bladder cancer reverted back to old habits after RC [36]. Crandall *et al.* [37] showed that lack of confidence and perceptions of doing themselves more harm than good prevented lung cancer patients from engaging in post-surgical exercise. Our participants also discussed barriers associated with losing skeletal muscle mass and feeling cold after surgery, as well as the challenge of having to manage their stoma bag during exercise post-operatively. Issues

with stoma bag management and adjusting to life after RC have previously been reported [31, 32, 38, 39, 40] and need to be taken into account in the design of post-operative exercise rehabilitation programmes. If exercise prehabilitation is to serve as a 'teachable moment' [41] for longer-term (post-operative) self-directed exercise in bladder cancer patients, these issues need to be considered in the design of future interventions and initiatives. Currently in the UK there are a growing number of community run 'cancer-specific' exercise facilities/programmes which patients can be referred to, however, unlike cardiac rehabilitation programmes, these are not a standardised part of care.

Aside from the expected improvements in physical fitness resulting from participation in the programme, the role of exercise prehabilitation as a platform for enhancing psychological preparation for surgery also became apparent. Within this study and others, individuals living with cancer have discussed the profound adverse impact that a cancer diagnosis has on their psychological wellbeing [42] but also how participation in exercise can act as a positive distraction [43] and can enhance daily life engagement [42]. It has been identified in a previous systematic review that little data have been collected on psychological issues for bladder cancer patients [44]. In our patient cohort, feelings of satisfaction were experienced as a result of making the best use of the time available before surgery (rather than sitting waiting for the operation) and positive mental thoughts emanated from proactively doing something to prepare for surgery. Whilst an improved cardiopulmonary reserve prior to RC has potential to improve post-operative recovery outcomes, these findings suggest that the psychological health benefits of exercise prehabilitation, as a distraction from concerns about their recent cancer diagnosis, and as a means of helping patients to mentally prepare themselves for their operation, should not be overlooked. Social benefits associated with being part of a peer group and providing an opportunity to share experiences, encourage and support each other were also highlighted in the focus group discussions. This finding is consistent with a meta-synthesis of views amongst people diagnosed with cancer on exercise

rehabilitation, which reported social support to be a key benefit of exercise programmes, providing *"a kind of informal counselling and support"* [43].

Participants were generally very positive in their comments about the exercise programme structure and design and their relationship with (and support received from) the exercise instructor. These positive feelings about exercise rehabilitation mirror the positive experiences reported in a qualitative study of colorectal and lung cancer patients' perceptions and experiences of exercise prehabilitation prior to surgery [35]. Nevertheless, patients did recount some important challenges associated with attending supervised exercise sessions. These included issues with travel to the centre, parking difficulties and discomfort caused by the bike seat during exercise training. Physical discomfort is a function of seat design and can be easily addressed, whereas travel and parking difficulties, which are commonly reported barriers to supervised exercise programmes in cancer, pulmonary and cardiac rehabilitation populations [35, 45, 46] can be more difficult to resolve. Home-based exercise programmes may offer advantages for some patients, but a recent systematic review found that distance exercise programmes for cancer patients and survivors often fail to achieve clinically important health outcomes, perhaps due to patients having less motivation for behaviour change in this setting [47]. Other evidence suggests that some level of face-to-face support is important for promoting sustainable health behaviour change in cancer populations [48] but resource limitations may impede such provision. Another issue raised by patients was the lack of clear information about appropriate attire for supervised exercise. Previous qualitative research showed that the shock of a bladder cancer diagnosis can mean that clear and concise information from healthcare providers about their diagnosis, treatment options, and course of care is an important need for this patient group [32].

Strengths and Limitations

A key strength of this research is the flexible nature of the focus groups, which allowed participants the freedom to discuss areas they felt pertinent. In some cases, areas that had not been considered prior to interview, for example barriers to post-operative exercise. The research team have a range of backgrounds including medical, exercise physiology, nursing and physiotherapy which strengthened the analysis of qualitative data. An important limitation of this study is that participants were recruited from a single centre serving a large rural catchment. This means that the views and experiences of our patient cohort, particularly with respect to transportation issues, may not be representative of patients from urban catchments living closer to supervised exercise facilities. It also seems plausible that participants recruited for this study were generally more motivated to engage in exercise than bladder cancer patients from the broader population, as they had volunteered for the exercise intervention and focus groups. The recruitment rate of eligible patients was 53.3% for the exercise intervention study [18] and engaging patients who are reluctant to participate in pre-operative exercise programmes is a challenge for future research.

