Design of programs to train pelvic floor muscles in men with urinary dysfunction: Systematic review

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Running title: Content of male pelvic floor muscle training programs

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Abstract

Aims

Pelvic floor muscle training (PFMT) is a first line conservative treatment for men with urinary dysfunction, but reports of its efficacy are variable. This study aimed to systematically review the content of PFMT programs used for urinary dysfunction in men.

Methods

Electronic databases (PubMed, CINAHL, EMBASE, Cochrane, PEDro) were searched for studies that used PFMT in the treatment of adult men with urinary dysfunction. Details of PFMT treatment sessions and home exercise protocols were extracted. Criteria specific to PFMT were developed, based on the Consensus on Exercise Reporting Template, and applied to all studies to measure the comprehensiveness of the PFMT description in the manuscript.

Results

Results from the 108 included studies indicate substantial heterogeneity in both the content of PFMT and the quality of reporting of the components of the exercise regimes. There was notable disparity in the muscles targeted by the interventions (and few focused on urethral control despite the use in management of urinary conditions) and the intensity of the programs (e.g. 18-240 contractions per day). Most studies were missing key details of description of the PFMT programs (e.g. the position in which the pelvic floor muscle (PFM) contraction was taught and how it was assessed, methods used to ensure exercise adherence).

Conclusions

Variation in content of PFMT programs is likely to contribute to variation in the reported efficacy for management of urinary dysfunction in men, and unclear description of the details of the evaluated programs makes it difficult to identify the effective/ineffective components.

PROSPERO (CRD42017071038).

Keywords

Urinary Incontinence, Pelvic Floor, Male, Exercise Therapy

Introduction

Urinary dysfunction, particularly urinary incontinence (UI), has a negative impact on the quality of life of men[1]. It is estimated that UI effects approximately 10% of men in Australia but conservative prevalence estimates vary considerably in the literature[2].

Pelvic floor muscle training (PFMT) is a first-line conservative treatment option for urinary dysfunction, and is often combined with electrical stimulation (ES) and/or biofeedback (BFB). Training involves repetitive contraction and relaxation of the pelvic floor muscles (PFM) to enhance their contribution to urethral pressure[3], either by increased muscle mass and/or improved activation amplitude and timing. First described in 1948 for women with stress UI[4], repetitive PFM contractions have since been adapted and widely employed for treatment of men with urinary dysfunction.. Despite its growing use in clinical practice, there is questionable evidence for efficacy[5,6] with considerable variation in outcomes between studies. "This might be explained by the large variation in design of PFMT protocols in this population and the application of pelvic floor muscle exercise programs (i.e. target muscles, instructions, feedback techniques, contraction types, etc) that were originally designed for women who have different anatomical characteristics and several major mechanisms for incontinence that differ from men (e.g. urinary incontinence is common after vaginal delivery in women vs. prostatectomy in men) that should be considered."

A review of PFMT protocols for women[7] identified substantial variation in exercise recommendations, for instance different programs suggested 5- 200 PFM contractions per

day. Variation also exists in contraction hold/ relax times, and the modalities used for feedback. These features of PFMT programs may potentially affect their efficacy in women. Haslam[8] emphasised the importance of precise training instructions, assessment for correct PFM activation, incorporation of patient education, and progression to functional exercise to optimise female patient outcomes. The breadth of exercise prescription used to train PFM in men has not been investigated.

Interpretation of clinical trials for translation into clinical settings, identification of reasons for limited efficacy, and progress in refinement of training depends on comprehensive reporting of program content. The recently developed Consensus on Reporting Template (CERT)[9] emphasizes the details necessary to report complex interventions in research trials. The comprehensiveness of details reported in studies of PFMT in men with urinary dysfunction has not been explored.

This study systematically reviewed the content of PFMT programs used in the rehabilitation of men with urinary dysfunction (overactive bladder, UI and post micturition dribble). The aims of the study were to consider variation in the content and prescription of PFM exercises, and to test the description of exercise programs against CERT criteria that were adapted to specifically consider application of PFMT to urinary dysfunction.

Methods

The study was designed in accordance with the PRISMA statement governing systematic reviews[10] and the protocol registered with PROSPERO (CRD42017071038).

Literature Search Strategy

The PubMed, CINAHL, EMBASE, PEDro and the Cochrane databases were systematically reviewed in December 2016 using a search strategy developed in consultation with the Cochrane Collaboration guidelines[11]. The search was restricted to manuscripts published in the English language that involved human participants but no limitation was placed on publication date. The text-word search strategy used was: ((((pelvic floor) AND muscle) AND (men OR male)) AND (exercise OR therapy OR contraction OR training) AND Humans[Mesh] AND English[lang]).

All studies identified by the search strategy were screened by one investigator (LH) and a randomly selected subset of 10% of the studies (n=141) screened by a second investigator (RA). The decision not to perform a full duplicate screening was based on the AMSTAR checklist. There were no discrepencies in eligibility of studies between investigators. Potentially relevant abstracts were retrieved and full-text manuscripts were reviewed if abstracts met the selection criteria or did not provide sufficient detail to determine eligibility. Review articles, meta-analyses and abstract-only studies were excluded. The reference lists of all included studies were searched to identify additional articles matching the selection criteria missed by the original database search. An update search was performed in June 2017 prior to final data analysis.

Selection criteria and data extraction

PFMT was considered to be repetitive selective voluntary contractions and relaxations of specific pelvic floor muscles[3]. Studies were included if they involved PFMT alone or in combination with other treatment modalities (e.g. BFB) in adult men with lower urinary tract symptoms, including UI, post micturition dribble, nocturia and overactive bladder. Studies that included both male and female participants were included if review eligibility criteria were met. Studies in men with non-urinary pelvic symptoms only were excluded. Given the focus of the review was on the content of PFMT programs, not study outcomes, the search was not limited to randomised controlled trials.

Data were extracted independently by two investigators (LH and RA) and discrepancies were resolved by consensus. Extracted information was tabulated in 2 domains: study and PFMT session details, and home exercise program (HEP) details. Study and PFMT session details included author information, participant group, condition treated, PFMT instructor/supervisor, participant education, PFMT intra-session details (duration and number of supervised sessions, supervised/guided treatment duration, contraction hold/relax times), muscles identified in the instruction used to teach/elicit the PFM contraction and the method used to confirm the contraction or provide feedback (e.g. BFB using an anal probe). This latter information was used, along with detail of methods used to enhance activation (e.g. ES) to determine the specific region of the pelvic floor that was the focus of the intervention. Extracted details of the HEP were: number of repetitions per session sessions and contractions per day, contraction intensity and hold/relax times, positions and activities in which PFMT was practiced, and the method used to monitor

program adherence. Total contractions per session or per day were calculated from available data for some studies.

The CERT[9] was applied to all studies as a measure of comprehensiveness of the PFMT description provided in the manuscript. Criteria were developed by two authors (LH and PH) for each item in the template to ensure consistent application to the PFMT programs. The details considered necessary to obtain a score of 1 (sufficient detail provided) for each CERT item are outlined in Table 1. The total score for each study was calculated as the sum of scores for each question, and descriptive statistics were calculated. Given one of the aims of the review was to investigate the comprehensiveness of the reported PFMT intervention, authors of included studies were not contacted for information omitted from manuscripts.

Results

The initial search retrieved 1967 citations of which 90 met the inclusion criteria (Fig. 1). After addition of 18 studies from a search of reference lists of eligible papers, a total of 108 manuscripts were included.

Study and CERT details

Of the 108 included studies, 81 involved men who had undergone (or were scheduled to undergo) prostatectomy, transurethral resection of the prostate or treatment for prostate cancer (Fig. 2a), and 77 studies investigated the effect of PFMT exclusively on UI (Fig. 2b). Eighteenteen studies included both male and female participants.

The scores from application of the CERT to the PFMT programs, ranged from 0 to 16 (mean 6.4) (Table 2). The information most commonly reported with sufficient detail was related to exercise program supervision (CERT item 4)(n=98) and instructor qualifications (CERT item 2)(n=80). Assessment of fidelity (CERT item 16a)(n=5) and how well the program was delivered as planned (CERT item 16b)(n=3) were the least commonly addressed details. Important elements of the intervention, including detailed explanation of the exercise to enable replication (CERT item 8), and the HEP (CERT item 9), were not sufficiently described in 82 and 92 studies respectively.

Training of PFM contractions and supervision of exercise (if applicable) were predominantly provided by physiotherapists/physical therapists (n=33) and nurses/nurse practitioners (n=21) (Fig. 2c). The majority of studies (n=63) did not mention whether participants were educated on anatomy and/or physiology of the pelvic floor or bladder, or mechanisms related to their urinary dysfunction (Fig 2d). Of those that did provide detail of participant education, either written of verbally, 31 included information related to pelvic floor/bladder anatomy, and/or the physiology of UI, micturition or lower urinary tract symptoms.

Treatment sessions used to teach/supervise PFM contractions ranged from 15- 90 minutes in duration (Fig. 3a). In studies that stated an exact session time the most common duration was 30 minutes (n=13). More often, the session duration was not stated (n=57) or the time

was individualised to the patient (n=21). The number of PFMT sessions provided during the trial varied from 1-74, but again, most commonly this information was not stated or was unclear (n=30) (Fig. 3b). Eighteen papers reported the number of PFMT sessions was individualised to the participant and often ceased once continence was achieved. The overall duration of the training programs (excluding the HEP) ranged from 1-52 weeks, but similarly to session number/duration this information was not stated in 36 studies (Fig. 4c). Treatment duration of 11-20 weeks was most common (n=21), followed by programs that were dependent on the individual progress of participants (n=17).

There was large variation in the instructions used to elicit/train PFM contractions. Many manuscripts did not state or make reference to instructions used in their intervention. Commonly, participants were asked to avoid using abdominal, gluteal and adductor muscles, but rarely did studies include information on what participants should feel or see during the exercises. The region of focus of the PFMT intervention was determined from the muscle included in the instruction to elicit/correct the contraction, the muscle referenced in the methods section, and/or the method used to confirm successful contraction. BFB using an anal probe was used most frequently to confirm performance of a correct contraction (n=19), followed by digital rectal examination (DRE) (n=18) and combined methods (e.g. DRE plus visualisation of the base of the penis) (n=18). There was no mention of how, or if, the contraction was assessed, and therefore performed as intended, in 25 of the studies (Fig 3d). In studies with males and female participants, males received BFB using an anal probe (EMG BFB n=8, pressure BFB n=4) and females almost exclusively received BFB using a vaginal probe (Table 3).

The anal sphincter was the region of the pelvic floor most commonly identified as the focus of the intervention (n=44). Given the majority of studies involved an UI indication, surprisingly only 7% (n=8) focused their training specifically on instructions related to urethral pressure. Instructions and feedback that encompassed both the anal and urinary regions were identified in 21 included studies (Fig 3e).

HEP details

Details of the number of PFM contractions per session, number of sessions per day, and total contractions per day were not stated in 47, 45 and 43 studies, respectively (Table 4). Information describing the number of contractions per session was provided in different ways, including the number of repetitions, a range of preferred repetitions or a time over which to practice contractions. Most studies reported a HEP that comprised 9-15 contractions per session (n=20), or stated a range (n=11) (Fig 4a). Sessions per day ranged from 2-15, with 3 sessions (n=38) the most commonly prescribed (Fig 4b). The number of PFM contractions per day was either extracted directly from the paper, or calculated if the number of contractions per session and sessions per day were provided. Contractions per day ranged from 18-240 with 50-51 daily contractions the most common (n=9) (Fig 4c).

