Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women (Review)

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[Intervention Review]

Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

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ABSTRACT

Background

About a third of women have urinary incontinence and up to a tenth have faecal incontinence after childbirth. Pelvic floor muscle training is commonly recommended during pregnancy and after birth both for prevention and treatment of incontinence.

Objectives

To determine the effect of pelvic floor muscle training compared to usual antenatal and postnatal care on incontinence.

Search strategy

We searched the Cochrane Incontinence Group Specialised Register (searched 24 April 2008) and the references of relevant articles.

Selection criteria

Randomised or quasi-randomised trials in pregnant or postnatal women. One arm of the trials needed to include pelvic floor muscle training (PFMT). Another arm was either no pelvic floor muscle training or usual antenatal or postnatal care. The pelvic floor muscle training programmes were divided into either: intensive; or unspecified if training elements were lacking or information was not provided. Reasons for classifying as intensive included one to one instruction, checking for correct contraction, continued supervision of training, or choice of an exercise programme with sufficient exercise dose to strengthen muscle.

Data collection and analysis

Trials were independently assessed for eligibility and methodological quality. Data were extracted then cross checked. Disagreements were resolved by discussion. Data were processed as described in the Cochrane Handbook. Three different populations of women were

considered separately: women dry at randomisation (prevention); women wet at randomisation (treatment); and a population-based approach in women who might be one or the other (prevention or treatment). Trials were further divided into: those which started during pregnancy (antenatal); and after delivery (postnatal).

Main results

Sixteen trials met the inclusion criteria. Fifteen studies involving 6181 women (3040 PFMT, 3141 controls) contributed to the analysis. Based on the trial reports, four trials appeared to be at low risk of bias, two at low to moderate risk, and the remainder at moderate risk of bias.

Pregnant women without prior urinary incontinence who were randomised to intensive antenatal PFMT were less likely than women randomised to no PFMT or usual antenatal care to report urinary incontinence in late pregnancy (about 56% less; RR 0.44, 95% CI 0.30 to 0.65) and up to six months postpartum (about 30% less; RR 0.71, 95% CI 0.52 to 0.97).

Postnatal women with persistent urinary incontinence three months after delivery and who received PFMT were less likely than women who did not receive treatment or received usual postnatal care (about 20% less; RR 0.79, 95% CI 0.70 to 0.90) to report urinary incontinence 12 months after delivery. It seemed that the more intensive the programme the greater the treatment effect. Faecal incontinence was also reduced at 12 months after delivery: women receiving PFMT were about half as likely to report faecal incontinence (RR 0.52, 95% CI 0.31 to 0.87).

Based on the trial data to date, the extent to which population-based approaches to PFMT are effective is less clear (that is, offering advice on PFMT to all pregnant or postpartum women whether they have incontinence symptoms or not). It is possible that population-based approaches might be effective when the intervention is intensive enough.

There was not enough evidence about long-term effects for either urinary or faecal incontinence.

Authors' conclusions

There is some evidence that PFMT in women having their first baby can prevent urinary incontinence in late pregnancy and postpartum. In common with older women with stress incontinence, there is support for the widespread recommendation that PFMT is an appropriate treatment for women with persistent postpartum urinary incontinence. It is possible that the effects of PFMT might be greater with targeted rather than population-based approaches and in certain groups of women (for example primiparous women; women who had bladder neck hypermobility in early pregnancy, a large baby, or a forceps delivery). These and other uncertainties, particularly long-term effectiveness, require further testing.

PLAIN LANGUAGE SUMMARY

Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in pregnant women and women who have recently given birth

About a third of women have urine leakage, and up to a tenth of women leak stool (faeces), after childbirth. Pelvic floor muscle training is commonly recommended during pregnancy and after birth for prevention and treatment of incontinence. This is a programme of exercises that women can do several times a day to strengthen their pelvic floor muscles. They are usually taught by a health professional such as a physiotherapist. The review of trials showed that women who do not leak urine while pregnant can reduce urine leakage for the first six months after childbirth by doing the exercises during and after pregnancy. Exercises can also help women who do leak urine after the birth and they may help them leak less stool. They may be helpful for women who are at higher risk of urine leakage, such as after having a large baby or a forceps delivery. However, there was not enough evidence to say if these effects last after the first year.

BACKGROUND

Accumulating epidemiological evidence suggests that women who have had a baby are at increased risk of developing urinary incontinence. It seems that both pregnancy and delivery are risk factors (Foldspang 1999; Rortveit 2003a; Rortveit 2003b; Viktrup 2006). Similarly, these women seem to be at greater risk of faecal incontinence, particularly those who have had vaginal deliveries (Eason 2002; MacArthur 2001; Pollack 2004; Sultan 1999).

Description of the condition

Urinary incontinence

Urinary incontinence is a common problem amongst adults living in the community. It is more frequent in women and pregnancy or the postnatal period may be the first time many women experience urinary incontinence. Stress (having the symptom of involuntary urine leakage with physical exertion) and urge (symptom of involuntary leakage associated with, or immediately following, a sudden compelling need to void) urinary incontinence are the two most common types of urine leakage in women. Many women have symptoms of both stress and urge urinary incontinence; this is called mixed urinary incontinence. Of these types, stress urinary incontinence is most commonly associated with pregnancy and the postnatal period (Rortveit 2003b; Viktrup 1993; Wilson 1996).

It seems that the prevalence of urinary incontinence increases during pregnancy and decreases following delivery, although postpartum prevalence still remains higher than before pregnancy (Allen 1990; Foldspang 1999; Mason 1999a; Stanton 1980; Thorp 1999; Viktrup 1992; Viktrup 2000). Prevalence estimates of any stress urinary incontinence during pregnancy vary between 6% (Stanton 1980) and 67% (Francis 1960), and from 3% (Viktrup 1993) to 38% (Morkved 1999) two to three months after delivery.

Factors known to be associated with a greater risk of postpartum incontinence include vaginal delivery (in the short term); previous urinary incontinence; and heredity, including anatomical and physiological factors such as pelvic anatomy and connective tissue structure (Beck 1965; Demirci 2001; Farrell 2001; Foldspang 1999; Hvidman 2002; Iosif 1981).

Faecal incontinence

Faecal incontinence is less common than urinary incontinence but is particularly distressing psychologically and physically (Johanson 1996). Women may experience involuntary loss of solid stool, liquid stool, or flatus (wind). Prevalence is very difficult to estimate both because there is no standard definition and because sufferers are reluctant to admit to faecal incontinence.

Estimates of the prevalence of incontinence to stool (faecal incontinence) in primiparous women ranges from 2% to 6% (Eason 2002; Fynes 1999; MacArthur 2001; Meyer 1998; Mørkved 1997); estimates are higher in studies that included involuntary loss of flatus in addition to stool (anal incontinence, 13% to 27%) (Eason 2002; Fynes 1999; Signorello 2000; Sultan 1993). One factor associated with the development of faecal incontinence is obstetric injury, in particular third or fourth degree tear or disruption of the external anal sphincter muscle (Christianson 2003; Fenner 2003; Sultan 1999). Estimates of prevalence of faecal incontinence range from 17% to 62% if there has been severe perineal trauma at delivery, or forceps delivery.

Description of the intervention

Treatment of urinary and faecal incontinence with pelvic floor muscle training (PFMT)

A wide range of treatments has been used in the treatment of urinary and faecal incontinence, including conservative interventions (such as physical therapies, lifestyle interventions, behavioural training, and anti-incontinence devices), pharmaceutical interventions, and surgery. Conservative interventions, such as pelvic floor muscle training (PFMT), are more likely to be used than drugs or surgery while a women is pregnant or in the postnatal period. Some drugs may be contraindicated in pregnancy and while breastfeeding; surgery is not likely until a woman has completed her family (with the exception of surgical repair of anal sphincter rupture which should be diagnosed and repaired immediately after delivery).

PFMT for the treatment of urinary incontinence was popularised by Arnold Kegel (Kegel 1948), although in a review of the literature prior to 1949 Bø identified several records of the use of pelvic floor muscle exercise (Bø 2004). PFMT has principally been recommended in the treatment of stress and mixed urinary incontinence but has increasingly become part of treatment offered to women with urge urinary incontinence. The use of PFMT in the treatment of urinary incontinence is based on two functions of the pelvic floor muscles: support of the pelvic organs, and a contribution to the sphincteric closure mechanism of the urethra. More detail about how PFMT might work to treat urinary incontinence can be found in the background to a previous Cochrane review of PFMT (Hay-Smith 2006).

PFMT has been used in the treatment of faecal incontinence, although there are fewer studies of its effect than for urinary incontinence. Theoretically, the external anal sphincter muscle (which is continuous with the puborectalis muscle component of the pelvic floor muscles) could be trained in a similar way to other pelvic floor muscle and it is not clear whether it is possible for people to tell the difference between a voluntary external anal sphincter contraction and a voluntary pelvic floor muscle contraction (Norton 2006).

Prevention of urinary and faecal incontinence with PFMT

There are three grades of prevention, that is primary, secondary, and tertiary prevention (Hensrud 2000). Primary prevention aims

to remove the causes of a disease. As an example, a trial that compared two obstetric practices (for example liberal versus restrictive episiotomy policies) and the effect on the prevalence of postnatal incontinence amongst previously continent women would be a primary prevention trial. Secondary prevention aims to detect asymptomatic dysfunction and treat it early, to stop progression; a trial that compared a treatment to improve the muscular supports of the bladder with no treatment in postnatal women who had weak pelvic floor muscles but no urinary incontinence symptoms would be classified as a secondary prevention trial. Tertiary prevention is the treatment of existing symptoms to prevent progression of disease.

Clinically it may be difficult to screen all potential trial participants to see if a disease process is either absent altogether or present but asymptomatic. In addition, with a condition such as incontinence there might be more than one factor that could contribute to development of the problem, for example denervation, fascial deficits, and poor muscle function. It is impractical to screen for all possible factors and, in many cases, there are no reliable or valid clinical tests available. Consequently, prevention trials may enrol people purely on the basis of the absence of symptoms. This is commonly the case in incontinence studies and the findings of these studies are probably a combination of primary and secondary prevention effects. This review makes no attempt to distinguish between primary and secondary effects but considers them together.

How the intervention might work

A variety of hypotheses have been suggested for why PFMT might help prevent urinary incontinence. For example, trained muscle might be less prone to injury, and previously trained muscle might be easier to retrain after damage as the appropriate motor patterns are already learned. It may be that previously trained muscle has a greater reserve of strength so that injury to the muscle itself, or its nerve supply, does not cause sufficient loss of muscle function to reach the threshold where reduced urethral pressure results in leakage. During pregnancy, training the pelvic floor muscles might help to counteract the increased intra-abdominal pressure caused by the growing fetus, the hormonally mediated reduction in urethral pressure, and the increased laxity of fascia and ligaments in the pelvic area. A similar rationale might be used to support the use of PFMT to improve the function of the external anal sphincter and thus prevent faecal incontinence.

Essentially, a PFMT programme may be prescribed for women to:

- increase strength (the maximum force generated by a muscle in a single contraction);
- endurance (ability to contract repetitively, or to sustain a single contraction over time);
- coordinate muscle activity (such as the pre-contraction of pelvic floor muscles prior to a rise in intra-abdominal pressure, or to suppress urge);
- or a combination of these.

There is not an absolute dividing line that differentiates strength from endurance type exercise programmes. It is common for both strength and fatigue resistance to improve in response to an exercise programme, although one may be affected more than the other. Characteristic features of strength training include low numbers of repetitions with high loads: one way to increase load is to increase the amount of voluntary effort with each contraction. Endurance training is characterised by high numbers of repetitions or prolonged contractions with low to moderate loads. Training to improve coordination and urge suppression usually involves the repeated use of a voluntary pelvic floor muscle contraction (VPFMC) in response to a specific situation, for example VPFMC prior to cough, or with the sensation of urge.