In conclusion, this qualitative study provides new insights into the perspectives and experiences of bladder cancer patients regarding participation in supervised pre-operative vigorous intensity aerobic interval exercise. Patient perspectives provide evidence that this type of pre-operative exercise programme is enjoyable and can lead to physical, psychological, and social health benefits. Some important challenges experienced by patients in attending pre-operative supervised exercise programmes were also identified. These qualitative findings will help to inform future exercise prehabilitation programmes for patients undergoing RC.

Declaration of interest

The authors report no conflicts of interest.

References

1. Cancer Research UK: Bladder Cancer Statistics [https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/bladder-cancer - heading-Zero. Accessed 23 November 2018]
2. Shariat SF, Sfakianos JP, Droller MJ, I. KP, Meryn S, Bochner BH: The effect of age and gender on bladder cancer: a critical review of the literature. *BJU Int.* 2010;105(3):300-308.
3. Oosterlinck W, Lobel B, Jakse G, Malmström P-U, Stöckle M, Sternberg C: Guidelines on Bladder Cancer. *Eur Urolol.* 2002;41(2):105-112.
4. Mayer EK, Bottle A, Aylin P, Darzi AW, Athanasiou T, Vale JA: The volume–outcome relationship for radical cystectomy in England: an analysis of outcomes other than mortality. *BJU Int.* 2011;108(8b):E258-E265.
5. Quek ML, Stein JP, Daneshmand S, Miranda G, Thangathurai D, Roffey P, Skinner EC, Lieskovsky G, Skinner DG: A Critical Analysis of Perioperative Mortality From Radical Cystectomy. *The J Urol.* 2006;175(3):886-890.
6. Liedberg F: Early Complications and Morbidity of Radical Cystectomy. *Eur Urol Supp.* 2010;9(1):25-30.
7. Gore JL, Yu H-Y, Setodji C, Hanley JM, Litwin MS, Saigal CS: Urinary diversion and morbidity after radical cystectomy for bladder cancer. *Cancer.* 2010;116(2):331-339.
8. Wynter-Blyth V, Moorthy K: Prehabilitation: preparing patients for surgery. *BMJ (Online).* 2017;358.
9. Ridgway ZA, Howell SJ: Cardiopulmonary exercise testing: a review of methods and applications in surgical patients. *Euro J Anaesthesiol (EJA).* 2010;27(10):858-865.
10. Prentis JM, Trenell MI, Vasdev N, French R, Dines G, Thorpe A, Snowden CP: Impaired cardiopulmonary reserve in an elderly population is related to postoperative morbidity and length of hospital stay after radical cystectomy. *BJU Int.* 2013;112(2):E13-E19.

11. Stringer W, Casaburi R, Older P: Cardiopulmonary exercise testing: does it improve perioperative care and outcome? *Curr Opin Anaesthesiol.* 2012;25(2):178-184.

12. Hijazi Y, Gondal U, Aziz O: A systematic review of prehabilitation programs in abdominal cancer surgery. *Int J Surg.* 2017;39:156-162.

13. Jensen BT, Laustsen S, Jensen JB, Borre M, Petersen AK: Exercise-based pre-habilitation is feasible and effective in radical cystectomy pathways-secondary results from a randomized controlled trial. *Support Care Cancer.* 2016;24(8):3325-3331.

14. Carli F, Gillis C, Scheede-Bergdahl C: Promoting a culture of prehabilitation for the surgical cancer patient. *Acta Oncologica.* 2017;56(2):128-133.

15. Mishra SI, Scherer RW, Geigle PM, Berlanstein DR, Topaloglu O, Gotay CC, Snyder C: Exercise interventions on health-related quality of life for cancer survivors. *Cochrane Database of Syst Rev.* 2012;(8).

16. Quirk et al. Supportive interventions to improve physiological and psychological health outcomes among patients undergoing cystectomy: a systematic review. BMC Urol. 2018; 18:71 doi:10.1186/s12894-018-0382-z

17. Weston M, Weston KL, Prentis JM, Snowden CP: High-intensity interval training (HIT) for effective and time-efficient pre-surgical exercise interventions. *Perioper Med (Lond).* 2016; 5:2.