The intensity of PFM contractions was not stated in 83% (n=86) of included studies (Fig. 4d). “Maximal”, “firm”, “intense” or “as strongly as possible” were used to describe the intended intensity in 13 studies. Training programs that included training at different intensities were described for some programs (n=8). These authors argued that different

programs aimed to train different muscle fibers and improve strength (maximal intensity), endurance (submaximal intensity) and control of the PFM. In these cases, the contraction hold/relax times also differed. In most instances, the hold and relax times were not provided (n=60 and n=69 respectively) but when they were, the most common time for both was 10 seconds (n=10 and n=12, respectively) (Fig. 5a and b).

The prescribed HEP included PFM contractions in different postures (e.g.sitting, standing and lying) (n=16), in different postures plus during functional activities (e.g. coughing, lifting) (n=32), or during functional activities alone (n=12) (Fig. 5c). Information on exercise position or functional components was not described in 48 studies. Compliance or exercise adherence was discussed in only 20 studies and commonly relied on patient self-reports (n=9) or logbooks (n=6) (Fig. 5d).

Discussion

This review is the first to systematically examine the content of individual PFMT programs used in men with urinary symptoms. Data from the 108 included studies revealed two primary issues: substantial heterogeneity in the reporting of the exercise intervention, and substantial variation in the content of the programs. These issues could be considered a cycle of heterogeneity in which variation in one drives variation in the other, and both are likely to contribute to the variation in efficacy of the intervention.

Heterogeneity in the reporting of exercise interventions

The application of the CERT to the included studies highlight the suboptimal reporting of PFMT programs for management of male urinary symptoms. The omission of potentially

important details (e.g. how contractions were assessed, contraction number, intensity and hold times) may limit interpretation of the efficacy of the exercise, the ability of clinicians to implement an efficacious PFMT program, and compromise replication of the intervention in further research. Lack of reported detail might be explained by multiple factors including word limits imposed by journals, oversight of authors, or lack of recognition of importance of reporting. If word limits are restrictive then it would seem prudent to identify alternative mechanisms to report program content such as appendices (as used by Moore et al[12] and Klutke et al[13]), separate publication of trial protocols (e.g. protocol by Dorey et al[14] for the randomised clinical trial by Glazener et al[15]) or supplementary data. Previous studies have also suggested that reporting of PFMT interventions in trials is deficient[16], thereby making it difficult to draw conclusions about program efficacy. This review addresses this issue and highlights the program details most often lacking in manuscripts. The reporting criteria adapted from the CERT may reduce the difficulty associated with interpreting outcomes based on limited information about the intervention. It is important to emphasise that although the original CERT has been previously published for general exercise, the template used in this study was adapted by the authors specifically for PFMT in men based on components on PFM interventions considered important in the current literature.

Heterogeneity in the content of PFMT programs

Although PFMT is recommended as a first-line conservative treatment option to remediate urinary dysfunction, there is little consensus regarding the elements of tested programs. This was particularly apparent in the instructions used to teach PFM contractions. Using

the information available in each manuscript we aimed to interpret whether PFMT programs in men with urinary symptoms predominantly targeted the anal or urethral region of the pelvic floor. Our results indicate that the anal region is most often the focus. Stafford et al[17] have shown that the pattern of activity of the PFM differs between verbal instructions. Although there is co-concomitant activation of multiple PFM with all instructions, greater urethral or anal sphincter activity is achieved with instructions focused on the urethra or anus, respectively. It is plausible that the efficacy of treatment might depend on the muscle targeted. This needs to be investigated, and if true would highlight the importance of specificity of instructions in PFM rehabilitation. Although the present review only considered studies that implemented PFMT for urinary-related conditions, only 7% of studies specifically targeted the urethral region. This should be considered with some caution, as our interpretation of the target region was based on the instruction, feedback and assessment, but was limited by a lack of detail of the feedback used (e.g. 'assisted by BFB' vs. 'an anal probe was inserted to provide visual feedback of the PFM contraction'), lack of a specific training instruction (e.g. 'patients were taught to contract the pelvic floor' vs. 'patients were instructed to contract the anal muscles around the examiners finger'), absence of any specific reference to the intended target muscle, or use of terminology that ignores the complexity of the PFM.

Assessment and correction of PFM activation is argued to be an essential part of effective PFMT[18]. Although, it is often assumed that a PFM contraction can be achieved after verbal or written instructions alone, research has shown this to be incorrect for both men[19] and women[20,21], with up to 50% failing to achieve an effective contraction after basic

instruction. An ineffective contraction (i.e. one that involves depression of the bladder base secondary to excessive abdominal muscle activation) that is not corrected early or throughout the trial may be a source of variability in the reported efficacy of PFMT.

The body position in which PFM contractions were taught and practiced varied between studies and might be important for treatment efficacy. Scott et al[19] demonstrated that participants' ability to contract the PFM differed between positions, with 32.7% and 26.9% of healthy men unable to perform an effective contraction in lying and standing, respectively. The present review identified that most studies did not describe the position participants adopted during teaching of the exercise, although most were prescribed a HEP that consisted of exercises in lying, sitting and standing. It is possible that choosing to teach exercises in only one position may diminish the efficacy of some programs.

Intensity of PFM exercise varied greatly between trials. If PFM training was insufficient to change muscle properties it may be another source of variability in the success of PFMT. Conversely, too much PFM exercise may cause fatigue. In comparison to limb muscles, voluntary activity of the PFM declines rapidly due to central fatigue[22], therefore too much exercise too early may be counterproductive. The median time-to-fatigue of PFM in women with UI is reported to be 11.5 s at approximately 80% MVC[23]. This review has shown that the most common contraction duration and intensity was 10 s at MVC (when details were stated). Although caution is required when applying findings of PFM research in women to men, contractions at MVC for 10 s may cause early fatigue in some men. Individual variation in the initial ability of participants to perform effective contractions, and the

strength and endurance of their PFM suggests that a personally tailored exercise program based on initial and ongoing assessment of the contraction during the intervention may be beneficial.

A fundamental determinant of success of any exercise intervention is participant adherence. Most studies in this review (81%) did not incorporate or report a measure of exercise adherence. Studies of short-term adherence to PFMT programs in women have identified poor adherence as a potential barrier to treatment effectiveness[24,25]. It has since been recommended that adherence be continually monitored and reported in research and clinical settings[26]. As adherence may contribute to the difference in efficacy of PFMT studies, absence of this information could compromise interpretation of the results of individual clinical trials.

Conclusion

This review highlights substantial heterogeneity of the components of PFM interventions and variation in the comprehensiveness of reporting program details in manuscripts. Many studies lack important details of the intervention that could assist in the interpretation of efficacy in reducing urinary symptoms in men. Despite a plethora of research on PFMT, there remains little or no consensus as to which instructions, positions, feedback or amount of repetition would be most beneficial. Lack of consistency in PFMT design is likely to be a consequence of lack of clarity regarding the effective elements of PFMT programs. Although the paucity of evidence guiding effective programs is partly explained by the fledgling evolution of understanding of PFM in men, resolution of this issue is hampered by poor quality of reporting which precludes data synthesis. A first step towards a solution is

to adhere to guidelines for the reporting of PFMT interventions. The CERT can provide useful guidance for this process. The results could then drive recommendations for optimal PFMT program content for men with urinary symptoms.

Figure 1: Search flow diagram

Figure 2. Study and PFMT training session details. (a) Participant group: 'Mixed' = studies with individuals who have undergone different treatments e.g. prostatectomy or TURP or radiotherapy, PD = Parkinson's disease, MS = multiple sclerosis, CVA = cerebrovascular accident, SCI =spinal cord injury, TURP = transurethral resection of the prostate, Prostate Ca = patients who have undergone treatment for prostate cancer (excluding prostatectomy) such as radiotherapy; (b) Condition treated by PFMT: UI= urinary incontinence, LUTS = lower urinary tract symptoms, OAB = overactive bladder, PMD = post micturition dribble; (c) PFMT instructor/supervisor: PT = physiotherapist/physical therapist, NP = nurse practitioner; 'Combined' = PFMT instructed by trainers from different professions, and (d) Education provided: 'Other' includes education on exercise, bladder control, and effect of prostate cancer on health, A/P = anatomy and/or physiology. Number of studies in each category provided in brackets.

Figure 3. PFMT teaching session details and treatment focus: (a) Duration of sessions: NA = not applicable; (b) Number of sessions per participant; (c) Period over which sessions were conducted; (d) Method for confirmation of the contraction: 'Combined methods' = combinations of biofeedback (BFB), digital rectal examination (DRE), visualisation and ultrasound (US), (s)EMG = (surface)electromyography, 'Other' = methods such as perineal palpation; (e) Region of the pelvic floor targeted by the PFMT intervention. Number of studies in each category provided in brackets.

Figure 4. Home exercise protocol contraction details. (a) Number of contractions per session; (b) Number of sessions per day; (c) Number of contractions per day, and (d) Contraction intensity: MVC = maximum voluntary contraction. Number of studies indicated in brackets.

Figure 5. Home exercise protocol posture and adherence details: (a) Contraction hold time; (b) Time between contractions; (c) Positions/activities in which to practice PFM contractions; (d) Method for measurement or encouragement of adherence. Number of studies indicated in brackets.

Table 1. Criteria developed for the application of CERT to PFMT programs for urinary incontinence in men

Table 2. Consensus on exercise reporting template (CERT) applied to PFMT interventions in included studies.

Table 3. Study and PFMT session data.

Abbreviations: A/P = anatomy and/or physiology, Ax = assessment, BFB = biofeedback, CI – chief investigator, CP = cystoprostatectomy, DI = detrusor instability, Di = dysfunction, DO = detrusor overactivity, DRE = digital rectal examination, ED = erectile dysfunction, ES = electrical stimulation, HEP = home exercise protocol, LUT = lower urinary tract, LUTD = lower urinary tract dysfunction, LUTS = lower urinary tract symptoms, max = maximum, min = minutes, MS = multiple sclerosis, NP = nurse practitioner, OAB = overactive bladder,

PF = pelvic floor, rehab = rehabilitation, PFMD = post micturition dribble, PFMs = pelvic floor muscles, PFMT = pelvic floor muscle training, Post-op = post-operatively, Pre-op = pre-operatively, PT = physiotherapist/physical therapist, RALP = Robotic-assisted laparoscopic prostatectomy, reps = repetitions, RP = radical prostatectomy, RRP = radical retropubic prostatectomy, Rx = treatment, sEMG = surface electromyography, SUI = stress UI, TURP = transurethral resection of the prostate,UI = urinary incontinence, Uro = urological, UUI = urge UI.

Table 4. Home exercise protocol (HEP) details.

Abbreviations: ADLs = activities of daily living, BFB = biofeedback, ES = electrical stimulation, IAP = intra-abdominal pressure, mins = minutes, MVC = maximal voluntary contraction, PFMT = pelvic floor muscle training, SUI = stress urinary incontinence, UI = urinary incontinence, UUI = urge urinary incontinence.