In many countries it is common for women to receive information about, and encouragement to perform, some pelvic floor muscle exercises during pregnancy and after delivery. Unsurprisingly then the control intervention in many of the included trials was usual antenatal and postnatal care which included advice on some form of PFMT. Therefore, when considering the potential for effect of the experimental intervention (PFMT) it was also important to consider how much difference there might be between the experimental and control conditions, especially where the control condition included some advice on PFMT.

Why it is important to do this review

Existing reviews of PFMT for antenatal and postnatal women

Previously, trials of PFMT for the treatment of urinary incontinence in antenatal and postnatal women (Hay-Smith 2002a) and physical therapies for the prevention of urinary incontinence (Hay-Smith 2002b) were considered in separate Cochrane reviews. There are also two Cochrane reviews of the conservative management of faecal incontinence, although neither focused on studies in antenatal or postnatal women (Hosker 2007; Norton 2006).

We considered that it would be helpful to bring together all the evidence for PFMT related to pregnancy in one review, and at the same time update the evidence previously published in the four different reviews.

This Cochrane review, therefore, aimed to consider together the trials specifically undertaken in antenatal and postnatal women. Given the physiological changes of pregnancy and the postpartum period it is possible that the effect of PFMT might differ in these women. We have made a clear distinction between wholly prevention trials, wholly treatment trials, and the trials in which there was a mix of prevention and treatment (that is, giving PFMT to all antenatal or postnatal women regardless of continence status). Close attention is needed to this distinction between treatment and prevention effects because a number of trials recruited antenatal or postnatal women whether they had symptoms of incontinence or not. Thus, for asymptomatic women the PFMT was a prevention strategy and for symptomatic women it was treatment.

These trials are difficult to classify, not being wholly prevention nor wholly treatment studies.

OBJECTIVES

To determine the effectiveness of PFMT in the prevention and/or treatment of urinary and faecal incontinence in pregnant or postnatal women.

We wished to test the following comparisons.

1. PFMT versus usual antenatal or postnatal care for the (primary or secondary) prevention of incontinence?
2. PFMT versus usual antenatal or postnatal care for the treatment of incontinence?
3. PFMT versus usual antenatal or postnatal care for the prevention and treatment of incontinence (that is, the population approach)?

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials and quasi-randomised studies (allocation by alternation) were included. Other forms of controlled clinical trials were excluded.

Types of participants

Trials that recruited antenatal (that is, pregnant) or postnatal women (that is, women recruited immediately following delivery, or postnatal women recruited because they had persistent urinary or faecal incontinence symptoms following their most recent delivery). Women could have urinary, faecal, or both urinary and faecal incontinence symptoms.

Comparisons were made in three populations of women:

1. prevention trials in women who were continent when randomised;
2. treatment trials in women who were incontinent when randomised;
3. mixed prevention and treatment trials in women some of whom were wet and some dry when randomised.

Types of interventions

One arm of all eligible trials included the use of a PFMT program to improve the function of the pelvic floor muscles or the external anal sphincter, or both. PFMT was defined as a programme of repeated voluntary pelvic floor muscle contractions taught and supervised by a healthcare professional. All types of PFMT programmes were considered, including using variations in purpose and timing of PFMT (for example PFMT for strengthening, PFMT for urge suppression), ways of teaching PFMT, types of contractions (fast or sustained), and number of contractions. In the other arm, or arms, of the trial the women were given usual antenatal and postnatal care, no treatment, or placebo treatments. Usual antenatal or postnatal care in many countries includes advice about PFMT. An a priori decision was made to include studies in which the control group had, or might have, received PFMT advice providing the PFMT arm was more intensive in some way than the control arm. For example, in the PFMT arm women were taught the exercises by a health professional whereas usual care involved distribution on the postnatal wards of a leaflet about PFMT.

Trials in which PFMT was combined with biofeedback, electrical stimulation, or advice on strategies for symptoms of urge and frequency (but without a scheduled voiding regimen characteristic of bladder training), were eligible for inclusion. Trials in which PFMT was combined with another stand alone therapy such as bladder training or drug therapy (for example an anticholinergic) were excluded. Trials of electrical stimulation (without PFMT) were excluded.

Types of outcome measures

With regard to prevention, it seemed that the most appropriate measure of outcome was the self-reported absence of urinary or faecal incontinence symptoms. For treatment, a wider range of outcomes was considered important, although the self-report of cure or improvement in urinary or faecal incontinence symptoms was thought to be most important.

Therefore, the primary outcome of interest was:

1. self-reported urinary or faecal incontinence.

Secondary outcomes of interest were:

2. condition-specific quality of life (for example King's Health Questionnaire, Incontinence Impact Questionnaire) or any other quality of life or health status measure (for example Short Form-36);
3. symptom severity;
4. number of urinary or faecal incontinence episodes;
5. measures of pelvic floor muscle function (for example electromyography, vaginal or anal squeeze pressures);
6. formal economic analysis (for example cost effectiveness, cost utility).

Other outcomes of interest were:

8. treatment adherence;
9. adverse events;
10. delivery outcome (for example type of delivery, perineal trauma) for women who did antenatal PFMT;
11. sexual function;
12. pelvic organ prolapse;
13. any other outcome not pre-specified but judged important when performing the review.

Search methods for identification of studies

This review drew on the search strategy developed for the Cochrane Incontinence Group (Formoredetailspleaseseethe'SpecializedRegister'sectionoftheGroup'smoduleinTheCochraneLibrary). Relevant trials were identified from the Cochrane Incontinence Group Specialised Register, which is also described under the Incontinence Group's details in *The Cochrane Library*. The register contains trials identified from the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, CINAHL, and handsearching of journals and conference proceedings. The trials in the Cochrane Incontinence Group Specialised Register are also contained in CENTRAL. The date of the last search was 24 April 2008.

The terms used to search the Incontinence Group Specialised Register are given below:

({design.cct*} or {design.rct*})

and

({intvent.prevent.pfe*}

or {intvent.prevent.pfmt*} or {intvent.prevent.physicaltherapies} or {topic.urine.incon.prevent.} or {topic.faecal.incon.prevent.} or {topic.urine.incon.postnatal.} or {topic.urine.incon.postobstetric.} or {topic.faecal.incon.postobstetric} or {topic.urine.incon.preg.} or {topic.urine.incon.stress.postnatal.} or {topic.urine.incon.stress.postpartum.} or {intvent.phys.biofeed*} or {intvent.phys.pfe*})

(All searches were of the keyword field of Reference Manager 9.5 N, ISI ResearchSoft).

We also searched for other possible relevant trials in the reference lists of relevant articles.

We did not impose any restrictions on language of publication or publication status (that is full publication, grey literature, etc).

A trial known to one of the review authors (SM) was accepted for publication after the date of the last search. This trial was eligible for inclusion. In addition, one of the review authors (SM) published six-year follow-up data for one of the trials included in the review after the date of the last search. The follow-up data were included as part of the outcomes of the primary trial (Morkved 2003).

Data collection and analysis

Screening for eligibility

Reports of all possibly eligible studies were evaluated for inclusion by two review authors without prior consideration of the results. Any disagreements were resolved by discussion and, where these were not resolved, final responsibility rested with a third person. Studies were excluded from the review if they were not randomised or quasi-randomised controlled trials, or they made comparisons other than those pre-specified. Excluded studies are listed, with reasons for their exclusion, in the table 'Characteristics of excluded studies'.

Assessment of susceptibility of bias

Assessment of susceptibility to bias was undertaken by two review authors. Allocation generation was classified as: random (low risk of bias), method unclear (moderate risk) or not random (high risk). Allocation concealment was: adequate (low risk of bias), unclear (medium risk), or not adequate (high risk). For outcome assessment, quality of blinding was assessed for the primary outcome measure (as defined by the trialists). Where the trialists had not stated the primary outcome measure, assessment of blinding was for the primary outcome measure for this review (number of incontinent women). Blinding was classified as: blind (low risk of bias), unclear if blind (medium risk), not blind or not feasible (high risk). Analysis in the group to which women were assigned (intention to treat) was classified as: done (low risk of bias), unclear (moderate risk of bias) or not done (high risk of bias). Losses to follow up were grouped as follows: below 10% (low risk of bias), 10 to 19.9% (medium risk), or 20% or higher (high risk). Any disagreements were resolved as previously described.

Data extraction

Data extraction was undertaken independently by two review authors and cross checked. Any differences of opinion related to the data extraction were resolved by discussion. Where trial data were possibly collected but not reported, or data were reported in a form that could not be used in the formal comparisons, further clarification was sought from the trialists. In addition, where the reported data were clearly incomplete (usually conference abstracts) trialists were contacted for data from the completed trial. All included trial data were processed as described in the Cochrane Collaboration Handbook for Systematic Reviews of Interventions (Higgins 2005).

Analysis

For categorical outcomes we related the numbers reporting an outcome to the numbers at risk in each group, to derive a relative risk (RR) and its 95% confidence Interval (CI). For continuous variables we used means and standard deviations to derive mean differences. Where possible, data from different studies were pooled using a fixed-effect model.

Some trials measured outcomes at more than one time point, usually in those trials where PFMT began antenatally. There were some differences in the timing of outcome measures but for the meta-analysis timing seemed to fall into the following clinical categories:

- late pregnancy (from 34 weeks up to delivery);
- early postnatal (up to 12 weeks after delivery);
- mid postnatal (12 weeks to 6 months after delivery);
- long-term postnatal (more than 6 months and up to 12 months after delivery).

Where a trial took measures at two time points within a single category (for example at eight and 12 months after delivery) the data from the longer time period were used. If follow-up data

from more than 12 months after delivery were available these were reported in the text.

Subgroup analysis

Subgroup analysis was used to consider the effects of beginning PFMT during pregnancy or after delivery.

Sensitivity analysis

Sensitivity analysis with respect to trial quality was planned as there is some evidence that the quality may have an impact on the findings of a meta-analysis (Moher 1998). There were insufficient trials and too many other potential causes of heterogeneity to make this useful.

Heterogeneity

The extent of heterogeneity was assessed in three ways: visual inspection of data plots, Chi^2 test for heterogeneity, and the I^2 statistic (Higgins 2003). Possible explanations were sought and discussed.

Publication bias

Although planned, formal analysis of publication bias was not possible because there were insufficient trials in any one comparison to make this useful.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.

Included and excluded studies

Twenty-eight potentially eligible studies were found; 12 were excluded for the following reasons.

- Seven studies did not collect any urinary or faecal incontinence outcome data (Agur 2005a; Dougherty 1989; Jonasson 1989; Jonasson 1992; Nielsen 1988; Norton 1990; Thorp 1994).
- Three trials included PFMT as part of an intervention but the actual comparisons were: active versus sham magnetic stimulation (Culligan 2005), and one type of feedback versus another (Fynes 1999; Mahony 2004). Another trial compared abdominal exercise with no abdominal exercise (Gouldthorpe).
- The remaining trial was listed in a trials register but no report of this trial could be found; there was no response to a letter to the principal investigator (Mason 1999b).

Sixteen trials were included.