18. Banerjee S, Manley K, Shaw B, Lewis L, Cucato G, Mills R, Rochester M, Clark A, Saxton JM: Vigorous intensity aerobic interval exercise in bladder cancer patients prior to radical cystectomy: a feasibility randomised controlled trial. *Supportive Care Cancer.* 2018; 26(5):1515-1523.

19. Richardson A, Addington-Hall J, Amir Z, Foster C, Stark D, Armes J, Brearley SG, Hodges L, Hook J, Jarrett N *et al*: Knowledge, ignorance and priorities for research in key areas of cancer survivorship: findings from a scoping review. *Br J Cancer.* 2011;105 Suppl 1:S82-94.

20. Borg G: Perceived exertion as an indicator of somatic stress. *Scand J Rehabil Med.* 1970;2:92-98.

21. CMOs: Start Active, Stay Active: A report on physical activity from the four home countries' Chief Medical Officers. Available at: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_128209 London: Department of Health; 2011.

22. Carlsen B, Glenton C: What about N? A methodological study of sample-size reporting in focus group studies. *BMC Med Res Methodol.* 2011;11(1):26.

23. Guest G, Namey E, McKenna K: How many focus groups are enough? Building an evidence base for nonprobability sample sizes. *Field methods.* 2017;29(1):3-22.

24. Ritchie J, Spencer L: Qualitative data analysis for applied policy research. In: *Analyzing qualitative data.* Edited by Bryman A, Burgess RG. London: Routledge; 1994: 173-194.

25. Gale NK, Heath G, Cameron E, Rashid S, Redwood S: Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol.* 2013;13(1):117.

26. Ritchie J, Spencer L: Qualitative data analysis for applied policy research. In: *The qualitative researcher's companion.* Edited by Huberman AM, Miles MB. Thousand Oaks, CA: Sage; 2002: 305-330.

27. Ritchie J, Spencer L, O' Connor W: Carrying out qualitative analysis. In: *Qualitative research practice: a guide for social science students and researchers.* Edited by Ritchie J, Lewis J. London: Sage; 2003: 219-262.

28. Comis R, L , Miller J, D, , Colaizzi D, D , Kimmel L, G: Physician-Related Factors Involved in Patient Decisions to Enroll Onto Cancer Clinical Trials. *J Oncol Pract.* 2009;5(2):50-56.

29. Kaplan CP, Nápoles AM, Dohan D, Hwang ES, Melisko M, Nickleach D, Quinn JA, Haas J: Clinical trial discussion, referral, and recruitment: physician, patient, and system factors. *Cancer Causes & Control*. 2013;24(5):979-988.

30. Rahman S, Majumder MAA, Shaban SF, Rahman N, Ahmed M, Abdulrahman KB, D'Souza UJ: Physician participation in clinical research and trials: issues and approaches. Adv Med Educ Pract. 2011;2:85.

31. Garg T, Connors JN, Ladd IG, Bogaczyk TL, Larson SL: Defining Priorities to Improve Patient Experience in Non-Muscle Invasive Bladder Cancer. *Bladder Cancer.* 2018;4(1):121-128.

32. Fitch MI, Miller D, Sharir S, McAndrew A: Radical cystectomy for bladder cancer: a qualitative study of patient experiences and implications for practice. *Can Oncol Nurs J.* 2010;20(4):177-187.

33. Nadler M, Bainbridge D, Tomasone J, Cheifetz O, Juergens RA, Sussman J: Oncology care provider perspectives on exercise promotion in people with cancer: an examination of knowledge, practices, barriers, and facilitators. *Support Care Cancer.* 2017;25(7):2297-2304.

34. Schwarzer R: Self-efficacy in the adoption and maintenance of health behaviours: Theoretical approaches and a new model. In: *Self-Efficacy: Thought Control of Action.* Edited by Schwarzer R. Washington: Taylor and Francis; 1992: 217–243.

35. Ferreira V, Agnihotram RV, Bergdahl A, van Rooijen SJ, Awasthi R, Carli F, Scheede-Bergdahl C: Maximizing patient adherence to prehabilitation: what do the patients say? *Supportive Care Cancer.* 2018;1-7.