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Table 1. Criteria developed for the application of CERT to PFMT programs for urinary incontinence in men

Item	Description	Minimum details required for studies that use PFMT interventions
1	Detailed description of the type of exercise equipment	Describes the device type (e.g. biofeedback) and electrodes used. If equipment was not required, this item was considered NA
2	Detailed description of the qualifications, teaching/supervising expertise and/or training undertaken by the exercise instructor	Provides the profession (e.g. physiotherapist, nurse practitioner) or training of the instructor (assessor trained in pelvic floor rehabilitation and biofeedback techniques)
3	Describe whether exercises are performed individually or in a group	States if PFMT was conducted one-on-one, individually or in a group
4	Describe whether exercises are supervised or unsupervised and how they are delivered	Mentions if PFMT was performed at home with written/verbal instruction (unsupervised), or with guidance/feedback from a therapist/trainer (supervised)
5	Detailed description of how adherence to exercise is measured and reported	Reference made to how closely exercise prescription was adhered to including, but not limited to, exercise logs, verbal reports of exercise participation etc.
6	Detailed description of motivation strategies	Includes, but not limited to one of the following: follow-up phone calls, message/app reminders of exercise, exercise diaries, patient-clinician goal setting, and revision of exercise prescription to reflect patient progress
7a	Detailed description of the decision rule(s) for determining exercise progression	Describes how it was decided the patient was ready to progress based on, but not limited to, the ability to maintain a set contraction hold time, ability to perform a pre-set number of contractions without losing strength, ability to maintain a contraction during activity
7b	Detailed description of how the exercise program is progressed	Describes, for example, how exercise repetitions, training sessions, contraction intensity and hold times were progressed. Mentioning the program was tailored to the individual was not considered a detailed description
8	Detailed description of each exercise to enable replication	Describes (or references) the PFMT instruction, how the PFMT contraction was confirmed during the training session/s, and the position in which the exercise was trained. If electrical stimulation or biofeedback is used, electrode position must be stated
9	Detailed description of any home programme component	Includes the number of sessions per day, number of repetitions per session, contractions hold/relax times, and the intensity of the contraction
10	Describe whether there are any non-exercise components	Includes, but not limited to, pelvic floor education (anatomy and physiology), behavioural therapy (e.g. diet and lifestyle modification, bladder training)
11	Describe the type and number of adverse events that occur during exercise	Includes only adverse events related to the PFMT intervention. These may include, but not limited to urine loss, discomfort or pain during exercise
12	Describe the setting in which the exercises are performed	Mentions where the exercise intervention took place. This may include, but is not limited to, the department and hospital name, the physiotherapy clinic, at participant's homes etc.
13	Detailed description of the exercise intervention	States the number of treatment sessions, treatment duration (if no reference to repetitions practiced in the session), contractions per session, contraction intensity, contraction hold and relax times. In the case of ES, the stimulation parameters (stimulation time, frequency, pulse width, output and intensity) must be provided.
14a	Describe whether the exercises are generic (one size fits all) or tailored	One size fits all was assumed if a "recipe" for PFMT was stated i.e. the HEP or training session details were fixed with no reference made to exercise progression, exercise starting levels etc. Otherwise, the program was considered to be tailored to the participant
14b	Detailed description of how exercises are tailored to the individual	Describes how the intervention was tailored, not simply states it was individualised. This may include, but is not limited to, different PFMT exercises for different incontinence types, added education sessions, or different levels of exercise prescription (repetitions, hold times, intensities). If "one size fits all" as per 14a, this item was considered NA
15	Describe the decision rule for determining the starting level at which people start an exercise programme	Includes a statement that defines how/why the initial PFMT exercise levels were prescribed

16a	Describe how adherence or fidelity to the exercise intervention is assessed	Describes how instructors were trained to deliver identical programs to participants (if multiple instructors used), and if session details were documented to improve fidelity
16b	Describe the extent to which the intervention was delivered as planned	Describes how the delivered program compared to the protocol. This could include, but is not limited to, percentage of participants that completed the program, which parts of the program were not adhered to and in which groups, reasons for abandoning the planned intervention and any alternative therapies introduced

Table 2. Consensus on exercise reporting template (CERT) applied to PFMT interventions in included studies.

	CERT item number																			
Author	1	2	3	4	5	6	7a	7b	8	9	10	11	12	13	14a	14b	15	16a	16b	Total score
Ahmed 2012[27]	1	1	0	0	1	0	0	0	1	0	0	0	1	0	1	1	1	0	0	8
Baigis-Smith 1989[28]	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	NA	0	0	0	5
Bales 2000[29]	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	NA	0	0	0	3
Burgio 2011[30]	NA	1	1	1	0	0	1	1	0	0	1	1	1	0	1	1	1	0	0	11
Burgio 2006[31]	1	0	0	1	0	0	1	1	0	0	0	0	0	0	1	1	1	0	0	7
Burgio 1985[32]	1	0	1	1	0	0	0	0	1	0	1	1	1	0	1	1	0	0	0	9
Burkert 2012[33]	NA	1	0	1	1	1	0	0	0	0	0	0	1	0	1	NA	0	0	0	6
Burkert 2011[34]	NA	1	0	1	1	1	0	0	0	0	0	0	1	0	1	NA	0	0	0	6
Burton 1988[35]	1	1	1	1	0	1	0	0	0	0	1	1	0	0	1	1	0	1	0	10
Centemero 2010[36]	NA	1	0	1	0	0	0	0	0	0	1	0	1	0	1	NA	0	0	0	5
Chang 1998[37]	NA	0	0	1	0	0	0	0	1	0	1	1	1	0	1	NA	0	0	0	6
Colley 2014[38]	NA	1	1	1	0	0	0	0	1	0	1	0	1	0	1	1	1	0	0	9
Cornel 2005[39]	NA	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3
Dieperink 2013[40]	1	1	1	1	0	1	0	0	0	0	1	0	1	0	1	0	0	1	0	9
Dijkstra-Eshuis 2015[41]	1	1	0	1	0	0	0	1	0	0	1	1	0	1	1	1	0	0	1	10
Dorey 2009[14]	NA	1	0	1	NA	1	1	1	1	1	1	NA	NA	1	1	1	1	1	NA	13
Dorey 2003[42]	1	0	1	1	0	1	0	0	0	0	1	0	0	0	1	NA	0	0	0	6
Dorey 1997[43]	NA	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	16
Dornan 2005[44]	NA	1	0	1	0	0	1	1	0	0	1	0	0	0	1	1	1	0	0	8
Dubbelman 2010[45]	NA	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3
Engberg 1997[46]	1	1	1	1	0	1	1	1	0	1	1	0	1	0	1	1	1	0	0	13
Faithfull 2011[47]	0	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	5
Fernández-Caudros 2016[48]	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	9
Filocamo 2007[49]	NA	0	1	0	0	0	0	0	0	0	0	0	0	0	1	NA	0	0	0	2
Filocamo 2005[50]	NA	0	0	1	0	0	0	1	1	0	0	0	0	0	1	NA	0	0	0	4

Fink 2008 [51]	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Floratos 2002 [52]	1	1	0	1	0	0	0	0	1	1	1	0	0	0	1	NA	0	0	0	7
Franke 2000 [53]	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	NA	0	0	0	4
Fried 1995 [54]	1	0	0	1	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	5
Gallo 1996 [55]	0	1	0	1	0	1	0	0	0	0	1	0	0	0	1	NA	0	0	0	5
Geraerts 2013a [56]	0	1	1	1	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	6
Geraerts 2013b [57]	0	1	1	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	5
Glazener 2011 [58]	NA	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	16
Goode 2011 [59]	1	1	0	1	1	1	0	1	0	0	1	1	1	0	1	1	1	0	0	12
Hayn 2000 [60]	0	0	0	1	1	0	0	0	0	0	1	0	1	0	1	NA	0	0	0	5
Hou 2015 [61]	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Hou 2013 [62]	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	NA	0	0	0	2
Jackson 1996 [63]	1	1	1	1	0	1	1	0	0	1	1	0	1	0	1	1	0	0	1	12
Joseph 2006 [64]	0	1	1	1	0	1	1	1	0	0	1	0	1	0	1	1	0	0	0	10
Joseph 2000 [65]	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Joseph 1989 [66]	NA	1	1	1	0	0	0	1	0	0	0	0	1	0	1	NA	0	0	0	6
Karon 2010 [67]	NA	1	1	1	0	1	1	1	0	1	1	0	1	0	1	1	0	0	0	11
Klutke 2009 [13]	NA	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	0	0	13
Kongtragul 2014 [68]	NA	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Krauss 1975 [69]	NA	0	1	1	0	1	0	0	0	0	0	0	0	0	1	NA	0	0	0	4
Laurienzo 2013 [70]	1	1	0	1	0	0	0	0	0	0	0	0	1	0	1	NA	0	0	0	5
Lee 2013 [71]	NA	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
Lilli 2006 [72]	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lombrana 2013 [73]	NA	1	1	1	1	0	0	0	0	0	0	0	1	0	1	NA	0	0	0	6
Manassero 2007 [74]	NA	1	1	1	0	0	0	1	0	0	0	0	1	0	1	NA	0	0	0	6
Manley 2016 [75]	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
Mao 2015 [76]	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marchiori 2010 [77]	0	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	0	0	0	8
Mariotti 2015 [78]	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	5
Mariotti 2009 [79]	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	5

Mathewson-Chapman 1997 [80]	1	1	1	1	0	0	1	1	1	0	1	0	1	0	1	NA	0	0	0	10
McClurg 2008 [81]	1	1	0	1	1	0	0	0	1	0	0	0	1	0	1	NA	0	0	0	7
McDowell 1999 [82]	0	1	1	1	1	1	1	1	0	0	1	0	1	0	1	1	1	0	1	13
McDowell 1992 [83]	1	1	1	1	0	0	1	1	1	0	1	0	1	0	1	1	1	0	0	12
Meaglia 1990 [84]	NA	1	1	1	0	0	0	1	1	0	1	0	1	0	1	1	0	0	0	9
Middaugh 1989 [85]	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	6
Millard 2004 [86]	NA	0	0	1	0	0	0	1	0	0	1	1	0	0	1	NA	0	0	0	5
Moore 2008 [87]	0	1	1	1	0	1	0	1	0	0	1	1	1	1	1	0	0	0	0	10
Moore 1999 [88]	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	NA	0	0	0	13
Mungovan 2013 [89]	NA	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	4
Nakagawa 2010 [90]	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	4
O'Brien 1991 [91]	NA	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	4
Ocampo-Trujillo 2014 [92]	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	NA	0	0	0	3
Overgård 2008 [93]	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1	NA	0	0	0	11
Palisaar 2015 [94]	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Pannek 2005 [95]	0	1	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	6
Parekh 2003 [96]	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Park 2012 [97]	1	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	5
Patel 2013 [98]	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	NA	0	0	0	5
Paterson 1997 [99]	NA	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	1	0	0	7
Pedriali 2016 [100]	1	1	1	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	6
Porru 2001 [101]	NA	1	1	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	5
Rajkowska-Labon 2014 [102]	1	1	1	1	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	8
Ribeiro 2010 [103]	1	1	0	1	0	0	1	1	1	0	0	1	0	0	1	1	1	0	0	10
Rigatti 2012 [104]	NA	1	0	1	0	0	0	0	1	0	0	0	0	0	1	NA	0	0	0	4
Robinson 2008 [105]	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	6
Rose 1990 [106]	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	6
Ruiz 2011 [107]	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	3
Santa Mina 2015 [108]	NA	1	0	1	0	1	0	1	1	1	1	NA	1	1	1	NA	0	0	NA	10
Santa Mina 2014 [109]	NA	1	1	1	1	1	0	1	0	1	1	NA	1	1	1	0	0	0	NA	11

Schega 2015 [110]	NA	1	1	1	1	1	0	0	0	0	1	1	1	0	0	0	0	0	NA	8
Schlenker 2006 [111]	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Serdà 2014 [112]	0	1	0	1	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	5
Shendy 2015 [113]	1	0	0	1	0	0	0	0	0	0	1	0	1	1	1	NA	0	0	0	6
Sighinolfi 2009 [114]	1	0	1	1	0	0	0	0	1	0	1	0	0	0	1	NA	0	0	0	6
Stein 1995 [115]	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	NA	0	0	0	4
Sueppel 2001 [116]	1	1	0	1	0	1	0	0	0	0	0	0	1	0	1	NA	0	0	0	6
Terzoni 2013 [117]	1	1	0	1	0	0	*	*	*	*	*	0	1	0	1	0	0	0	0	5
Tibaek 2016 [118]	NA	1	1	1	0	0	0	0	0	1	1	0	0	1	1	NA	0	0	0	7
Tibaek 2007 [119]	NA	1	1	1	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	7
Tienforti 2012 [120]	1	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	6
Vahtera 1997 [121]	1	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	5
Van Kampen 2009 [122]	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	4
Van Kampen 2000 [123]	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	5
Van Kampen 1998 [124]	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Vásquez 2015 [125]	NA	1	1	1	1	1	0	0	0	1	0	0	0	1	1	NA	0	0	0	8
Vaughan 2011 [126]	1	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	4
Wille 2003 [127]	1	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	6
Yamanishi 2010 [128]	1	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4
Yokoyama 2004 [129]	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3
Zhang 2015 [130]	0	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	5
Zhang 2008 [131]	0	1	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	6
Zhang 2006 [132]	1	1	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	7
Sum per question	47	80	51	98	19	34	15	27	26	16	67	22	58	14	69	24	16	5	3	

1 Detail provided 0 Insufficient detail provided NA Not applicable

* Not available

Table 3. Study and PFMT session data.