- Three were primary or secondary prevention trials (that is none of the women had incontinence symptoms at the start of training); all three investigated the effect of beginning PFMT antenatally (Gorbea 2004; Reilly 2002; Stothers 2002). The authors of two mixed prevention or treatment trials (see below, Morkved 2003; Sampselle 1998) kindly provided data for the subgroup of women who did not have incontinence symptoms at the start of training; these two trials, therefore, also contributed data to the prevention comparisons of the review.
- Five were treatment trials (that is all women had incontinence symptoms at the start of training). These investigated the effects of beginning PFMT antenatally (Skelly 2004; Woldringh 2007) and postnatally (Dumoulin 2004; Glazener 2001; Wilson 1998).
- Eight were mixed prevention or treatment trials as some women did, and others did not, have incontinence symptoms at the start of training; these trials investigated the effects of starting PFMT either antenatally (Dannecker 2004; Hughes 2001; Morkved 2003; Sampselle 1998) or postnatally (Chiarelli 2002; Ewings 2005; Meyer 2001; Sleep 1987). The authors of two mixed prevention or treatment trials (Morkved 2003; Sampselle 1998) kindly provided data for the subgroup of women who did not have incontinence symptoms at the start of training. These two trials have, therefore, contributed data to the prevention comparisons of the review.

Seven (Chiarelli 2002; Hughes 2001; Meyer 2001; Morkved 2003; Reilly 2002; Sampselle 1998; Sleep 1987) of the 16 studies were included in the previous version of this review (Hay-Smith 2002a). Only one of the included trials did not report any useable data (Skelly 2004); this trial was reported in a conference abstract. The primary reference for two further trials was a conference abstract (Hughes 2001; Stothers 2002). No further published reports were found for any of these three studies but one trialist kindly provided additional data, from a thesis (Hughes 2001).

Sample characteristics

Parity

All but two (Skelly 2004; Stothers 2002: both conference abstracts) of the studies either reported parity or gravidity, or used this as an inclusion criterion for the trial. Women who were recruited while pregnant were usually nulliparous (Gorbea 2004; Hughes 2001; Meyer 2001; Morkved 2003) or primigravid (Dannecker 2004; Reilly 2002; Sampselle 1998); in all but one of these trials (Meyer 2001) women started PFMT antenatally. Other trials included both nulliparae and multiparae (Chiarelli 2002; Dumoulin 2004; Ewings 2005; Glazener 2001; Sleep 1987; Wilson 1998; Woldringh 2007); in all but one of these trials (Woldringh 2007) women started PFMT postnatally. Parity was comparable between groups at baseline in all of the mixed parity studies.

Age

Age of the participants was described in a number of ways, although one trial did not report on this (Skelly 2004). In one trial, women's age ranged from 24 to 42 years (Stothers 2002), and in two trials about 50% to 60% of the women were aged 20 to 29 years (Chiarelli 2002; Ewings 2005). Median age was about 28 years in two trials (Hughes 2001; Reilly 2002); and somewhat older, at 36 years, in another (Dumoulin 2004). In the remaining nine studies the mean age was in the mid to late 20s for seven (Glazener 2001; Gorbea 2004; Meyer 2001; Morkved 2003; Sampselle 1998; Sleep 1987; Wilson 1998) and early 30s for two (Dannecker 2004; Woldringh 2007). Age was comparable at baseline in the comparison groups in 13 trials; it was not clear if age was comparable in three trials (Meyer 2001; Skelly 2004; Stothers 2002).

Weight

Body weight or body mass index (BMI) was reported by eight of the 16 trials. In the women recruited antenatally, mean or median BMI was in the mid 20s (Hughes 2001; Morkved 2003; Reilly 2002; Woldringh 2007); body weight was 66 kg on average (Gorbea 2004). In the two trials that recruited women on postnatal wards more than 30% of women had a BMI in the overweight or obese range (Chiarelli 2002; Ewings 2005); in the trial that recruited postnatal women who had persistent incontinence symptoms the median BMI (24 kg/m^2) was in the normal range (Dumoulin 2004). BMI or body weight was comparable at baseline in the two comparison groups for all of these trials, although one trial noted that weight gain in pregnancy was significantly greater in the PFMT group (Gorbea 2004).

Type of delivery

Some details on delivery were given by five of the seven trials that began PFMT after delivery. In two trials of these trials all women delivered vaginally (Chiarelli 2002; Sleep 1987): in the former all women had a forceps or ventouse delivery, and in the latter about 18% had an instrumental delivery. The types of delivery appeared comparable across the PFMT and control groups in both trials. In the trials by Glazener et al and Wilson et al some women had a caesarean section (about 8% in the former and 18% in the latter) with the proportion of caesarean sections being similar in both PFMT and control groups for both trials (Glazener 2001; Wilson 1998). Glazener et al also reported that about 14% of women in both the PFMT and control groups had assisted vaginal deliveries. In the remaining small trial it was not clear if all 107 women delivered vaginally but it was reported that 30% of PFMT and 16% of control women had forceps delivery; this difference was not statistically significant (Meyer 2001).

For the trials in which PFMT began antenatally, it was possible that the type of delivery was affected by PFMT. For these trials, type of delivery was a possible confounder of the postnatal incontinence outcome but may itself be an outcome of importance. A short summary of the data is given here in the text; the data are also reported in more detail in Other Data Tables 01.09.01 and 03.09.01. Some details on the type of delivery, by group, were given by only three of the nine trials. In two trials (Dannecker 2004; Morkved 2003) delivery type was similar across both comparison groups but in a third (Gorbea 2004) there seemed to be fewer vaginal deliveries in the PFMT group (16 of 38 women in the PFMT group, 22 of 38 in the control group).

Exclusion criteria

The most common exclusion criterion (in nine trials) was a comorbidity that might have made PFMT difficult or might have altered the outcome of training, such as psychological or neurological conditions. Four trials apiece also excluded women with high-risk pregnancies; twins, or other multiple pregnancies or births; if the baby was stillborn or was very ill or died after birth; or language difficulties meant it was difficult to seek informed consent.

Pelvic floor muscle training regimens and and control interventions (Table 1)

The PFMT and control interventions are described in the table 'Characteristics of included trials' (overview) and in Table 1 (details of exercise parameters).

Table 1. PFMT programmes and adherence

Study ID	VPFMC confirmed?	PFMT parameters	PFMT supervision	Control comparison	Adherence	Notes
Chiarelli 2002	Visual inspection of perineum.	Maximum of 6 VPFMC per set; held 3 to 6 seconds each; 3 sets	PFMT taught one to one with physiotherapist. One (20 minute) contact in hospi-	Routine postnatal care; usual postnatal leaflet given; invitation to join postnatal	292 of 348 PFMT and 189 of 328 controls were performing PFMT at "ade-	

Table 1. PFMT programmes and adherence (*Continued*)

		per day; for 8 weeks.	tal, and another (30 minutes) 8 weeks later at home or hospital.	class on ward; no restriction on PFMT if recommended by other health professional.	quate" level at 3 months postpartum (84% and 58% respectively).	
Dannecker 2004	Not stated.	15 minutes daily; for 3 to 6 weeks.	Not stated.	Not stated.	Not stated.	PFMT with inflatable vaginal balloon in-situ to provide resistance.
Dumoulin 2004	Not stated.	8 to 12 high intensity (close to maximal) VPFMC per set; held for 6 to 8 seconds each with 3 to 4 fast contractions at the end of each contraction; 6 seconds rest between contractions; 3 sets per day; 5 days a week; for 8 weeks. Also 'The Knack' (VPFMC prior to hard cough and maintained through cough until abdominal wall relaxed).	PFMT taught one to one with physiotherapist. Weekly physiotherapy appointments for 8 consecutive weeks.	Same number of physiotherapy contacts for relaxation massage of back and extremities; asked not to do PFMT at home.	Not stated.	In addition to PFMT 15 minutes of electrical stimulation and 25 minutes of electromyographic biofeedback per appointment.
Ewings 2005	Not stated.	6 months.	PFMT taught one to one with physiotherapist in hospital. Invitation to attend PFMT class at	Standard care including verbal promotion of PFMT and leaflet on PFMT.	Of 117 women in PFMT group 114 were visited by the physiotherapist in hospital, 21 attended the 2 month PFMT group, and	

Table 1. PFMT programmes and adherence (*Continued*)

			2 and 4 months postnatally.		5 attended the 4 month group.	
Glazener 2001	Not stated.	8 to 10 sessions of fast and slow VPFMC per day with aim of 80-100 per day; for up to 8 months.	PFMT taught one to one with nurse, health visitor or continence advisor. Visited at home at 5, 7 and 9 months postnatally.	Usual antenatal and postnatal care that may have included advice on PFMT.	218 of 278 PFMT women and 118 of 244 controls had done some PFMT in the 11th postnatal month (78% and 48% respectively). PFMT women were doing a mean of 20 VPFMC per day (SD 29) and controls 5 VPFMC (SD 15) per day at 12 months postnatally.	Frequency and urgency strategies added if needed at 7 or 9 months postnatally.
Gorbea Chavez 2004	Surface electromyography (electrodes either side of anus).	10 VPFMC; held for 8 seconds each followed by 3 fast 1 second contractions; 6 second rest between contractions; for up to 20 weeks.	PFMT taught one to one with physiotherapist. Clinic appointments (one hour each) weekly for 8 weeks, then weekly phone calls.	Requested not to do PFMT during pregnancy or postnatally.	63% attended all 8 physiotherapy appointments, 21% attended 7 appointments.	Electromyographic biofeedback at each appointment. Asked to complete exercise diary.
Hughes 2001	Vaginal digital palpation.	Daily; for up to 11 months.	One individual session with physiotherapist, and one group PFMT session led by physiotherapist between 22 and 25 weeks gestation with maximum of 6 women per group.	Usual antenatal and postnatal care that may have included advice on PFMT (personal communication).	Of 586 women in the PFMT group 461 attended the group PFMT session (79%) (personal communication).	16 of 460 women who attended the group PFMT session could not perform a VPFMC after teaching (3.5%), and 13 could contract but not sustain a contraction (per-

Table 1. PFMT programmes and adherence (*Continued*)

						sonal communication).
Meyer 2001	Not stated.	Up to 8 months.	12 one to one appointments with physiotherapist between 2 and 10 months postnatally.	No intervention.	Not stated.	In addition to PFMT 15 minutes of electrical stimulation and 20 minutes of biofeedback per appointment.
Morkved 2003	Vaginal digital palpation.	8 to 12 near maximal VPFMC; held 6 to 8 seconds each with 3 to 4 fast contractions at the end of each contraction; 6 second rest between contractions; twice daily; for up to 8 months. Also weekly 60 minutes PFMT class for 12 weeks.	12 weekly group contacts with physiotherapist between 20 and 36 weeks gestation.	Usual antenatal and postnatal care that may have included advice on PFMT. Not discouraged from doing PFMT on their own.	28 of 148 PFMT women attended less than half the 12 weekly PFMT classes and did not return training diaries (19%).	During PFMT class VPFMC done in range of body positions (lying, sitting, kneeling and standing with legs apart). PFMT interspersed with abdominal, back and thigh muscle exercise. Asked to complete exercise diary.
Reilly 2002	Not clear, but seems likely as physiotherapists gave individualised programmes to those not able to follow exercise regimen due to inability to do VPFMC.	8 to 12 VPFMC; held for 6 seconds each; 2 minutes rest between each set of 8 to 12 contractions; 3 sets of 8 to 12 contractions twice daily; for about 20 weeks. Also asked to do VPFMC with every cough and sneeze.	About 5 (monthly) contacts with physiotherapist between 20 weeks gestation and delivery.	Usual antenatal and postnatal care that may have included advice on PFMT. Appear to have had same number of clinic visits as PFMT group and appear to have been asked if doing PFMT at each of these visits.	52 of 120 PFMT women did not return an exercise diary (43%); 13 completed less than 28 days of PFMT (11%), and 55 completed 28 days or more (46%). When asked postnatally 33 of 120 PFMT women and 37 of 110 controls were doing occasional or no PFMT (28%	If unable to follow PFMT regimen than individualised programme until able to do so. Asked to complete exercise diary.