36. Lauridsen SV, Thomsen T, Kaldan G, Lydom LN, Tonnesen H: Smoking and alcohol cessation intervention in relation to radical cystectomy: a qualitative study of cancer patients' experiences. *BMC Cancer.* 2017;17(1):793.

37. Crandall K, Maguire R, Campbell A, Kearney N: A qualitative study exploring the views, attitudes and beliefs of patients and health professionals towards exercise intervention for people who are surgically treated for lung cancer. *Eur J Cancer Care.* 2018;27(2):e12828.

38. Mohamed NE, Pisipati S, Lee CT, Goltz HH, Latini DM, Gilbert FS, Wittmann D, Knauer CJ, Mehrazin R, Sfakianos JP *et al*: Unmet informational and supportive care needs of patients following cystectomy for bladder cancer based on age, sex, and treatment choices. *Urol Oncol.* 2016;34(12):531 e537-531 e514.

39. Cerruto MA, D'Elia C, Cacciamani G, De Marchi D, Siracusano S, Iafrate M, Niero M, Lonardi C, Bassi P, Belgrano E *et al*: Behavioural profile and human adaptation of survivors after radical cystectomy and ileal conduit. *Health Qual Life Outcomes.* 2014;12:46.

40. Edmondson et al. The patients' experience of a bladder cancer diagnosis: a systematic review of the qualitative evidence. J Cancer Surviv. 2017; 11:453-61.

41. McBride CM, Puleo E, Pollak KI, Clipp EC, Woolford S, Emmons KM: Understanding the role of cancer worry in creating a "teachable moment" for multiple risk factor reduction. *Soc Sci Med.* 2008;66(3):790-800.

42. Cormie P, Turner B, Kaczmarek E, Drake D, Chambers SK: A qualitative exploration of the experience of men with prostate cancer involved in supervised exercise programs. *Oncol Nurs Forum.* 2015;42(1):24-32.

43. Midtgaard J, Hammer NM, Andersen C, Larsen A, Bruun D-M, Jarden M: Cancer survivors' experience of exercise-based cancer rehabilitation–a meta-synthesis of qualitative research. *Acta Oncologica.* 2015;54(5):609-617.

44. Taarnhøj et al. Quality of life in bladder cancer patients receiving medical oncological treatment; a systematic review of the literature. Health Qual Life Outcomes. 2019

45. Santa Mina D, Alibhai SM, Matthew AG, Guglietti CL, Steele J, Trachtenberg J, Ritvo PG: Exercise in clinical cancer care: a call to action and program development description. *Curr Oncol.* 2012;19(3):e136-144.

46. Neubeck L, Freedman SB, Clark AM, Briffa T, Bauman A, Redfern J: Participating in cardiac rehabilitation: a systematic review and meta-synthesis of qualitative data. *Eur J Prev Cardiol.* 2012;19(3):494-503.

47. Groen WG, van Harten WH, Vallance JK: Systematic review and meta-analysis of distance-based physical activity interventions for cancer survivors (2013-2018): We still haven't found what we're looking for. *Cancer Treat Rev.* 2018;69:188-203.

48. Bourke L, Homer KE, Thaha MA, Steed L, Rosario DJ, Robb KA, Saxton JM, Taylor SJ: Interventions to improve exercise behaviour in sedentary people living with and beyond cancer: a systematic review. *Br J Cancer.* 2014;110(4):831-841.

Table 1. Characteristics of the participants

Characteristics	Values
Males, females	13,1
Age (y)	72.3 ± 6.0 (Range: 64-82)
Height (m)	1.71 ± 0.05
Weight (kg)	78.7 ± 14.8
BMI (kg/m^2)	27.0 ± 4.8
Pre-operative exercise sessions	7.8 ± 1.4
Current smoker, ex-smoker	3,7

Type 2 Diabetes Mellitus	1
Ischaemic heart disease	1
Hypertension	1
Neo-adjuvant chemotherapy	3

Personal characteristics and number of pre-operative exercise sessions are presented as mean ± SD. Other variables are presented as number of participants. BMI: Body mass index.

Table 2. Topic guide for focus groups

1	Consider which elements of the exercise programme were perceived as being most and least helpful.
2	Explore participant perceptions of the effect the exercise programme had on their well-being and quality of life before and after surgery.
3	Uncover any potential barriers or problems associated with the exercise programme.
4	Explore how the exercise programme could be refined and enhanced.