Author	Participant group	Condition treated	PFMT instructed by	PF education	Time per PFMT session (min)	Number of PFMT sessions	PFMT Rx duration (weeks)	Intra-session PFMT contraction details (reps, hold/relax time, intensity, position)	PFM included in instruction or reference that indicates muscle used	Method for confirmation of contraction	Region of focus
Ahmed 2012 [27]	Post RP	UI	PT	?	30	ES: 24* ES+BFB: 24*	12	ES+BFB: 3 x 10 rapid + 3 sustained (5, 7 or 10 s hold) contractions, right lateral decubitus position. 10 X prolonged expiration, supine, hips flexed ~60°	Anal sphincter	Perineal sEMG BFB	Anal
Baigis-Smith 1989 [28]	Older adults (♂, ♀)	SUI, UUI, mixed UI	NP	?	?	?	?	?	Pubococcygeus muscle	Anal EMG BFB[#]	Anal
Bales 2000 [29]	RRP	UI	Nurse (BFB)	?	45	1	Individual (2-4)	PFMT+BFB: 10-15 X 5-10 s holds	Muscle that starts and stops urine flow	sEMG (electrode placement ?)	Urethral
Burgio 2011 [30]	Male veterans	OAB	NP	?	?	?	?	2-10 s hold, 2-10 s relax. Initial duration dependant on ability	PFMs	DRE	Anal
Burgio 2006 [31]	RP	UI	?	?	?	1	26	2-10 s hold, 2-10 s relax. Initial duration dependant on ability	Sphincter muscles; slow/interrupt urinary stream	Rectal probe	Urethral and anal
Burgio 1985 [32]	Elderly patients (♂, ♀)	SUI, UUI, DI	?	?	60-120	Individual (1-8)	Individual	10 s hold, 10 s relax. Practiced contractions prior to coughing, hold contractions 3-4 coughs	Sphincters and PFMs; interrupt urinary stream	Rectal pressure probe	Urethral and anal
Burkert 2012 [33]	Post RP	?	PT staff	?	?	?	?	?	?	?	Not clear
Burkert 2011 [34]	Post RP	?	PT staff	?	?	?	?	?	?	?	Not clear
Burton 1988 [35]	Elderly patients (♂, ♀)	SUI and UUI	NP	Bladder control	30 or 75 with BFB	Individual (1-6)	Individual	?	Anal and urethral sphincter; resist defecation; interrupt urinary stream	Bladder, anal canal and rectum pressure BFB	Urethral and anal
Centemero 2010 [36]	RP	UI	PT	?	30	Pre-op: 16* All: 8*	Pre-op: 8 Post-op: 4	?	PFMs, superficial perineal structures	Subscrotal digital Ax, visualisation of perineum, scrotum	Urethral

Chang 1998 [37]	Post TURP	UI, terminal dribbling	?	A/P - micturition	?	?	?	Lateral decubitus position	Anal sphincter muscles; interrupt urinary stream; control flatus	DRE	Urethral and anal
Colley 2014 [38]	RALP	UI	Nurse	?	?	?	?	Initial session: 5 X 6 s holds, 6 rapid contractions in lying.	PFMs	Palpation of perineum	Not clear
Cornel 2005 [39]	Post RRP	UI	PT	A/P - pelvis	?	Individual (weekly until continent)	Individual	Supine position. PFMT progressed to increase PFM power, endurance and coordination	Anal sphincter	?	Anal
Dieperink 2013 [40]	Post radiation for prostate cancer	Adverse effects of Rx	PT	Rx effects on health	60 then 45	2	8	Lateral position. Rx included exercises for major muscle groups for endurance, strength and balance (3 sessions of 10-12 reps for each muscle group). [Unclear if this applies to PFMT]	PFMs	Digital rectal Ax	Not clear
Dijkstra-Eshuis 2015 [41]	Laparoscopic RP	SUI	PF PT	A/P	30	4	4	Behavioural+BFB training included MVCs (3 s hold), endurance (30 s hold), relaxation, and coordination with abdominal breathing. 1 min rest between tasks	PFMs	Anal probe BFB, intra-anal ES	Anal
Dorey 2009 [14]	Post-TURP or post-prostatectomy	UI, Sexual Di	PT, nurse	A/P - LUT, PFMs	?	4	12	?	Anal sphincter and puborectalis; stop wind escaping; base of penis and testicle movement	DRE, visualisation of penis and testicles	Urethral and anal
Dorey 2003 [42]	Adult males - Case studies	ED + PMD	?	?	?	5	5	Maximum intensity, hold/relax times individualised	Stop urinary flow; PFMs, base of penis and testicles movement	DRE, manometric BFB, visualisation of penis and testicles	Urethral
Dorey 1997 [43]	Post TURP	PMD, SUI, enuresis	PT	PFMs, external urethral sphincter	?	4	4	Supine, sitting, standing astride (focus pelvic contraction to the front)	External urethral sphincter; prevent voiding urine	Patient felt base of penis lift	Urethral
Dornan 2005 [44]	Post RP and post-TURP	SUI	PT	?	?	?	?	Level 1: specific PFM contraction. Level 2: PFM + abdominal co-contraction. Level 3: PFM contraction + activity. Level 4: aerobic conditioning + PFM contraction	Anal sphincter; perineum; prevent urine flow	?	Urethral and anal

Dubbelman 2010 [45]	Post RRP	UI	PT	A/P - prostate, PFMs	30	9	26	?	PFMs	DRE	
Engberg 1997 [46]	Homebound older adults (♂, ♀)	UI	NP	?	60	8	8	?	PFMs	sEMG BFB	Not clear
Faithfull 2011 [47]	Post radiotherapy for prostate cancer	LUTS	Nurse - prostate Ca	Information provided (no detail)	60 min individual90 min group	4	8	?	PFMs	?	Not clear
Fernández-Caudros 2016 [48]	Adult males	UI	PT	?	30	20	10	Supine position with lower limbs semi-flexed, 118 X 3 s hold, 7 s relax	?	Peri-anal sEMG	Anal sphincter
Filocamo 2007 [49]	RRP	UI	Qualified instructor	?	?	Every 15 days	?	?	Pelvic muscles	DRE	Anal
Filocamo 2005 [50]	RRP	UI	?	?	?	3	?	?	Pelvic muscle; base of penis movement	DRE	Urethral and anal
Fink 2008 [51]	Post RP or TURP	UI	PT	?	?	?	Individual (max 26)	?	?	BFB (no details)	Not clear
Floratos 2002 [52]	Post RP	UI	PT, rehab staff	A/P - pelvis	30	15	4	Lateral decubitus position	Anal sphincter; hold back bowel movements or passing gas	DRE or perineal sEMG	Anal
Franke 2000 [53]	RP	UI	?	Post-op instruction	45	5	5	?	PFMs	Perineal patch sEMG BFB	Not clear
Fried 1995 [54]	Diverse disabilities (♂, ♀)	UI	?	?	Individual	Individual (3-19)	Individual	?	PFMs	Intrarectal sEMG BFB[#]	
Gallo 1996 [55]	RP	UI	Nurse	A/P - PF, bladder control	45-60	3	< 52	?	PFMs	EMG BFB	Not clear
Geraerts 2013a [56]	RP and RALP	UI	UI therapist	?	30	3	3	?	PFMs	DRE or EMG BFB	Anal
Geraerts 2013b [57]	RP	UI	Therapist	?	?	Individual (weekly until continent)	?	?	PFMs	EMG BFB	Not clear

Glazener 2011 [58]	Post RP and TURP	UI	PT, nurse	A/P - LUT, PFMs	?	4	12	?	Anal sphincter and puborectalis; stop wind escaping; base of penis and testicle movement	DRE	Urethral and anal
Goode 2011 [59]	Post RP	UI	Physician, NP	A/P - UI, PFMT	?	4	8	?	PFMs; slow/interrupt urinary stream	DRE, sEMG BFB (peri-anal or rectal probe)	Urethral and anal
Hayn 2000 [60]	Adults (♂, ♀)	UI	?	?	15 min ES (session time?)	Individual (average 7)	?	4 s hold, 8 s relax	PFMs	EMG BFB (electrode type, placement?)	Not clear
Hou 2015 [61]	RP	UI	?	?	?	?	?	?	PFMs	BFB (not details)	Not clear
Hou 2013 [62]	Post TURP	LUTS	?	A/P - micturition	?	?	?	5 s hold, 10 s relax	PFMs; interrupt urine flow	sEMG (no details provided)	Urethral
Jackson 1996 [63]	Post RP	UI	Nurse, trainer	A/P - PF	15	10	10	Contractions varied to enhance strength, speed and endurance	PFMs	Anal probe, sEMG, visualisation	Anal
Joseph 2006 [64]	Post prostatectomy	UI	Nurses	?	?	?	?	?	Rectal muscles	DRE	Anal
Joseph 2000 [65]	Post RP and TURP	UI	Practitioner	?	15	4	?	?	Squeeze around finger during DRE	BFB (no details)	Anal
Joseph 1989 [66]	Post prostatectomy	UI	Nurse	?	15-30	3	?	?	Interrupt urinary stream	DRE	Urethral and anal
Karon 2010 [67]	Adults (♂, ♀)	UI, nocturia	PT, nurse	A/P	?	?	?	5 X 5-10 s holds at max intensity	PFMs	?	Not clear
Klutke 2009 [13]	Adults (♂, ♀)	OAB	Physician, nurse	PFMT, OAB, voiding	30	2	12	?	Muscles that hold gas in the rectum; slow/stop urine flow	Ensured proper PFMT technique (no details)	Urethral
Kongtragul 2014 [68]	Post RP	UI	?	?	?	?	?	?	Muscle tension around the anus	?	Anal
Krauss 1975 [69]	Post suprapubic prostatectomy and TURP	UI	Physician	?	?	?	?	?	Rectal sphincter; suppress urge to defecate; penile retraction	Visualisation of penile retraction, DRE if required	Urethral and anal