Table 1. PFMT programmes and adherence (*Continued*)

					and 34% respectively).	
Sampselle 1998	Yes, but not clear how or who by.	30 maximal or near maximal VPFMC per day; for up to 17 months.	Not stated.	Usual antenatal and postnatal care; no systematic PFMT programme.	At 35 weeks gestation 85% of PFMT women reported to be doing PFMT 75% of the time. At one year PFMT adherence reported to vary between 62 and 90%.	
Skelly 2004	Not stated.	Not stated.	"One to one teaching about pelvic floor exercises"	"Conventional care (hand-out information about pelvic muscle exercises)"	Not stated.	
Sleep 1987	Not stated.	As for controls with additional section in leaflet recommending a specific exercise each week that integrated VPFMC with usual activities of daily living; up to 3 months.	One to one session with midwifery co-ordinator each postnatal day in hospital.	Usual antenatal and postnatal care including PFMT leaflet; might include PFMT at antenatal class and/or postnatal class on ward; instructed to do VPFMC as often as remembered and mid-stream urine stop.	At 10 days postnatally 78% of PFMT and 68% of controls were doing some PFMT, with 58% and 42% respectively doing some PFMT at 3 months.	
Stothers 2002	Not stated.	Not stated.	Seen twice monthly throughout pregnancy, and every 3 months postnatally for one	"other (placebo) including no pelvic floor exercises"	Not stated.	

Table 1. PFMT programmes and adherence (*Continued*)

			year (by physiotherapist?).			
Wilson 1998	Not stated.	Mix of fast and slow VPFMC 8 to 10 times a day with aim of 80 to 100 VPFMC daily; up to 9 months.	One to one sessions with physio- therapist at 3, 4, 6, and 9 months postnatally.	Usual PFMT as taught in antenatal and postnatal classes.	Mean number of daily VPFMC at 12 months postnatally was 86 (95% CI 69-104) in the PFMT group and 35 (95% CI 30 to 40) in the controls.	Perineometry for biofeedback at each appointment.
Woldringh 2007	Observation and palpation of perineal body.	Not stated.	4 one to one half hour sessions with physiotherapist - 3 antenatally and one at 6 weeks postnatally.	Usual antenatal and postnatal care including advice on PFMT; nearly two thirds received some instruction on PFMT. It seems the controls were asked the same questions about frequency and duration of PFMT as the PFMT group.	At 35 weeks gestation 6% reported no PFMT, 17% reported some PFMT, 40% were doing PFMT at low intensity and 37% were exercising intensively in the PFMT group versus 36%, 25%, 26% and 14% respectively in the control group.	

Eight trials gave enough details on the experimental PFMT intervention and the care in the control group to make categorisation of the training possible.

- Four trials selected exercise parameters that seemed to favour strength and effort (load) training (that is, short duration contractions of maximal of near maximal effort and a relatively small number of repetitions) (Dumoulin 2004; Morkved 2003; Reilly 2002; Sampselle 1998). One of these trials (Reilly 2002) stated that the exercise protocol used was that described by Bø (Bo 1995), which is also the pelvic floor muscle strength training protocol on which the trials by Morkved 2003 and Dumoulin 2004 were based. Supervised treatment duration was only eight weeks in the trial by Dumoulin 2004 and this might have been insufficient for muscle hypertrophy to be established. In addition to strength training, Dumoulin 2004and Reilly 2002 included some coordination type training (women were encouraged to perform VPFMC in conjunction with rises in intra-abdominal pressure such as with coughing or sneezing, also known as 'the knack'). The control group in the trial by Mørkved and colleagues were instructed in how to do a correct voluntary pelvic floor muscle contraction (so the measures of pelvic floor muscle function were valid) and received the standard information on PFMT that was part of usual care. In two trials (Reilly 2002; Sampselle 1998) the control condition was usual care that may have included PFMT; Reilly and colleagues reported more than occasional PFMT at three months postpartum in 72% and 66% of the PFMT and control groups, respectively. Dumoulin and colleagues asked their controls not to do any PFMT.

- Two further trials described PFMT programmes that were characteristic of strength training but did not mention loading (effort) (Chiarelli 2002; Gorbea 2004); supervised treatment duration was only eight weeks in the trial by Chiarelli and colleagues and this might have been insufficient for muscle hypertrophy to be established. In the trial by Chiarelli and colleagues the control condition was usual care that may have included PFMT; at three months postpartum 84% and 58% of the PFMT and control groups, respectively, were performing PFMT at 'adequate' levels. Gorbea 2004 asked their controls not to do any PFMT.

- The PFMT programmes of two trials were more difficult to categorise and seemed to have characteristics of training for strength and fatigue resistance (Glazener 2001; Wilson 1998). These programmes included fast and slow contractions, relatively large numbers of sets (8 to 10 per day) with relatively few repetitions per set (about 10) but overall large number contractions per day (80 to 100 per day); there was no description of effort. The programmes might have affected strength or endurance, or both, depending on the number of contractions performed per day and the amount of voluntary effort with each contraction. In both trials the control group received usual care that may have included advice on PFMT. At 12 months postpartum (the primary endpoint in both trials), the mean number of VPFMC per day in PFMT and control groups was 20 (SD 29) versus 5 (SD 15) (Glazener 2001), and 86 (95% CI 69 to 104) versus 35 (95% CI 30 to 40), respectively.

The remaining eight trials did not report sufficient detail on the PFMT intervention or care in the control groups to be sure that the training programme had the potential to improve muscle function (Dannecker 2004; Ewings 2005; Hughes 2001; Meyer 2001; Skelly 2004; Sleep 1987; Stothers 2002; Woldringh 2007).

- In the trials by Sleep and Grant (Sleep 1987) and Woldringh and colleagues (Woldringh 2007), the control groups received usual advice about PFMT and about half (or more) of the women in the experimental and control groups were doing PFMT. In both trials a greater proportion of women in the experimental group were doing some PFMT (58% PFMT versus 42% controls at three months postpartum (Sleep 1987), and 94% PFMT versus 65% at 35 weeks gestation (Woldringh 2007)).

- In three trials (Ewings 2005; Hughes 2001; Skelly 2004) the control groups also got usual advice about PFMT but it was not clear how many of these women actually exercised; so it was difficult to tell how much difference there might have been between the groups with regard to PFMT.

- Two trials reported that the controls had no PFMT (Meyer 2001; Stothers 2002) although they did not provide any details on the PFMT intervention given in the PFMT arm.

- Finally, Dannecker 2004 gave no details on the control group.

The impact of not knowing whether there was any real clinical difference between experimental and control conditions in these eight trials is considered in the discussion.

Outcome measures

Nine of the 16 trials clearly stated the primary outcome(s) of interest in the trial:

- in six it was self-reported incontinence (Chiarelli 2002; Ewings 2005; Glazener 2001; Gorbea 2004; Morkved 2003; Reilly 2002);
- in two this was a pad or stress test with a standardised bladder volume (Dumoulin 2004; Stothers 2002);
- one trial combined data from a urinary diary and questionnaire to give an incontinence severity score (Woldringh 2007).

While there was some consistency in the choice of outcome measures by trialists the differences in the measures or the way the data were reported limited the possibilities for combining results from individual trials. Only one of the trials, reported as a conference abstract, did not contribute any data to the analyses (Skelly 2004). Only three trials reported long-term results after the first year (Glazener 2001; Morkved 2003; Reilly 2002).

Risk of bias in included studies

Due to brevity of reporting it was difficult to assess the three trials that were published as conference abstracts (Hughes 2001; Skelly 2004; Stothers 2002); and one of these abstracts did not report sample size (Skelly 2004). One trial was small with fewer than 25 women per comparison group (Dumoulin 2004) and three were of moderate size with between 25 and 50 women per group (Gorbea 2004; Sampselle 1998; Stothers 2002). Nine trials allocated more than 50 women per group (Chiarelli 2002; Dannecker 2004; Ewings 2005; Glazener 2001; Hughes 2001; Meyer 2001; Morkved 2003; Reilly 2002; Woldringh 2007); four of these were large (that is, more than 300 women per comparison group) (Chiarelli 2002; Glazener 2001) or very large (more than 500 per group) trials (Hughes 2001; Sleep 1987). Wilson and colleagues randomised just over 100 women to the control and individual treatment groups, with the individual treatment group being further randomised into three groups: PFMT only, PFMT with vaginal cones, vaginal cones only (Wilson 1998).

Nine of the 16 trials reported an a priori power calculation (Chiarelli 2002; Dumoulin 2004; Glazener 2001; Gorbea 2004; Meyer 2001; Morkved 2003; Reilly 2002; Sleep 1987; Woldringh 2007). One of the trials without a power calculation was reported as a pilot trial (Ewings 2005).

Random allocation generation and random allocation concealment

Six trials gave enough details on random allocation generation and concealment for us to be reasonably sure that the trials had a low risk of bias (Chiarelli 2002; Ewings 2005; Glazener 2001; Morkved 2003; Sampselle 1998; Wilson 1998). One trial reported adequate allocation concealment although the method of allocation generation was not clear (Gorbea 2004); three reported random allocation generation but it was not clear if allocation was adequately concealed (Dumoulin 2004; Hughes 2001; Reilly 2002). The remaining six trials stated only that women were allocated at random (Dannecker 2004; Meyer 2001; Skelly 2004; Sleep 1987; Stothers 2002; Woldringh 2007). The seven trials with adequate random allocation concealment were considered to be at low risk of selection bias (Chiarelli 2002; Ewings 2005; Glazener 2001; Gorbea 2004; Morkved 2003; Sampselle 1998; Wilson 1998) with all the other trials having a moderate risk.

Blinding of participants, therapists and outcome assessment

It was not considered feasible, in any of the included trials, to blind the treatment provider or participants to group allocation and so all 16 trials were at high risk of performance bias; the difficulty of blinding exercise-based interventions is a common problem. However, blinded outcome assessment should be possible. Eight trials reported blinded outcome assessment of the primary outcome measure of the trial (for example a pad test) or reported that an anonymised or blinded method of collecting patient-reported incontinence symptom data was used (Chiarelli 2002; Dannecker 2004; Dumoulin 2004; Glazener 2001; Morkved 2003; Reilly 2002; Sampselle 1998; Stothers 2002). These eight trials were considered to be at low risk of bias, with the remaining trials at moderate risk.

Reporting of dropout and withdrawal, and analysis by intention to treat

Some trials assessed outcomes and reported losses to follow up at more than one time point; assessment of susceptibility to bias was made at the primary endpoint for each trial. In three trials (Meyer 2001; Skelly 2004; Stothers 2002), where two of these were conference abstracts (Skelly 2004; Stothers 2002), losses to follow up and analysis by intention to treat were not reported.

Eleven trials stated that analysis was carried out on the basis of group assignment (Chiarelli 2002; Dannecker 2004; Ewings 2005; Glazener 2001; Hughes 2001; Morkved 2003; Reilly 2002; Sampselle 1998; Sleep 1987; Wilson 1998; Woldringh 2007). There were no large differences in the proportion of dropouts between the two comparison groups in any of the trials, but the overall proportion of losses to follow up ranged from 4% to 38%. The proportion of participants lost to follow up increased with the time between recruitment and assessment of the primary endpoint. Dropout rates were 4% (Gorbea 2004) and 3% (Dumoulin 2004) at six and nine weeks postpartum, and ranged from 4% (Morkved 2003) through to 6% (Chiarelli 2002), 11% (Sleep 1987) and 14% (Reilly 2002) at three months postpartum. By six to seven months postpartum, dropout rates ranged from 19% (Ewings 2005) to 24% (Dannecker 2004) and 34% (Hughes 2001). At 12 months, dropout rates were 30% or more, being: 30% (Glazener 2001), 36% (Sampselle 1998), 37% (Wilson 1998), and 38% (Woldringh 2007).

As there were not large differences in the proportion of dropouts between comparison groups in any of the trials the 11 trials that stated analysis was carried out the basis of intention to treat were considered to be at least risk of attrition bias (Chiarelli 2002; Dannecker 2004; Ewings 2005; Glazener 2001; Hughes 2001; Morkved 2003; Reilly 2002; Sampselle 1998; Sleep 1987; Wilson 1998; Woldringh 2007). However, the power to detect difference in the primary outcome at the primary endpoint may well have been compromised by the high proportions of dropouts in some of these 11 trials.

Effects of interventions

One of the 16 trials did not contribute data for analysis (Skelly 2004). The other 15 trials compared PFMT (3040 women) with usual care or no PFMT (3141 women) for antenatal and postnatal women. There were some data available to explore the hypothesis that PFMT is better than usual antenatal and postnatal care, or no treatment, for the prevention and treatment of urinary and faecal incontinence. The primary analysis investigated the prevalence of urinary and faecal incontinence. Data for outcomes of secondary interest (in 'Other data tables') are only briefly discussed to give an indication of whether the findings were broadly consistent with the usable data, or not.

The 15 trials contributing to the analysis were categorised as:

- primary or secondary prevention trials, in which women had no incontinence symptoms;
- treatment trials, in which all women had incontinence symptoms when they began PFMT;
- mixed prevention and treatment trials, in which some women did and some women did not have incontinence symptoms when they began PFMT.

Within each of the three categories, the trials were subgrouped according to whether PFMT began before delivery (antenatal), or after delivery (postnatal).

Comparison 1: Prevention of incontinence (Analysis 1)

Five trials contributed to this comparison (Gorbea 2004; Morkved 2003; Reilly 2002; Sampselle 1998; Stothers 2002). Four of the trials recruited nulliparous (Gorbea 2004; Morkved 2003) or primiparous women (Reilly 2002; Sampselle 1998) during pregnancy, and the other recruited "pregnant women" (Stothers 2002).

In all five trials PFMT began during pregnancy, while controls were asked not to do PFMT (Gorbea 2004; Stothers 2002) or received usual care that might have included information on PFMT (Morkved 2003; Reilly 2002; Sampselle 1998). All the women were continent at the time of randomisation.

Two of these trials were mixed prevention and treatment trials, but published or unpublished data were available for women who were continent at recruitment (Morkved 2003; Sampselle 1998). In one trial (Sampselle 1998) 54 of 72 women were continent based on a standing stress test at 20 weeks gestation. After dropouts, unpublished data were available from 37 previously continent women (16 PFMT and 21 controls). Another trial (Morkved 2003) published data for 207 of 301 women who were continent before pregnancy and at 20 weeks gestation. After dropouts, data were available from 193 previously continent women (94 PFMT and 99 controls). Neither trial was powered to find differences in the previously continent subgroup; the subgroup sizes were small.

Primary outcome measure *: self-reported urinary or faecal incontinence (*Analysis 1.1 to Analysis 1.5)

- In late pregnancy, PFMT women were 56% less likely to report urinary incontinence than controls (RR 0.44, 95% CI 0.30 to 0.65) (Analysis 1.1).

Statistically significant heterogeneity was observed in this comparison. While the point estimates in all three trials favoured PFMT, these differed considerably between the trials (RR 0.86, 0.46, and 0.03 in the trials by Sampselle 1998, Morkved 2003, and Gorbea 2004, respectively). There were two possible reasons why the difference between PFMT women and controls was more pronounced in the trial by Gorbea 2004. Firstly, the comparison group was asked not to do PFMT, whereas in the other two trials in this comparison the controls had usual care that might have included PFMT. Secondly, none of the women in the PFMT group in the trial by Gorbea 2004 reported urinary incontinence in late pregnancy; it is not clear how stable the point estimate and CI was when there were no events in one of the two comparison groups.

- PFMT women were about 50% less likely to report urinary incontinence, compared to controls, in the early postpartum period (RR 0.50, 95% CI 0.31 to 0.80) (Analysis 1.2).

- PFMT women were still significantly less likely than controls to have urinary incontinence at between three and six months postpartum, although the difference in risk had reduced to 30% (RR 0.71, 95% CI 0.52 to 0.97) (Analysis 1.3). The pooled estimate favoured PFMT, but only the trial by Reilly and colleagues was statistically significant, in favour of PFMT.

In two of the four trials in this comparison, the data were from a subgroup of previously continent women (Morkved 2003; Sampselle 1998); the trials were not powered to find a difference in the subgroup of continent women. When considering the difference in outcome between the two groups in the trial by Reilly 2002, it is interesting to note that all the women were potentially at increased risk of postpartum urinary incontinence as they had bladder neck hypermobility at 18 weeks gestation. At three months postpartum, 72% of PFMT women and 66% of controls were doing more than occasional PFMT. At four-year follow up, Reilly 2002 reported that 7/42 (17%) PFMT women and 26/58 (45%) controls had symptoms of stress incontinence.

- There were too few participants (n=44) in one trial (Sampselle 1998) to identify whether or not there was a difference in prevalence of urinary incontinence between PFMT women and controls at 12 months postpartum (Analysis 1.4).

Four years after the index delivery, Reilly and colleagues found that about 17% of the PFMT group reported urinary incontinence versus 45% of women in the usual care group. This apparent advantage for the PFMT group needs to be viewed with caution as less than half of the original sample were followed up.

None of the five trials reported data on the prevalence of postpartum faecal incontinence.

Secondary outcome measures *: condition-specific quality of life (* Analysis 1.6*), symptom severity (*Analysis 1.7*), pelvic floor muscle function (*Analysis 1.8*), and adverse effects*

Only one trial (Reilly 2002) collected condition-specific quality of life data (King's Health Questionnaire, which is for urinary not faecal incontinence) but the data were not reported (Analysis 1.6). In their trial report Reilly and colleagues stated that there was "no difference between the trial groups on any of the eight scales". However, the PFMT group scored significantly higher on the SF36 general health domain (Analysis 1.6).

Four of the five trials reported some data on symptom severity, such as frequency or amount of urine leakage (Analysis 1.7). None of the measures, or the ways of reporting these, were common to the four trials. Some of the data suggested that PFMT women with symptoms of urinary incontinence might have had less severe symptoms than women in the control groups but this was not a consistent or clear-cut finding.

Pelvic floor muscle function was measured in two trials: using electromyography (Gorbea 2004), and vaginal squeeze pressure (Reilly 2002). The lack of explanation of the type of electromyography and unusual presentation of the data in the former trial (Gorbea 2004) made it difficult to interpret. In the latter trial (Reilly 2002), mean vaginal squeeze pressure was not statistically significantly greater in the PFMT group than the control group.

Adverse effects

Only one trial noted any adverse events: two of 43 PFMT women withdrew due to pelvic floor pain (Stothers 2002).

Other outcomes *: treatment adherence (*Table 1*), delivery outcome (*Analysis 1.9*), any other outcome not pre-specified but of interest*

Two trials (Gorbea 2004; Reilly 2002) reported some data related to treatment adherence (Table 1). Gorbea 2004 reported that 84% of PFMT women attended seven or all of the eight physiotherapy appointments offered. In the trial by Reilly 2002, nearly half the women in the PFMT group exercised for 28 days or more. Postnatally, similar proportions of women in the intervention and control groups were doing only occasional or no PFMT (28% and 34%, respectively).

Delivery outcome was reported by one trial (Gorbea 2004): fewer PFMT women had vaginal births compared with women in the control group; and vice versa for caesarean section (RR for caesarean section 1.83, 95% CI 1.07 to 3.15) (Analysis 1.9).

Reilly 2002 recruited women with increased bladder neck mobility (determined using ultrasound) at 18 weeks gestation. At three months postpartum the mean change in bladder neck mobility was -0.16 mm (SD 0.44, n=84) in PFMT women and -0.08 mm (SD 0.48, n=82) in control women. This was not statistically significantly different.

Comparison 2: Treatment of incontinence (Analysis 2)

Four trials contributed to this comparison (Dumoulin 2004; Glazener 2001; Wilson 1998; Woldringh 2007). All four trials recruited a mix of primiparous and multiparous women.

Antenatal trial *:* one trial began supervised PFMT during pregnancy in women with antenatal incontinence (Woldringh 2007); the controls received usual care.

Postnatal trials : in the other three trials, supervised PFMT began at three or more months postpartum as treatment for women with persistent urinary incontinence symptoms after delivery (Dumoulin 2004; Glazener 2001; Wilson 1998); the controls received usual care (Glazener 2001; Wilson 1998) or were asked not to do PFMT (Dumoulin 2004).

Primary outcome measure *: self-reported urinary or faecal incontinence (*Analysis 2.1 to Analysis 2.5*)*

- Antenatal PFMT: one trial (Woldringh 2007) was too small to identify a significant difference in the prevalence of urinary incontinence between PFMT and control groups at any of the four time points (late pregnancy, early, mid or late postpartum).

- Postnatal PFMT: in three trials (Dumoulin 2004; Glazener 2001; Wilson 1998), PFMT women were about 20% less likely to have urinary incontinence after treatment compared to controls at 12 months (RR 0.79, 95% CI 0.70 to 0.90) (Analysis 2.4.2).

Dumoulin 2004 reported this outcome at nine weeks after the intervention began. Women were recruited at varying lengths of time following delivery (all more than three months postpartum) so it was difficult to determine whether the data should be presented as mid- or long-term postnatal data. It was decided to present the data alongside that from Glazener 2001 and Wilson 1998, in the long-term category, although the treatment effect in the trial by Dumoulin 2004 was much greater than that in the other two trials.

Statistically significant heterogeneity was observed in these data but the effect persisted even if a random-effects model was chosen, albeit with wide confidence intervals (RR 0.71, 95% CI 0.52 to 0.97). There were two clear clinical differences begtween trials. One difference was that the controls in the trial by Dumoulin 2004 were asked not to do PFMT, whereas controls in the other two trials received usual care and both intervention and control groups were doing PFMT (a mean of 20 versus 5 pelvic floor muscle contractions per day in the PFMT and control groups, respectively (Glazener 2001); and 86 versus 35 in Wilson 1998). The other difference was in the PFMT intervention. Dumoulin 2004 used a strengthening PFMT programme with adjunctive electrical stimulation and biofeedback involving physiotherapy appointments once a week for eight weeks, whereas in the other two trials (Glazener 2001; Wilson 1998) the PFMT intervention was not clearly targeted at either strength or endurance and the women had three or four appointment with health professionals over approximately six months.

- Two trials (Glazener 2001; Wilson 1998) reported data on the prevalence of faecal incontinence 12 months after delivery: PFMT women were about half as likely to report faecal incontinence (RR 0.52, 95% CI 0.31 to 0.87) (Analysis 2.5).

Secondary outcome measures *: condition-specific quality of life (* Analysis 2.6*), symptom severity (*Analysis 2.7*), pelvic floor muscle function (*Analysis 2.8*)*

Urinary incontinence condition-specific quality of life was measured using the Incontinence Impact Questionnaire (IIQ) (Dumoulin 2004; Woldringh 2007) or Urogenital Distress Inventory (UDI) (Dumoulin 2004). Woldringh and colleagues categorised IIQ scores, which meant that it was not possible to interpret these data. Dumoulin and co-workers found more change (an improvement) in the IIQ and UDI scores for women given PFMT than control women.

All four treatment trials reported some data on symptom severity, such as frequency or amount of urine leakage. None of the measures, or the ways of reporting these, were common to the four trials. The data suggested that PFMT women with symptoms of urinary incontinence might have had less severe symptoms than controls but this was not a consistent or clear-cut finding.

Pelvic floor muscle function was measured using a dynamometer and vaginal squeeze pressure: while the dynamometer findings

favoured the PFMT group (Dumoulin 2004), the vaginal squeeze pressure readings did not (Wilson 1998).

Adverse effects

Dumoulin et al stated that none of the women in the PFMT group reported any adverse events (with PFMT or electrical stimulation).