Laurienzo 2013 [70]	RRP	UI	PT	A/P - prostate region	?	10	?	5 s holds, 10 X 5 contractions in decubitus position, 10 X 5 in decubitus position with waist elevation, 5 X 10 lying with legs adducted, 10 X standing with 60° hip flexion	Perineum; PFMs	?	Anal
Lee 2013 [71]	Adults (♂, ♀)	OAB	?	A/P - urine storage, emptying	?	?	?	?	PFMs	?	Not clear
Lilli 2006 [72]	RP	UI	?	?	20 with BFB	≤ 15* (daily ≤ days pre-op)	?	Relaxation time twice the hold time. Exercises taught during different manoeuvres (coughing, raising the head, extending the abdomen)	Perineal contractions	sEMG BFB (electrode type, placement ?)	Not clear
Lombrana 2013 [73]	RP	UI	Nurse	PFMT	20 then 10	2	?	Seated or standing	Pubococcygeal muscle	DRE and urine stop test	Urethral and anal
Manassero 2007 [74]	RP	UI	Urologists	?	?	?	?	?	Pelvic muscles	DRE	Anal
Manley 2016 [75]	Post RALP	?	PT	A/P	Initial 120	3	4	"Strength, reflex action, coordination and endurance training exercises were individualised according to assessment findings"	?	Rectal exam, trans-abdominal ultrasound, anterior PFM Ax	Not clear
Mao 2015 [76]	RRP or LRP	UI	?	?	?	Individual	Individual	3 PFMT session per day	?	?	Not clear
Marchiori 2010 [77]	Post RRP	UI	Urologist	A/P - PF	?	?	?	? [ES: 10 sessions, 15 min duration]	Sphincter; PFMs	DRE	Anal
Mariotti 2015 [78]	RP	UI	Clinician	?	35 (20 ES + 15 BFB)	12	6	?	Anal sphincter; pelvic muscles	Perineal sEMG BFB	Anal
Mariotti 2009 [79]	Post RP	UI	Clinician	?	35 (20 ES + 15 BFB)	12	6	?	Anal sphincter; pelvic muscles	Perineal sEMG BFB	Anal
Mathewson-Chapman 1997 [80]	RP	UI	Nurse	A/P - prostate, PFMs, sphincters	?	36	10	Series of contractions and relaxations for 3 min, 10 s hold, 10 s relax	Perineal muscles	Anal probe BFB	Anal
McClurg 2008 [81]	MS (♂, ♀)	LUTS	PT	Booklet (no details)	?	9	9	Warm-up of 5 X 5 s hold/5 s relax then assessment of contraction/relaxation	PFMs	Anal probe EMG BFB[#]	Anal
McDowell 1999 [82]	Home-bound older adults (♂, ♀)	UI	NP	?	40-60	8	8	?	PFMs	EMG BFB (no detail)	Not clear

McDowell 1992 [83]	Geriatric outpatients (♂, ♀)	UI	Nurse, psychologist, geriatrician	?	30-90	Individual (every 2-4 weeks)	Individual	?	PFMs	Anal probe pressure BFB[#]	Anal
Meaglia 1990 [84]	Post prostatectomy	UI	Nursing staff	?	?	?	?	Lateral decubitus position	Anal sphincter muscles; slow/interrupt urinary stream	DRE	Urethral
Middaugh 1989 [85]	Post stroke	UI	?	?	?	Individual (every 2-4 weeks)	12	Side-lying, bladder fill technique used to induce bladder contractions. 10-20 sphincter-training trials with 10 s holds	External anal and urethral sphincters; interrupt urinary stream	Rectal tube	Urethral and anal
Millard 2004 [86]	Adults (♂, ♀)	OAB	HEP only	?	NA	NA	NA	NA	PFMs	?	Not clear
Moore 2008 [87]	Post RRP	UI	PT	?	30	Individual	Individual (max 24)	Supine, knees bent. Strength: 12-20 X 5-10 s hold/10-20 s relax. Endurance: 6-8 X 20-30 s hold/60 s relax at 50-60% MVC. Speed: 5-10 contractions in 10 s, 20 s relax. Control: 6-10 X slow to MVC, 15 s release, 15 s relax	Bulbocavernosus muscle; stop urine flow; stop passing gas; anal and rectal muscle; base of penis movement	Visualisation of perineum and rectum	Urethral and anal
Moore 1999 [88]	Post RP	UI	PT	?	30	24	12	Supine, knees bent. Strength: 12-20 X 5-10 s hold/10-20 s relax. Endurance: 8-10 X 20-30 s hold/20-30 s relax at 60-75% MVC. Speed: quick contractions in 10 s, 20 s relax. Control: 5 s to MVC, 5 s hold, 5 s release, 15-30 s relax	Bulbocavernosus muscle, base of penis movement	Visualisation of base of penis, palpation of perineum	Urethral and anal
Mungovan 2013 [89]	RP	UI	PT	A/P - PFMs	?	? Pre-op, 2 post-op	?	?	PFMs	Trans-abdominal ultrasound	Not clear
Nakagawa 2010 [90]	RRP	UI	?	?	?	?	> 1	?	?	?	Not clear
O'Brien 1991 [91]	Adults (♂, ♀)	UI	Nurse	?	?	4	?	?	?	?	?
Ocampo-Trujillo 2014 [92]	RP	-	?	?	?	74* (3 X daily)	4	?	Levator ani muscles	Anal BFB	Anal
Overgård 2008 [93]	RP	UI	PT	A/P - PFMs	45	Individual (weekly)	Individual	? [Some patients received a PFMT instructional DVD with the same content as the training sessions]	PFMs	DRE, visualisation of perineum and scrotum	Anal

Palisaar 2015 [94]	Post RP	UI	PT	?	?	42* (twice daily)	3	?	?	?	Not clear
Pannek 2005 [95]	RP	UI	PT	A/P - PF	30	3	?	Exercises to increase PFM endurance and coordination. [Rehabilitation program included intensive physiotherapy, ES (if SUI was 2nd or 3rd grade), video feedback training and anticholinergic meds]	PFMs	?	Not clear
Parekh 2003 [96]	RP	UI	PT	PFMs	?	6	12	Session 1: PFMT in hook lying. 4 contractions with posterior pelvic tilt, bridging, adduction, hip external rotation. Session 2: 4 contractions on ball with posterior pelvic tilt, bouncing, and sit to stand.	PFM contraction at the anus or base of penis	Palpation or rectal probe BFB	Urethral and anal
Park 2012 [97]	RP	Adverse effects of RP	Sports experts	Post-op symptoms	60	24	12	? [Weeks 1-4: Education, PFMT, PFMT sitting on a ball. Weeks 5-8: PFMT sitting on a ball, other muscle exercises using a ball. Weeks 9-12: elastic band exercises]	?	?	Not clear
Patel 2013 [98]	RRP	UI	PT	A/P - bladder, urethra, PFMs	60	Individual (1-4)	Individual	10 X 10 s contractions in sitting, standing and lying positions	PFMs	Trans-abdominal ultrasound	Not clear
Paterson 1997 [99]	Male outpatients	PMD	CI	A/P - micturition	?	?	12	5 X 1 s contraction (fast twitch) + as many MVCs as possible without loss of strength and duration of contraction. Individualised	Muscles that control flatus or interrupt urine flow; penile and scrotal lift	DRE, visualisation of penile and scrotal lift	Urethral and anal
Pedriali 2016 [100]	RP	UI	PT	?	40-50	10	10	3 X 10 MVCs in supine, seated and standing positions	PFMs	?	Anal
Porru 2001 [101]	Post TURP	UI, PMD	Urologist	?	?	4	4	Lateral decubitus position	Anal sphincter muscles	DRE	Anal
Rajkowska-Labon 2014 [102]	Post RP	UI	PT	A/P - urinary system, PFMs, micturition	60	Individual	Individual (max 52)	20-25% MVC, 7-10 X 5-10 s holds. Progression: open and closed kinematic-chain exercises, unstable bases, resistance and functional exercises	Urethral sphincter, PFMs	Anal probe sEMG	Anal
Ribeiro 2010 [103]	Post RP	UI	PT	?	30	Individual	Individual (max 12)	3 X 10 rapid contractions in right lateral decubitus position, 3 sustained (≤ 10 s hold), and 10 during prolonged expiration in supine with 60° hip flexion	PFMs	Anal probe, DRE	Anal

Rigatti 2012 [104]	RALP	UI	PT	?	30	16	8	?	Superficial perineal structures; PFMs	Subscrotal digital Ax , visualisation of perineum and scrotum	Urethral
Robinson 2008 [105]	RP	LUTS	Nurse - Continence	?	30-60	4	4	?	?	Perianal sEMG BFB	Anal
Rose 1990 [106]	Older adults (♂, ♀)	UI	Nurse	No	?	?	?	? Followed in home initially fortnightly, then monthly, then 3 monthly (reinforcement only)	Pubococcygeal muscle	Rectal EMG BFB[#]	Anal
Ruiz 2011 [107]	Older adults (♂, ♀)	OAB	Internet-based training	A/P - LUT	?	?	6	?	PFMs	?	Not clear
Santa Mina 2015 [108]	RP	UI	PT	?	?	?	?	?	PFMs; urinary control at the toilet	DRE	Urethral and anal
Santa Mina 2014 [109]	RP	-	Research coordinator	PFMT	?	?	?	?	PFMs	?	Not clear
Schega 2015 [110]	Prostate cancer survivors	-	Exercise therapists	Effects of exercise	90	52	26	? Program includes specific aerobic, strengthening, flexibility, balance and relaxation exercises	PF and sphincter	?	Not clear
Schlenker 2006 [111]	Post RP or CP	UI	?	?	?	?	?	?	?	BFB (no details)	Not clear
Serdà 2014 [112]	Radiotherapy, prostatectomy patients	UI	Rehab staff	?	60	32	16	Intense, reactive short duration contractions <1 s hold (fast twitch fibers). Sustained moderate/low intensity contractions, 5 s hold (slow twitch)	Levator ani	?	Anal
Shendy 2015 [113]	Spinal cord injury	ED, Bladder Di	?	?	?	12	6	Fowler lying position, 1 s holds and 6-10 s holds of target muscles	PFMs; interrupt urine flow; sEMG BFB at base of penis	sEMG BFB	Urethral
Sighinolfi 2009 [114]	Post RP	UI, ED, climacturia	?	A/P - PF	?	~ 16* (weekly)	16*	Supine position, MVCs with 10 s holds, 10 s relax	PFMs; prevent urine flow	DRE, visualisation of scrotal lift, penile retraction	Urethral and anal
Stein 1995 [115]	Adults (♂, ♀)	UI	Physician or nurse	?	30	6	3	?	?	Rectal pressure probe[#]	Anal
Sueppel 2001 [116]	RP	UI	Nurse - BFB	?	?	Individual (5-7)	52*	?	Pelvic muscles	Rectal pressure probe BFB	Anal

Terzoni 2013 [117]	RRP	UI	Nurse - uro rehab	?	?	Individual (median 14)	Individual	?	?	?	Not clear
Tibaek 2016 [118]	Post stroke	LUTS	PT	A/P - bladder, PFMs	60	12	12	Group Rx: Isolated PFM contractions (6 s hold/6 s relax); strength exercises (3 s hold/3 s relax + 6 s hold/6 s relax); endurance exercises (max 30 s hold/30 s relax)	PFMs	DRE	Anal
Tibaek 2007 [119]	Post TURP	-	PT	A/P - bladder, PFMs	60	4	4	Group Rx: 4-8 X [Isolated PFM contractions (6 s hold/6 s relax); strength exercises (3 s hold/3 s relax + 6 s hold/6 s relax); endurance exercises (max 30 s hold/30 s relax)] in supine, standing and sitting positions	Anal sphincter	DRE	Anal
Tienforti 2012 [120]	RP	UI	Urologist	A/P - LUT, PFMs	20	2	2	Supine position, hips flexed to ≈ 60°	PFMs	Anal probe BFB	Anal
Vahtera 1997 [121]	MS	LUTD	?	?	?	ES: 6. BFB 1-2	ES: 2	Lying position, hips and knees flexed 90°[#]. Warm-up: 10 X 3 s hold/3 s relax. MVCs: 5 X 5 s hold/3 s relax. Endurance: 5 X 15 s hold/30 s relax.	PFMs	Anal probe sEMG	Anal
Van Kampen 2009 [122]	RRP	UI	PT	PFM function	?	?	?	ES used in patients with weak PFM contractions	PFMs	?	Not clear
Van Kampen 2000 [123]	RRP	UI	PT	A/P - PF, bladder	?	Individual	Individual (max 52)	?	PFMs	DRE	Anal
Van Kampen 1998 [124]	RP	UI	?	?	?	?	?	?	?	?	Not clear
Vásquez 2015 [125]	Incomplete spinal injury	UI, DO	PT	A/P - PF	NA	NA	NA	NA	Inward lift of PF; stop bowel movement or passing wind	HEP only	Anal
Vaughan 2011 [126]	Parkinson's disease (♂, ♀)	UI	?	?	?	5	8	?	PFMs	Anorectal EMG BFB[#]	Anal
Wille 2003 [127]	RRP	UI	PT	?	≤ 30	3	12*	?	Anal sphincter; PFMs	Anal probe BFB	Anal
Yamanishi 2010 [128]	RRP	UI	Nurse	?	?	Individual	Individual (max 52)	?	Bulbocavernosus muscle; stop urine flow; stop passing gas; anal and rectal muscle; base of penis movement	Visualisation of perineum and rectum	Urethral and anal

Yokoyama 2004 [129]	Post RP	UI	Examiner	?	?	?	?	?	Anal sphincter muscles	DRE	Anal
Zhang 2015 [130]	Post prostate cancer Rx	UI	BFB technician	?	45-60	1 BFB + 6 support sessions	12	?	?	BFB (no details)	Not clear
Zhang 2008 [131]	Post prostatectomy	UI	PT	?	45	1	-	? [Support from psychologist in 6 group sessions over 3 months - no PFMT in these sessions]	?	BFB (no details)	Not clear
Zhang 2006 [132]	Post prostatectomy	UI	PT	A/P - UI	45	1 BFB + 6 support sessions	12	?	?	Rectal EMG BFB	Anal

Abbreviations: A/P = anatomy and/or physiology, Ax = assessment, BFB = biofeedback, CI – chief investigator, CP = cystoprostatectomy, DI = detrusor instability, Di = dysfunction, DO = detrusor overactivity, DRE = digital rectal examination, ED = erectile dysfunction, ES = electrical stimulation, HEP = home exercise protocol, LUT = lower urinary tract, LUTD = lower urinary tract dysfunction, LUTS = lower urinary tract symptoms, max = maximum, min = minutes, MS = multiple sclerosis, NP = nurse practitioner, OAB = overactive bladder, PF = pelvic floor, rehab = rehabilitation, PFMD = post micturition dribble, PFMs = pelvic floor muscles, PFMT = pelvic floor muscle training, Post-op = post-operatively, Pre-op = pre-operatively, PT = physiotherapist/physical therapist, RALP = Robotic-assisted laparoscopic prostatectomy, reps = repetitions, RP = radical prostatectomy, RRP = radical retropubic prostatectomy, Rx = treatment, sEMG = surface electromyography, SUI = stress UI, TURP = transurethral resection of the prostate,UI = urinary incontinence, Uro = urological, UUI = urge UI.

Table 4. Home exercise protocol (HEP) details.

Author	Contractions (or time) per session	Sessions per day	Contractions (or time) per day	Contraction intensity	Contraction hold time (s)	Time between repetitions (s)	Positions practiced and/or functional PFMT	Exercise adherence measure?
Ahmed 2012 [27]	15-20	3	45-60*	?	3-5	6-10	Supine, sitting, standing, squatting, and before functional activities	Exercise logbook
Baigis-Smith 1989 [28]	15 morning, 15 afternoon, 20 evening	3	50*	?	10	10	?	?
Bales 2000 [29]	15	4	60*	?	10	?	?	?
Burgio 2011 [30]	15	3	45	?	2-10	2-10	?	?
Burgio 2006 [31]	15	3	45	?	2-10	2-10	Various positions and integrated into ADLs	?
Burgio 1985 [32]	?	?	50	?	10	10	Lying, sitting and standing, and prior to and during stressful activities	?
Burkert 2012 [33]	10 min	3	30* min	?	?	?	?	Self-report
Burkert 2011 [34]	10 min	3	30* min	?	?	?	?	Self-report
Burton 1988 [35]	17	3	51	?	?	?	Different positions, while walking, and prior to activities that increase IAP	?
Centemero 2010 [36]	?	?	30 min	Alternating maximal and submaximal	?	?	?	?
Chang 1998 [37]	?	?	?	?	?	?	Various positions	?
Colley 2014 [38]	5 slow + 6 fast	3	33*	?	6	?	Lying, sitting, standing and with exertion	?
Cornel 2005 [39]	10 per hour	?	?	?	?	?	Lying, sitting and standing, and during ADLs	?

Dieperink 2013 [40]	?	3	?	?	?	?	Integrated into ADLs	?
Dijkstra-Eshuis 2015 [41]	30	2	60*	?	?	1 breath	Various positions and integrated into ADLs	?
Dorey 2009 [14]	3 lying, 3 sitting and 3 standing	2	18*	MVC	Individualised (≤10)	10	Lying, sitting and standing, during walking, sexual activity, and UI provoking activities, after urinating	?
Dorey 2003 [42]	9	2	18*	MVC during lying, sitting and standing (50% MVC during walking)	10	?	Lying, sitting and standing, and during walking, sexual activity. "Squeeze out" contraction after voiding	?
Dorey 1997 [43]	16 (8 slow + 8 rapid)	6	96*	MVC for slow and rapid (submaximal during walking)	6 (10 s during walking)	?	Lying, sitting, standing, and during walking	Self-reports
Dornan 2005 [44]	?	Level 1: 2	Level 2: >200	?	?	?	During exercises and stressful activities	?
Dubbelman 2010 [45]	10 (in a 1-3 min period)	15*	150	?	?	?	Functional treatment in daily activities (no details provided)	?
Engberg 1997 [46]	10 (or 15 X 3 sessions)	4	45 maximum (individualised)	Individualised	3-4 (individualised)	3-4 (individualised)	Lying, sitting and standing, and integrated into ADLs	?
Faithfull 2011 [47]	?	?	?	?	?	?	?	?
Fernández-Caudros 2016 [48]	?	?	?	?	?	?	?	?
Filocamo 2007 [49]	10	3	30	?	5	10	During UI provoking activities	?
Filocamo 2005 [50]	10	3	30*	?	5	10	Sitting, standing, squatting, up/down stairs and during UI provoking activities	?
Fink 2008 [51]	?	?	?	?	?	?	?	?

Floratos 2002 [52]	PFMT: 25	PFMT: 4	PFMT: 80-100 PFMT+BFB: 50-100	PFMT: 70% MVC	3-5	6-10	Sitting, standing, squatting, up/down stairs and during UI provoking activities	
Franke 2000 [53]	20	3	60*	?	?	?	?	?
Fried 1995 [54]	25	2	50*	?	10	10	SUI: before UI provoking activities. UUI: on the urge to urinate	?
Gallo 1996 [55]	25	2	50*	?	10	10	?	?
Geraerts 2013a [56]	?	?	60	?	?	?	Contract before UI provoking activities and during functional activities	Exercise diary
Geraerts 2013b [57]	?	?	60	?	?	?	?	?
Glazener 2011 [58]	3 lying, 3 sitting and 3 standing	2	18*	MVC	Individualised (≤10)	10	Lying, sitting and standing, during walking, sexual activity, and UI provoking activities, after urinating	Self-reports
Goode 2011 [59]	15	PFMT: 3 ES+BFB: 2	PFMT: 45* ES+BFB: 30*	?	2-10 (increased 1 s weekly)	2-10 (increased 1 s weekly)	Lying, sitting and standing	Exercise logbook
Hayn 2000 [60]	15 including 1 min of "quick flicks"	2-3	30-45*	?	4	8	?	Questionnaire
Hou 2015 [61]	?	?	?	?	?	?	?	?
Hou 2013 [62]	5 min	3	15 min	?	5	10	?	?
Jackson 1996 [63]	10-15 min	3	30-45* min	?	?	?	Incorporated into ADLs	?
Joseph 2006 [64]	45	1	45	?	Individualised (≤10)	Individualised (≤10)	Lying, sitting and standing, during ADLs or UI provoking activities	?
Joseph 2000 [65]	?	?	?	?	?	?	?	?
Joseph 1989 [66]	17	3	51	?	3-10 (increased weekly)	3-10 (increased weekly)	Lying, sitting and standing	?
Karon 2010 [67]	5-10	5-8	25-80*	MVC	5-10	?	Lying, sitting	?

Klutke 2009 [13]	10	5	30-50	?	3-10 (increase as able)	3-10 (increase as able)	Lying, sitting and standing	?
Kongtragul 2014 [68]	?	?	240	?	?	?	?	Regularity stated (no detail)
Krauss 1975 [69]	30	Hourly whilst awake	?	?	?	?	Lying, sitting and standing	?
Laurienzo 2013 [70]	?	?	?	?	5	?	Different body positions	?
Lee 2013 [71]	5-6	?	?	?	?	?	?	?
Lilli 2006 [72]	25	4	100*	?	?	Twice the hold time	?	?
Lombrana 2013 [73]	?	?	10-50	?	5-20	5	Sitting or standing	Self-reports
Manassero 2007 [74]	15 (increased to 30)	3	45* (increased to 90*)	?	?	?	Lying, sitting and standing, then integrated into ADLs	?
Manley 2016 [75]	?	?	?	?	?	?	?	?
Mao 2015 [76]	?	3	?	?	?	?	?	?
Marchiori 2010 [77]	30	3	90*	?	Alternating 1-2 then 6-7	?	?	?
Mariotti 2015 [78]	?	?	?	?	?	?	Lying, sitting and standing, then during ADLs	?
Mariotti 2009 [79]	?	?	?	?	?	?	Lying, sitting and standing, then during ADLs	?
Mathewson-Chapman 1997 [80]	15 (increased to 35)	3 per week	?	?	5 (increased to 10)	10	Contractions prior to UI provoking activities	?
McClurg 2008 [81]	?	?	?	?	?	?	Integrated into ADLs	Downloaded from ES unit
McDowell 1999 [82]	10-15	3	30-45*	?	≤ 10	≤ 10	Lying, sitting and standing	Self-reports, training session data
McDowell 1992 [83]	15	3	45	?	≤ 10	≤ 10	Lying, sitting and supine, and prior to and during UI provoking activities	?