Other outcomes *: treatment adherence (Table 1), economic analysis, any other outcome not pre-specified but of interest*

Three trials reported some data related to treatment adherence. In one antenatal training trial (Woldringh 2007) 37% of the PFMT women were exercising intensively, compared to 14% of controls, at 36 weeks gestation. Women in two postnatal trials (Glazener 2001; Wilson 1998) were reported as performing significantly more voluntary pelvic floor muscle contractions per day at 12 months postpartum in the PFMT groups. The mean number of contractions was 20 (SD 29) and 86 (95% CI 69 to 104) per day in PFMT women, and 5 (SD 15) and 35 (95% CI 30 to 40) per day in control women, respectively.

Wilson 1998 noted that the average time to teach PFMT to the intervention group was 32 minutes (95% CI 30 to 34) but no further economic analysis was reported.

Glazener 2001 followed up women six years after the index delivery. At six years there were no significant differences between the groups: 100/263 (38%) of the intervention group, and 99/253 (39%) of controls experienced urinary incontinence at least once per week; the numbers experiencing faecal incontinence (to stool) were 32/261 (12%) and 32/248 (13%), respectively. Similar proportions of women in both groups were doing some PFMT: 132/263 (50%) and 127/253 (50%) in the intervention and control groups, respectively. There were no statistically significant differences between the groups for any of these long-term outcomes.

Comparison 3: Mixed prevention and treatment of incontinence (Analysis 3)

Eight trials contributed to this comparison (Chiarelli 2002; Dannecker 2004; Ewings 2005; Hughes 2001; Meyer 2001; Morkved 2003; Sampselle 1998; Sleep 1987).

Antenatal trials : four trials recruited nulliparous or primiparous women and randomised the women to supervised antenatal PFMT or usual care, which might have included information on PFMT (Dannecker 2004; Hughes 2001; Morkved 2003; Sampselle 1998).

Postnatal trials : the other four trials recruited either nulliparous women during pregnancy (Meyer 2001) or postnatal women of mixed parity (Chiarelli 2002; Ewings 2005; Sleep 1987) and randomised the women to postnatal PFMT versus usual care (Chiarelli 2002; Ewings 2005; Sleep 1987) or versus no PFMT (Meyer 2001).

Primary outcome measure *: self-reported urinary or faecal incontinence (Analysis 3.1 to Analysis 3.5)*

- Women who were randomised to antenatal PFMT had about 10% less risk of urinary incontinence in late pregnancy (RR 0.88, 95% CI 0.81 to 0.96) (Analysis 3.1).

  The women were nulliparous (Hughes 2001; Morkved 2003) or primiparous (Sampselle 1998).

Statistically significant heterogeneity was observed in this comparison and the difference between the groups was not significant when a random-effects model was used (RR 0.82, 95% CI 0.66 to 1.02). While the point estimates in all three trials favoured PFMT, these differed considerably between the trials (RR of 0.67, 0.81, and 0.93 in the trials by Morkved 2003, Sampselle 1998, and Hughes 2001, respectively). The last trial (Hughes 2001) carried considerable weight in the pooled analysis, most likely because it was a much larger trial. One of the differences between the trial by Morkved 2003 and the other two trials in this comparison was the intensity of supervision or number of health professional contacts. Women in the trial by Morkved 2003 had 12 (one in a week) contacts with a physiotherapist (in a group setting) between 20 and 36 weeks of pregnancy whereas women in the trial by Hughes 2001 had two (one individual, one group) contacts with a physiotherapist during pregnancy; the women in the trial by Sampselle 1998 had an unknown number of contacts (possibly five) with a health professional over about 16 months.

There was no statistically significant difference in the prevalence of urinary incontinence between antenatal PFMT and control groups in:

- the early postnatal period (RR 0.82, 95% CI 0.48 to 1.40) (Analysis 3.2);
- the mid postnatal period (RR 0.89, 95% CI 0.78 to 1.02) (Analysis 3.3.1); or
- the late postnatal period (RR 0.96, 95% CI 0.70 to 1.32) (Analysis 3.4).

Although not evident when the data were combined, it was noted that the statistically significant difference in favour of supervised PFMT observed by Morkved 2003 in late pregnancy persisted at three months postpartum but was no longer apparent six years later (22/94 (23%) had urinary incontinence in the PFMT group versus 16/94 (17%) in the control group).

There was no statistically significant difference in the prevalence of urinary incontinence in women randomised to postnatal PFMT or control in:

- the mid postnatal period, to 6 months (RR 0.97, 95% CI 0.85 to 1.09) (Analysis 3.3.2); or
- the late postpartum period, to 12 months (RR 0.94, 95% CI 0.75 to 1.16) (Analysis 3.4.2).

Statistically significant heterogeneity was observed in the combined data for the mid postnatal period, with one trial in favour of PFMT (Chiarelli 2002); one that did not favour PFMT or control (Sleep 1987); and one that favoured the control group, but not significantly (Ewings 2005). There were two clinical differences between the trial by Chiarelli 2002 and the trials of Sleep 1987 and Ewings 2005. The first notable difference was that Chiarelli 2002 recruited women who were at potentially increased risk of

postnatal incontinence, such as those who had a large baby or a forceps delivery. The second was that Chiarelli 2002 recommended a strength training programme; neither of the other two trials described their PFMT programme so it was not clear if these could have been effective or how different the PFMT and control conditions were. Sleep 1987 found only a moderate difference between group, according to PFMT and control group allocation, in the proportion of women doing some PFMT at three months postpartum (58% and 42%, respectively). Interestingly, Chiarelli 2002 also found about half the controls were doing PFMT (58%), although an even greater proportion of the PFMT group (84%) were exercising at an 'adequate' level three months postpartum.

Three trials reported the prevalence of postnatal faecal incontinence (Dannecker 2004; Meyer 2001; Sleep 1987). There was no evidence of a statistically significant difference between PFMT and control groups (Analysis 3.5). Neither was there enough detail of the PFMT programs to be sure they had the potential to improve pelvic floor muscle function.

Secondary outcome measures *: condition-specific quality of life (Analysis 3.6), symptom severity (Analysis 3.7), pelvic floor muscle function (Analysis 3.8), adverse effects.*

Urinary incontinence condition-specific quality of life was measured using the Bristol Lower Urinary Tract Symptoms questionnaire in one trial but the overall score was not reported (Hughes 2001). Three trials reported some data on symptom severity, such as frequency or amount of urine leakage. None of the data suggested that PFMT was superior to control, or vice versa, at the primary endpoint of either three months postpartum (Hughes 2001; Sleep 1987) or 12 months postpartum (Sampselle 1998). Pelvic floor muscle function was measured using digital palpation (Dannecker 2004) and vaginal squeeze pressure (Meyer 2001; Morkved 2003). In keeping with the findings of Morkved 2003 as detailed above, the pelvic floor muscle function measure also favoured the PFMT group in that trial. PFM function data from the other two trials was inconclusive.

Adverse effects

None of the trials reported on whether or not there were any adverse effects.

Other outcomes *: treatment adherence (Table 1), delivery outcome (Analysis 3.9), sexual function, any other outcome not pre-specified but of interest*

Three antenatal PFMT trials (Hughes 2001; Morkved 2003; Sampselle 1998) and three postnatal PFMT trials (Chiarelli 2002; Ewings 2005; Sleep 1987) reported some data related to treatment adherence (Table 1).

In the antenatal PFMT trials, Hughes et al (personal communication) observed that 79% of women assigned to PFMT attended the group training session; and Morkved 2003 noted that 81% of women assigned to PFMT attended half or more of the weekly classes and followed the home training protocol. Sampselle 1998 reported that, at 35 weeks gestation, 85% of PFMT women were doing their PFMT 75% of the time.

In the postnatal PFMT trials, at three-months postpartum, Chiarelli 2002 reported that 84% of PFMT women and 58% of controls were doing 'adequate' levels of PFMT; and in Sleep 1987 58% of PFMT women and 42% of controls were doing some PFMT. In the trial by Ewings 2005 97% of women were visited on the postnatal wards by the physiotherapist but only 18% and 4% attended the follow up groups at two and four months postpartum, respectively.

Two trials reported on the delivery outcome (Analysis 3.9); for one trial this was the primary outcome of the trial (Dannecker 2004) while in the other it was a secondary outcome (Morkved 2003). Delivery data from Dannecker 2004 did not favour either the intervention or control group. Morkved 2003 did not find any statistically significant difference in the type of delivery, although women in the supervised antenatal PFMT group had a statistically significantly shorter second stage of labour. It is worth noting, however, that fetal head circumference was also statistically significantly smaller in the PFMT group.

One of the antenatal PFMT trials (Morkved 2003) and two of the postnatal PFMT trials (Meyer 2001; Sleep 1987) measured some aspect of sexual function. At six-year follow up, Morkved 2003 found that 34/94 (36%) of the PFMT women reported improved sexual satisfaction after delivery compared to 17/94 (18%) of the control group. Meyer 2001 noted that 5/51 (10%) PFMT and 13/56 (23%) of the control group reported a diminished vaginal sexual response at 10 months postpartum. Sleep 1987 found that 714/819 (87%) of PFMT women and 681/792 (86%) of the control group had attempted sexual intercourse within three months of delivery; 167 (20%) and 154 (19%) respectively reported that sexual intercourse was still painful at three months postpartum.

DISCUSSION

This review considers whether PFMT (as defined by the trialists) is better than usual antenatal or postnatal care for the prevention and treatment of urinary and faecal incontinence in childbearing women. Another Cochrane systematic review addresses a similar question (whether PFMT is better than no treatment, placebo, or inactive control treatments) in women with urinary incontinence. That review specifically excluded trials that recruited antenatal or postnatal women (Hay-Smith 2006).

Summary of main results

Is PFMT better than usual antenatal or postnatal care for the prevention and treatment of urinary and faecal incontinence?

There are three potential approaches to delivery of PFMT interventions in the antenatal and postnatal period. The first is to provide PFMT programmes for women who already have incontinence symptoms (that is, give treatment); the second is to identify groups of women who are most at risk of developing antenatal or postnatal incontinence and provide PFMT before they are symptomatic (that is, primary or secondary prevention); and the third is to provide PFMT to all ante- and postnatal women (regardless of whether they are symptomatic or not, or at risk or not). The latter approach is a population approach employed in public health programmes such as sun protection or healthy eating. Accordingly, there were three comparisons in the review.

1. PFMT versus usual antenatal or postnatal care for the (primary or secondary) prevention of incontinence
2. PFMT versus than usual antenatal or postnatal care for the treatment of incontinence
3. PFMT versus usual antenatal or postnatal care for the prevention and treatment of incontinence (that is the population approach)

1. Primary or secondary prevention of incontinence

Pooled data from five trials suggested that women without urinary incontinence symptoms who began PFMT from 20 weeks gestation were statistically significantly less likely to report urinary incontinence in late pregnancy (56% less likely); up to 12 weeks postpartum (50% less likely); and between three and six months postpartum (30% less likely). The statistically significant difference is potentially even more notable because in three trials (Morkved 2003; Reilly 2002; Sampselle 1998) the usual care arm were not discouraged from doing PFMT. Four of the five trials that contributed data to this comparison recruited nulliparous, primiparous, or primigravid women. The largest treatment effect at three to six months postpartum was found in the trial by Reilly and colleagues; they recruited continent primigravid antenatal women with increased bladder neck mobility that was measured by ultrasound at 18 weeks gestation.

There was no statistically significant difference between PFMT and usual care groups at more than six and up to 12 months after delivery. However, these data were for a subgroup of previously continent primiparous women from one trial, and there was insufficient power to find an important difference between PFMT and usual care arms in this subgroup (Sampselle 1998). In contrast, four years after the index delivery Reilly and colleagues found that about 16% of women who had received PFMT reported urinary incontinence versus 45% of those in the usual care group; this apparent advantage for the PFMT group needs to be viewed with caution as less than half of the original sample were followed up.