Meaglia 1990 [84]	17	3	51	?	3-10 (increased weekly)	?	Lying, sitting and standing, and integrated into ADLs and UI provoking activities	?
Middaugh 1989 [85]	10-25	Several	50	?	?	?	Contractions prior to standing	?
Millard 2004 [86]	15 morning, 15 afternoon, 20 evening. Increased to 25 as able	3	50-75*	?	10	10	?	?
Moore 2008 [87]	29-48* (Strength: 12-20, Endurance: 6-8, Speed: 5-10, Control: 6-10)	3	87-144*	Strength: MVC, Endurance: 50-60% MVC, Control: MVC	Strength: 5- 10, Endurance: 20-60, Control: gradual	Strength: 10-20, Endurance: 20-60, Speed: 20, Control 15	Lying, sitting or standing	?
Moore 1999 [88]	Strength: 12-20, Endurance: 8-10, Speed: reps in 10 s	?	?	Strength: MVC, Endurance: 65-75% MVC, Control: MVC	Strength: 5-10, Endurance: 20-30, Control 5 s,	Strength: 10-20, Endurance: 20-30, Speed: 20, Control: 15-30	?	Check-list exercise reminder
Mungovan 2013 [89]	?	?	?	?	?	?	Lying, sitting and standing, and during ADLs	?
Nakagawa 2010 [90]	?	?	?	?	?	?	?	?
O'Brien 1991 [91]	?	?	?	?	?	?	?	?
Ocampo-Trujillo 2014 [92]	?	?	?	?	?	?	?	?
Overgård 2008 [93]	10 + 3-4 fast contractions after each MVC	3	30* MVC + 90-120* fast	MVC	6-8	?	Lying, sitting or standing	Training diary
Palisaar 2015 [94]	?	?	?	?	?	?	?	?
Pannek 2005 [95]	?	?	?	?	?	?	?	?
Parekh 2003 [96]	?	2	?	?	?	?	Different positions, on exercise ball, and contraction prior to UI provoking activities	?

Park 2012 [97]	?	?	?	?	?	?	Different positions, on an exercise ball	?
Patel 2013 [98]	10	3	30*	MVC	10	?	Lying, sitting and standing, and during ADLs	?
Paterson 1997 [99]	5 fast twitch + as many MVCs without fatigue	?	?	MVC	Fast twitch: 1. Slow twitch: as able	?	Lying, sitting and standing	?
Pedriali 2016 [100]	10	3	30*	MVC	?	?	Lying, sitting and standing	?
Porru 2001 [101]	15	3	45	?	?	?	?	?
Rajkowska-Labon 2014 [102]	15-20 min	3	45-60* min	?	?	?	Different positions, unstable bases, with resistance, functional activities	?
Ribeiro 2010 [103]	?	?	?	?	?	?	Lying, sitting and standing	?
Rigatti 2012 [104]	?	?	?	?	?	?	?	?
Robinson 2008 [105]	20	3	60*	?	?	?	Lying, sitting and standing, and prior to UI provoking activities	?
Rose 1990 [106]	15 morning, 15 afternoon, 20 evening	3	50	?	10	10	?	?
Ruiz 2011 [107]	?	?	?	?	?	?	?	?
Santa Mina 2015 [108]	10-20 (rhythmic and sustained)	Multiple	30-180 (increased every 2 weeks)	MVC	Rhythmic: 1 Sustained: 5-10	Rhythmic: 1 Sustained: ?	Lying, sitting and standing	Leisure activities
Santa Mina 2014 [109]	Equal rhythmic and sustained contractions	?	60-180 (increased every 2 weeks)	MVC	Rhythmic: 1 Sustained: ≤10	Rhythmic: 1 Sustained: ?	?	Self-reports
Schega 2015 [110]	?	?	?	?	?	?	?	Sessions attended Vs prescribed
Schlenker 2006 [111]	?	?	?	?	?	?	?	?
Serdà 2014 [112]	Same as PFMT sessions?	?	?	?	?	?	?	?

Shendy 2015 [113]	30	3	90*	Strength: MVC, Endurance: 65-75% MVC, Control: MVC	Strength: 5-10, Endurance: 20-30, Control: 5 s,	Strength: 10-20, Endurance: ?, Control: 15-30, Speed: 20	?	?
Sighinolfi 2009 [114]	?	?	90	MVC	10	10	Lying, sitting and standing, during ADLs or UI provoking activities	?
Stein 1995 [115]	"practice at home"	?	?	?	?	?	?	?
Sueppel 2001 [116]	?	3	?	?	?	?	?	?
Terzoni 2013 [117]	?	2	?	Variable	Half the relaxation time	Twice the hold time	?	?
Tibaek 2016 [118]	6-10 close to MVC, 6-10 submaximal	1-2	12-20*	MVC and submaximal	MVC: 6 30% MVC: ≤ 30	MVC: 6 30% MVC: 30	Lying, sitting and standing, and before and during UI provoking ADLs	?
Tibaek 2007 [119]	10 close to MVC, 10 at 30% MVC	2	40*	Close to MVC, and 30% MVC	MVC: 6 30% MVC: ≤ 30	MVC: 6 30% MVC: 30	Lying, sitting and standing, and before and during UI provoking ADLs	?
Tienforti 2012 [120]	10 mins	3	30* mins	?	5	5	Lying, sitting and standing	?
Vahtera 1997 [121]	Warm-up: 10, MVCs: 5, Endurance: 5	3-5 per week	?	?	Warm-up: 3, MVCs: 5, Endurance: 15	Warm-up: 3, MVCs: 3, Endurance: 30	Lying, sitting and standing, and during ADLs	Self-reports
Van Kampen 2009 [122]	?	?	60	?	?	?	Lying, sitting and standing, and during ADLs	?
Van Kampen 2000 [123]	?	?	90	?	?	?	Lying, sitting or standing, and integrated into ADLs	?
Van Kampen 1998 [124]	?	?	?	?	?	?	?	?
Vásquez 2015 [125]	40 (3 sets prolonged and 1 set short)	3	120*	MVC	≤10	≤10	Lying, sitting, standing, prior to UI provoking activities, pre/post urinating, during sexual activity	PFMT diary
Vaughan 2011 [126]	15	3	45	?	?	?	Lying, sitting and standing, and before UI provoking activities	?
Wille 2003 [127]	?	2	?	?	?	?	?	Self-reports

Yamanishi 2010 [128]	?	?	?	?	?	?	?	?
Yokoyama 2004 [129]	?	?	?	?	?	?	?	?
Zhang 2015 [130]	?	3	?	?	?	?	?	?
Zhang 2008 [131]	?	?	?	?	?	?	?	?
Zhang 2006 [132]	5-10 min	3	15-30* min	?	?	?	?	?

Abbreviations: ADLs = activities of daily living, BFB = biofeedback, ES = electrical stimulation, IAP = intra-abdominal pressure, mins = minutes, MVC = maximal voluntary contraction, PFMT = pelvic floor muscle training, SUI = stress urinary incontinence, UI = urinary incontinence, UUI = urge urinary incontinence.

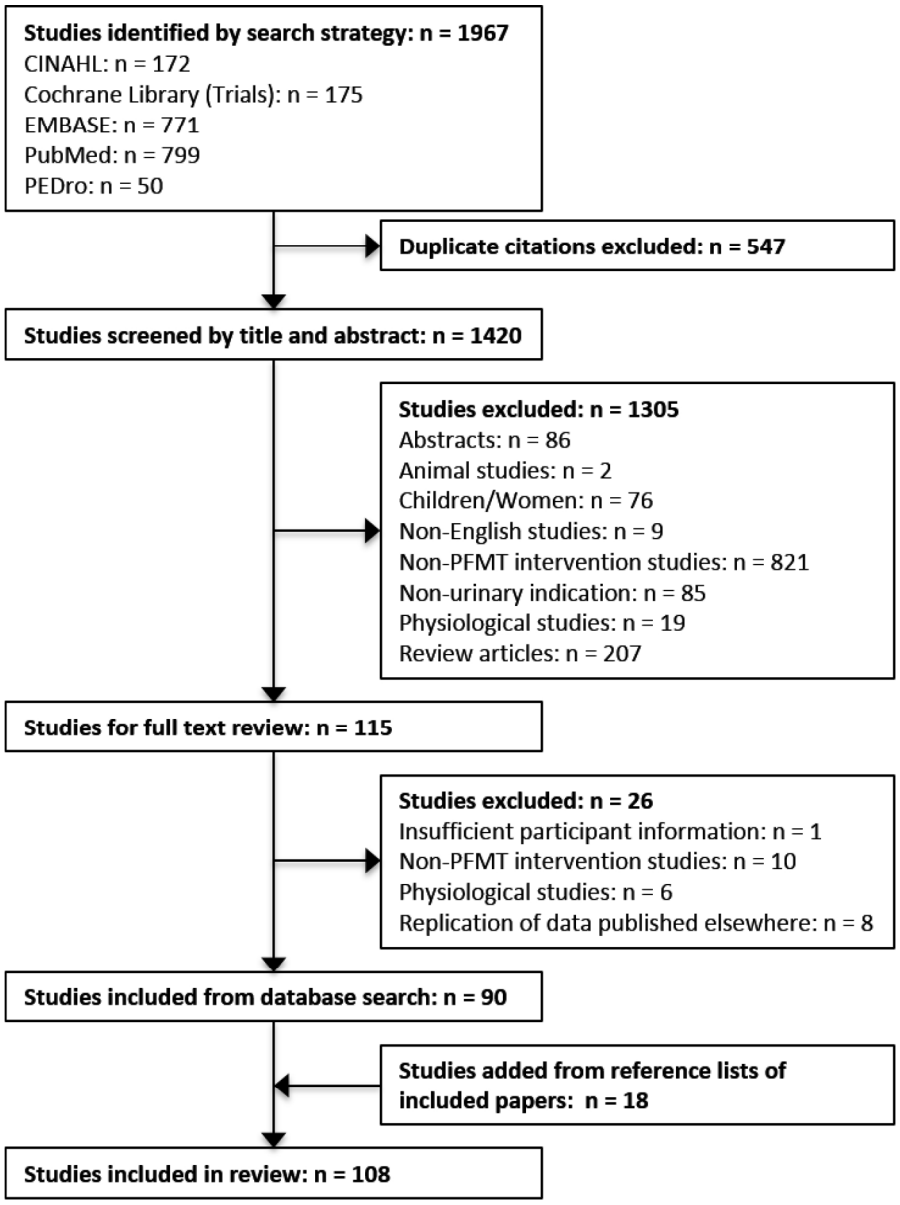

Figure 1. Search flow diagram

123x166mm (300 x 300 DPI)

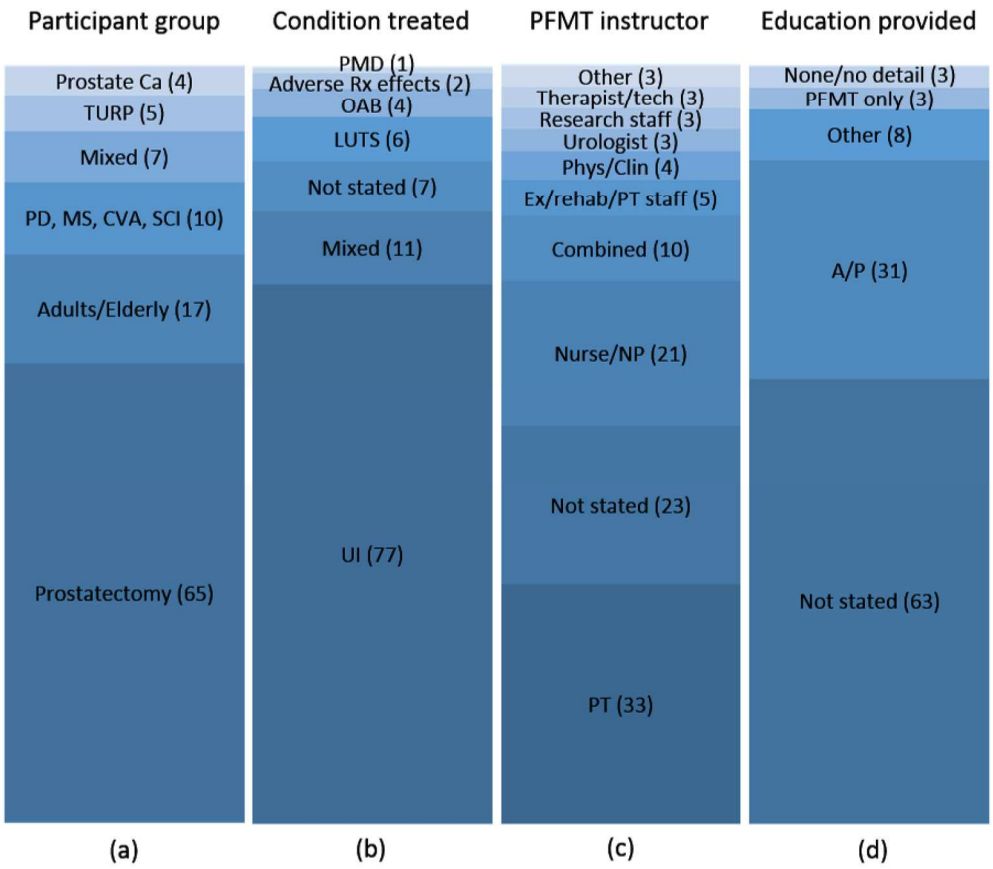

Figure 2. Study and PFMT training session details. (a) Participant group: 'Mixed' = studies with individuals who have undergone different treatments e.g. prostatectomy or TURP or radiotherapy, PD = Parkinson's disease, MS = multiple sclerosis, CVA = cerebrovascular accident, SCI =spinal cord injury, TURP = transurethral resection of the prostate, Prostate Ca = patients who have undergone treatment for prostate cancer (excluding prostatectomy) such as radiotherapy; (b) Condition treated by PFMT: UI= urinary incontinence, LUTS = lower urinary tract symptoms, OAB = overactive bladder, PMD = post micturition dribble; (c) PFMT instructor/supervisor: PT = physiotherapist/physical therapist, NP = nurse practitioner; 'Combined' = PFMT instructed by trainers from different professions, and (d) Education provided: 'Other' includes education on exercise, bladder control, and effect of prostate cancer on health, A/P = anatomy and/or physiology. Number of studies in each category provided in brackets.

153x132mm (300 x 300 DPI)

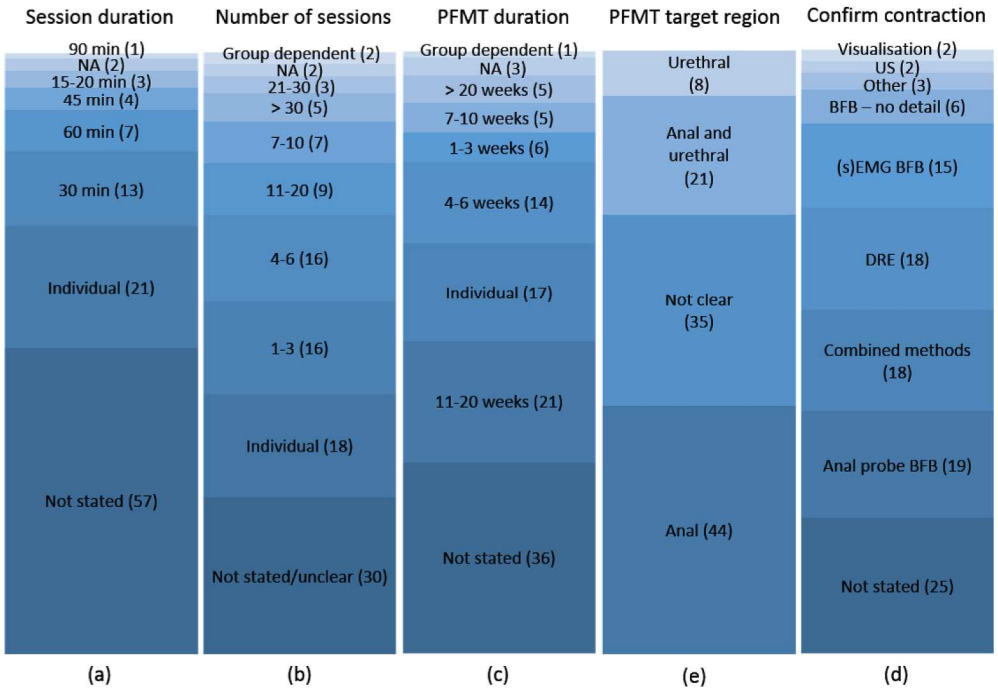

Figure 3. PFMT teaching session details and treatment focus: (a) Duration of sessions: NA = not applicable; (b) Number of sessions per participant; (c) Period over which sessions were conducted; (d) Method for confirmation of the contraction: 'Combined methods' = combinations of biofeedback (BFB), digital rectal examination (DRE), visualisation and ultrasound (US), (s)EMG = (surface)electromyography, 'Other' = methods such as perineal palpation; (e) Region of the pelvic floor targeted by the PFMT intervention. Number of studies in each category provided in brackets.

191x132mm (300 x 300 DPI)

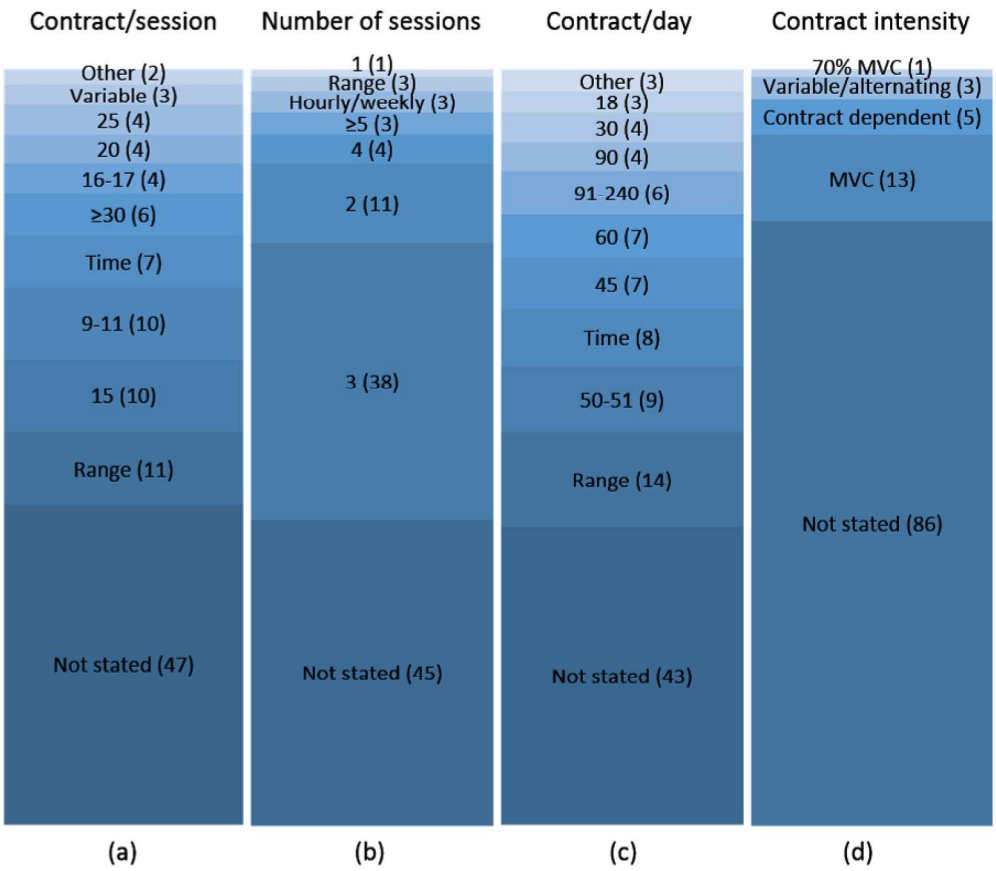

Figure 4. Home exercise protocol contraction details. (a) Number of contractions per session; (b) Number of sessions per day; (c) Number of contractions per day, and (d) Contraction intensity: MVC = maximum voluntary contraction. Number of studies indicated in brackets.

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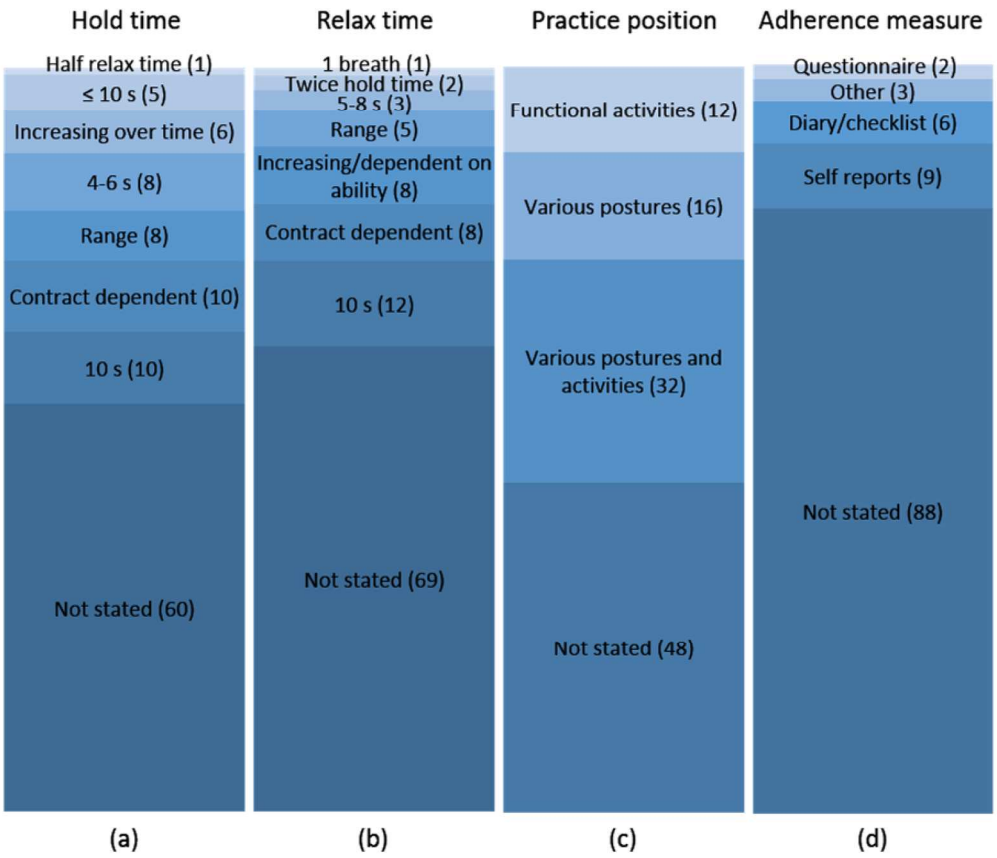

Figure 5. Home exercise protocol posture and adherence details: (a) Contraction hold time; (b) Time between contractions; (c) Positions/activities in which to practice PFM contractions; (d) Method for measurement or encouragement of adherence. Number of studies indicated in brackets.

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