None of the five trials reported data on faecal incontinence.

Pregnancy and birth appear to be the most consistent and important factors associated with the development of urinary and faecal incontinence in women. Therefore, all women who choose to have a child, or children, might be considered to be at risk of later incontinence. In addition, some women (such as those with connective tissue disorders, who are obese, or have forceps deliveries) might be at even greater risk. The review data (drawn principally from trials in nulliparous, primiparous, or primigravid women) suggested that continent antenatal women benefit from more 'intensive' PFMT programmes than the PFMT provided in usual care. Although the PFMT programmes varied somewhat, as did the amount of health professional contact, it seems reasonable to assume that a more 'intense' PFMT programme comprises both sufficient exercise dose and sufficient contact with a health professional to teach, supervise, and encourage training. The amount of health professional contact in the PFMT arms ranged from five contacts with a physiotherapist (Reilly 2002), eight contacts with a physiotherapist then follow up phone calls (Gorbea 2004), nine contacts in total over the pregnancy and first postpartum year (Stothers 2002), and 12 contacts with a physiotherapist in an exercise class (Morkved 2003). In the four trials that described their PFMT intervention, the programmes were characteristic of strength training (Gorbea 2004; Morkved 2003; Reilly 2002; Sampselle 1998).

Only one of these trials reported on delivery outcome (Gorbea 2004); there were more caesarean sections in the PFMT group than the control group (Analysis 1.9).

2. Treatment of incontinence

To date, only one trial has investigated the effect of PFMT during pregnancy for the treatment of urinary incontinence in primiparous and multiparous pregnant women (Woldringh 2007); no studies investigated the treatment of faecal incontinence in this group. Woldringh 2007 did not find any statistically significant difference in the prevalence of urinary incontinence in late pregnancy or in the early, mid, or late postnatal periods. This was a moderate-sized trial, at moderate risk of bias, and did not describe the PFMT programme used in the PFMT arm. In the absence of any details about the PFMT programme it was not possible to tell if the intervention had the potential to be effective.

Consistent with the findings of the Cochrane review on PFMT for treatment of urinary incontinence in women (Hay-Smith 2006), it appears that PFMT is an effective treatment for urinary incontinence in postnatal women. Three trials investigated the effect of PFMT after delivery for the treatment of urinary incontinence in primiparous and multiparous postnatal women (Dumoulin 2004; Glazener 2001; Wilson 1998). Pooled data suggested that PFMT women were statistically significantly less likely to be incontinent of urine (21% less likely) or faeces (46% less likely) six to 12 months following delivery. For urinary incontinence, the effect was much greater in the trial by Dumoulin 2004 than the trials by Glazener 2001 and Wilson 1998; in the latter trial the treatment period was only eight weeks. However, Dumoulin 2004 added weekly electrical stimulation to the PFMT programme, had weekly patient-health professional contact for eight weeks, and offered a strength training programme. In contrast, the PFMT programmes

used by Glazener 2001 and Wilson 1998 were difficult to characterise as strength or endurance training and offered three or four appointments with a health professional over approximately six months. It is not clear if the benefit of PFMT is maintained with more time or with subsequent deliveries; six years after the index delivery Glazener 2001 did not find any difference in the prevalence of urinary or faecal incontinence, or in the frequency of practising pelvic floor exercises, between PFMT and usual care groups.

The effect of PFMT for women with persistent postnatal urinary incontinence on the prevalence of faecal incontinence is interesting. Glazener 2001 and Wilson 1998 recruited women with persistent urinary incontinence three months postpartum. In both trials, women who also had faecal incontinence reported a decrease in their faecal leakage (RR 0.52, 95% CI 0.31 to 0.87; Analysis 2.5). It is possible that women with urinary incontinence are at greater long-term risk of faecal incontinence and PFMT for the treatment of urinary symptoms may also delay or prevent the onset of faecal incontinence symptoms.

3. The population approach - trials with a mixed prevention and treatment approach

One (Dannecker 2004) of the four trials that investigated the effect of antenatal PFMT was primarily interested in delivery rather than continence outcomes. Women in this trial did not begin PFMT until late pregnancy, with the purpose of improving the elasticity and control of pelvic floor muscle function for delivery. It seems unlikely that such a short training period with an alternative focus would affect continence outcomes. Pooled data from the other three trials (Hughes 2001; Morkved 2003; Sampselle 1998), where PFMT began at about 18 weeks gestation, did suggest a reduced risk of urinary incontinence in late pregnancy although this difference did not continue into the postnatal period. All four trials contributing data to this comparison recruited nulliparous, primiparous, or primigravid women. The effect was more marked in one of these trials, with persistent effect at three months postpartum although not at six years after the index delivery (Morkved 2003). This was the trial with the most intensive intervention in terms of health professional contacts and the PFMT programme. Interestingly, women who participated in this 'intensive' antenatal PFMT had a statistically significantly shorter second-stage labour, although there was no difference between the groups for type of delivery.

Similarly, there were differences between trials in the effect of postnatal PFMT. One trial recruited primiparous and multiparous women who were at potentially greater risk of postpartum incontinence (Chiarelli 2002) because of a forceps delivery or delivery of a large baby vaginally and used a strengthening PFMT programme. They did find a difference in favour of PFMT in the mid- but not longer-term postpartum period. Neither of the other two trials (Meyer 2001; Sleep 1987) reported any outcomes in favour of the PFMT group but neither trial described the PFMT programme sufficiently to be sure that it could be effective.

Other considerations

Anecdotally, some obstetricians and midwives seem to believe that antenatal PFMT is associated with adverse delivery outcomes (such as prolonged second-stage labour, assisted or caesarean delivery, episiotomy and perineal tears) while mounting evidence is to the contrary (for example Agur 2005b; Bo 2007). Of the two trials in this review that measured delivery outcome after 16 to 20 weeks of supervised antenatal PFMT, one found more caesareans in the PFMT than the control group (Gorbea 2004, n=75) while the other did not (Morkved 2003, n=301). The latter trial also reported other related data (such as length of second stage, perineal trauma, baby birthweight, and head circumference), which gave a more complete picture of delivery outcome; variables such a episiotomy rates and length of second stage favoured the PFMT group.

Overall completeness and applicability of evidence

Only one trial, reported as a conference abstract (Skelly 2004), did not report any data suitable for inclusion in the meta-analysis. Overall, there was a lack of consistency in the way the primary outcome of interest for the review (patient-reported urinary or faecal incontinence) was measured and the data presented. While it appeared the trials were trying to measure the same outcome, it is not clear how comparable the measures were (that is, there might have been some variability in definitions of urinary and faecal incontinence across the trials); or how much this contributed to heterogeneity in the comparisons. Only the data for prevalence of urinary and faecal incontinence were displayed on forest plots. There were insufficient comparable data for any of the other prespecified outcomes for forest plots to be worthwhile; these data were reported in 'Other data' tables.

Quality of the evidence

Trial quality and reporting

Methodological quality was evaluated from the trial reports. Therefore, the quality of reporting might have affected the judgement of methodological quality. Three of the included trials were published only as abstracts (Hughes 2001; Skelly 2004; Stothers 2002) although one trialist provided further information from a thesis (Hughes 2001). Limited methodological detail was given in the abstracts, which made it particularly difficult to judge the quality of these trials. In addition, few data were reported.

It was disappointing that only seven of the 16 trials sufficiently described the randomisation process for the review authors to be reasonably sure there was adequate allocation concealment. Because of the nature of the intervention, it was not feasible to blind

the treatment provider or participants to group allocation (performance bias) in any of the included trials; the difficulty of blinding exercise-based interventions is unavoidable. Half the trials (eight) reported blinding of assessment of the primary outcome. The proportion of dropouts and withdrawals ranged from 4% to 38%; generally the longer the period of follow up the more dropouts. Although some of the included trials were small or moderately sized, a notable feature of this review was the inclusion of four large and very large trials (Chiarelli 2002; Glazener 2001; Hughes 2001; Sleep 1987). This is in contrast to many other reviews of PFMT.

Based on the reported adequacy of allocation concealment and blinding, four trials appeared to be at low risk (Chiarelli 2002; Glazener 2001; Morkved 2003; Sampselle 1998), two at low to moderate risk (Ewings 2005; Wilson 1998), and the remainder at moderate risk of bias (Dannecker 2004; Dumoulin 2004; Gorbea 2004; Hughes 2001; Meyer 2001; Reilly 2002; Skelly 2004; Sleep 1987; Stothers 2002; Woldringh 2007). Sensitivity analysis on the basis of trial quality was not considered appropriate in view of the small number of trials contributing to each comparison group.

Potential biases in the review process

Sources of heterogeneity

There were three notable sources of clinical heterogeneity. These were the variation in baseline characteristics (such as parity, type of delivery, type and duration of incontinence, if women were symptomatic when recruited); the PFMT programmes; and the control care. To investigate the effects of baseline characteristics on treatment outcome would require an individual patient data meta-analysis, which was beyond the scope of this review.

Quality of PFMT regimens

The content of PFMT programmes was often poorly described. When poorly described, it was difficult to make judgements about the similarities and differences between the training programmes, or their potential effectiveness. Including trials with a suboptimal exercise dose alongside those with a sufficient dose could adversely influence the pooled estimate of PFMT effect. Assessment of the interaction between quality and the effect of the intervention has been recommended (Herbert 2005). However, in addition to recommended exercise dose there is also the issue of treatment adherence; a potentially sufficient dose is only sufficient if the recommended program is adhered to. With regard to the control groups, in some of the included trials the control condition (usual or standard care) encompassed advice on PFMT, while in other control groups no PFMT advice was given. Where PFMT advice was given the advice was not usually well described.

If all three factors (exercise dose, treatment adherence, control care) are considered together, the included trials could potentially fall into two categories.

The first category would include trials in which 'sufficient' PFMT (sufficient based on exercise description and adherence) was compared with no PFMT, or 'sufficient' PFMT with 'insufficient' PFMT (insufficient based on exercise description and/or lack of adherence). Trials in this first category would potentially show the greatest difference in outcome between PFMT and control arms. In the second category would be trials in which the difference in intervention between PFMT and control arms was less clear cut, such as insufficient PFMT versus no PFMT, or insufficient PFMT in the PFMT arm versus usual care including PFMT advice in the control arm. The review authors could have chosen to exclude trials where the exercise dose in the PFMT arm did not appear to be sufficient to improve muscle function, or was not described in enough detail to be sure, but this would not deal with the difficulty of assessing sufficiency of treatment adherence. Unfortunately, adherence to home-based exercise is difficult to assess. The validity of methods such as the use of paper diaries has been questioned (Stone 2002; Stone 2003).

Rather than excluding or including trials on the basis of sufficiency of PFMT, or the likelihood that a clear cut comparison between PFMT and control condition had been made, the preferred approach would be a sensitivity analysis on the basis of PFMT programme characteristics, or amount of clinical difference between the PFMT and control interventions. However, more trials would be needed in each of the comparisons in the review before this was possible. Therefore, visual inspection of the plots, and the statistical tests for heterogeneity, were used to identify potentially important differences between the trials. Where potentially important differences were identified they have been discussed.

AUTHORS' CONCLUSIONS

Implications for practice

For women having their first baby, antenatal PFMT appears to reduce the prevalence of urinary incontinence in late pregnancy (34 weeks or more) and early postpartum (less than 12 weeks). However, it is uncertain whether this effect persists beyond three months after delivery or whether PFMT is helpful for multiparous women as the trial data were drawn principally from nulliparous, primiparous and primigravid women.

It seems a PFMT programme of sufficient dose might be important both for women at potentially increased risk of postnatal incontinence and in a population-based approach to prevention of postnatal incontinence with the use of antenatal PFMT.

With regard to postnatal PFMT, it appears that this an effective treatment in women who have persistent urinary or faecal incontinence after delivery. The greatest treatment effect was seen in the trial with the most intensive, supervised strengthening PFMT programme (with the addition of weekly electrical stimulation).

The trial data were drawn from mixed parity women and it is not clear if the size of treatment effect is associated with parity.

It is less clear whether there is any benefit of a population approach to postnatal PFMT (that is offering PFMT to all postnatal women, starting on postnatal wards, regardless of urinary continence status) in reducing the prevalence of postnatal urinary or faecal incontinence; particularly if the PFMT is barely sufficient in terms of exercise dose or supervision. Based on the trials to date, the most beneficial population approach for postnatal PFMT appeared to be to offer an individually taught strengthening PFMT programme (with the addition of a number of adherence strategies) to women potentially at greater risk of postnatal incontinence, such as after a forceps delivery or vaginal delivery of a large baby.

In summary, the evidence suggests that, to reduce the prevalence of late pregnancy and postpartum urinary or faecal incontinence, population approaches to PFMT need to be more intensive than is common in much of the research to date (and in practice if the research reflects current clinical practice) or the limited resource available to support PFMT should be targeted at specific groups of women who are most likely to benefit. However, there is not enough evidence to suggest whether any effects persist in the longer term.

Implications for research

Very few trials have investigated, even as a secondary outcome, the effect of antenatal or postnatal PFMT on the prevalence of antenatal or postnatal faecal incontinence. It is strongly recommended that all future trials of PFMT in antenatal and postnatal women collect data on faecal incontinence (stool).

The effect of antenatal PFMT on delivery type and other delivery outcomes is worthy of further investigation in prospective trials to elucidate the associations, if any, between these and PFMT variables such as the type, duration and PFMT dose.

There is a need for at least two large, pragmatic, rigorous and explicitly reported trials with long-term follow up (five plus years) of population-based approaches to PFMT using intensive PFMT in each of antenatal and postnatal care. These trials would recruit antenatal or postnatal women, respectively, regardless of continence status or parity; sample size would be based on a clinically important difference in the prevalence of urinary and faecal incontinence at 12 months postpartum and of sufficient size to investigate the associations between outcome, prior continence status, and parity. One arm of the trial would comprise a supervised PFMT programme based on sound exercise science to improve muscle strength with confirmation of a correct voluntary pelvic floor muscle contraction (by vaginal palpation or ultrasound) and appropriate adherence measures. The choice of programme would have to be set against the resource implications of intensive, supervised PFMT and the opportunity cost this represents. Careful clinical judgement would be needed about the style and content of a programme that could actually be applied in everyday practice; and in different countries with different healthcare delivery systems and funding. The control arm in each trial would be usual antenatal or postnatal care, which might include advice or teaching on PFMT. A reliable and valid measure of PFMT adherence is needed in both arms of each trial. Such trials would require substantial funding and multiple recruitment centres across several countries.

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REFERENCES

References to studies included in this review

Chiarelli 2002 *{published data only}*

Chiarelli P, Cockburn J. Preventing urinary incontinence in postpartum women (Abstract). *Neurourology and Urodynamics* 2001;**20**(4): 448–9. [: SR–INCONT12109]

* Chiarelli P, Cockburn J. Promoting urinary continence in women after delivery: randomised controlled trial [Extended electronic version]. *BMJ* 2002;**324**:1–6. [: SR–INCONT14669]

Chiarelli P, Murphy B, Cockburn J. Acceptability of a urinary continence promotion programme to women in postpartum. *BJOG: an International Journal of Obstetrics and Gynaecology* 2003;**110**(2): 188–96. [: SR–INCONT15783]

Chiarelli P, Murphy B, Cockburn J. Promoting urinary continence in postpartum women: 12-month follow-up data from a randomised controlled trial. *International Urogynecology Journal* 2004;**15**(2):99–105. [: SR–INCONT17410]

Dannecker 2004 *{published data only}*

* Dannecker C. The effect of the pelvic floor training device Epi-No on the maternal pelvic floor function six months after childbirth - follow-up study of a randomised controlled trial [Einfluss des Geburtstrainers Epi–No auf die mutterliche Beckenbodenfunktion sechs Monate nech Entbinding – Follow–up einer prospektiven und randomisierten Studie]. *Geburtshilfe und Frauenheilkunde* 2004;**64** (11):1192–8. [: SR–INCONT21149]

Dumoulin 2004 *{published data only}*

* Dumoulin C, Lemieux MC, Bourbonnais D, Gravel D, Bravo G, Morin M. Physiotherapy for persistent postnatal stress urinary incontinence: a randomized controlled trial. *Obstetrics and Gynecology*

2004;**104**(3):504–10.

Dumoulin C, Morin M, Bourbonnais D, Lemieux M, Gravel D. Effect of adding deep abdominal muscle training to pelvic floor muscle training to treat stress urinary incontinence: a one-year follow up [Abstract 662]. Proceedings of the International Continence Society (34th Annual Meeting) and the International Urogynecological Association. Paris, 23–27 August, 2004.

Ewings 2005 *{published data only}*

* Ewings P, Spencer S, Marsh H, O'Sullivan M. Obstetric risk factors for urinary incontinence and preventative pelvic floor exercises: cohort study and nested randomized controlled trial. *Journal of Obstetrics and Gynaecology* 2005;**25**(6):558–64. [: SR–INCONT21250]

Glazener 2001 *{published data only}*

Glazener CM, Herbison GP, MacArthur C, Grant A, Wilson PD. Randomised controlled trial of conservative management of postnatal urinary and faecal incontinence: six year follow up. *BMJ* 2005;**330** (7487):337–40.

* Glazener CM, Herbison GP, Wilson PD, MacArthur C, Lang GD, Gee H, et al.Conservative management of persistent postnatal urinary and faecal incontinence: a randomised controlled trial [Extended electronic version]. *BMJ* 2001;**323**:1–5.

Glazener CM, Herbison GP, Wilson PD, MacArthur C, Lang GD, Gee H, et al.Conservative management of persistent postnatal urinary and faecal incontinence: randomised controlled trial. *BMJ* 2001; **323**(7313):593–6.

Rennie AM, Wilson D, Glazener C, Gee H, Lang G, MacArthur C. A multicentre randomised trial of treatment of postnatal incontinence [Abstract]. Proceedings of the International Confederation of Midwives, 24th Triennial Congress. Oslo, 26–31 May, 1996:8.

Wilson PD, Glazener C, McGee M, Herbison P, MacArthur C, Grant A. Randomised controlled trial of conservative management of postnatal urinary and faecal incontinence: long term follow-up study [Abstract]. *Neurourology and Urodynamics* 2002;**21**(4):370.

Wilson PD, Herbison GP, Glazener CMA, Lang G, Gee H, MacArthur C. Postnatal incontinence: a multi centre, randomised controlled trial of conservative treatment [Abstract]. *Neurourology and Urodynamics* 1997;**16**(5):349–50.

Gorbea 2004 *{published data only}*

* Gorbea Chavez V, Velazquez Sanchez MdP, Kunhardt Rasch JR. Effect of pelvic floor exercise during pregnancy and puerperium on prevention of urinary stress incontinence [Efecto de los ejercicios del piso pelvico durante el embarazo y el puerperio en la prevencion de la incontinencia urinaria de esfuerzo]. *Ginecologia y Obstetricia de Mexico* 2004;**72**(12):628–36. [: SR–INCONT20384]

Hughes 2001 *{published data only}*

Hughes P. Personal communication 2006.

* Hughes P, Jackson S, Smith P, Abrams P. Can antenatal pelvic floor exercises prevent postnatal incontinence [Abstract]. *Neurourology and Urodynamics* 2001;**20**(4):447–8. [: SR–INCONT12110]

Meyer 2001 *{published data only}*

* Meyer S, Hohlfeld P, Achtari C, De Grandi P. Pelvic floor education after vaginal delivery. *Obstetrics and Gynecology* 2001;**97**(5 Pt 1): 673–7. [: SR–INCONT12119]

Meyer S, Hohlfeld P, De Grandi P, Megalo A. Is pelvic floor reeducation after vaginal delivery effective? A prospective double-blind randomized study in primiparae [Abstract]. *International Urogynecology Journal and Pelvic Floor Dysfunction* 1999;**10 Suppl 1**:39–40. [: SR–INCONT9846]

Meyer S, Hohlfeld P, De Grandi P, Megalo A. Is pelvic floor re-education after vaginal delivery effective? A prospective double-blind randomized study in primiparae [Abstract]. Neurourology and Urodynamics. 18 1999; Vol. 18, issue 4:290. [: SR–INCONT9941]

Morkved 2003 *{published data only}*

* Morkved S, Bo K, Schei B, Salvesen KA. Pelvic floor muscle training during pregnancy to prevent urinary incontinence: a single-blind randomized controlled trial. *Obstetrics and Gynecology* 2003;**101**(2): 313–9. [: SR–INCONT15816]

Morkved S, Rommen K, Schei B, Salvesen KA, Bo K. No difference in urinary incontinence between training and control group six years after cessation of a randomized controlled tiral, but improved sexual satisfaction in the training group [Abstract 50]. *Neurourology and Urodynamics* 2007;**26**(5):667.

Morkved S, Rommen K, Schei B, Savlesen KA, Bo K. No difference in urinary incontinence between training and control group six years after cessation of a randomized trial, but improved sexual satisfaction in the training group [Abstract 50]. *Neurourology and Urodynamics* 2007;**26**(5):667.

Morkved S, Salvesen KA. Does pelvic floor muscle training during pregnancy have an effect on labour? [Abstract]. *Neurourology and Urodynamics* 2004;**23**(5/6):410–1. [: SR–INCONT19001]

Morkved S, Salvesen KÅ, Scheil B, Bo K. Prevention of urinary incontinence during pregnancy - a randomized controlled trial of primiparous women [Abstract]. *International Urogynecology Journal and Pelvic Floor Dysfunction* 2001;**12 Suppl 3**:1. [: SR–INCONT15713]

Salvesen KA, Morkved S. Randomised controlled trial of pelvic floor muscle training during pregnancy. *BMJ* 2004;**329**(7462):378–80. [: SR–INCONT17558]

Reilly 2002 *{published data only}*

Reilly EIL, Freeman RM, Waterfield MR, Waterfield AE, Steggles P, Pedlar F. Can post partum stress incontinence be prevented? [Abstract]. *International Urogynecology Journal* 2001;**12 Suppl 3**:1. [: SR–INCONT15712]

* Reilly ETC, Freeman RM, Waterfield MR, Waterfield AE, Steggles P, Pedlar F. Prevention of postpartum stress incontinence in primigravidae with increased bladder neck mobility: a randomised controlled trial of antenatal pelvic floor exercises. *BJOG* 2002;**109**(1): 68–76. [: SR–INCONT12890]

Reilly ETC, Pedler F, Steggles P, Waterfield AE, Freeman RM. Prevention of postpartum stress incontinence in at risk primigravidae [Abstract]. *International Urogynecology Journal and Pelvic Floor Dysfunction* 1999;**10 Suppl 1**:2. [: SR–INCONT9837]

Udayasankar VJ, Steggles P, Freeman RM, Waterfield M, Adekanmi OA, Reilly ETC. Prevention of stress incontinence by ante-natal pelvic floor exercises in primigravidae with bladder neck mobility: a three year follow-up [Abstract]. *International Urogynaecology Journal* 2002;**13 Suppl 1**:57–8. [: SR–INCONT16343]

Sampselle 1998 *{published data only}*

Sampselle C, Miller J. Personal communication 2006.

* Sampselle CM, Miller JM, Mims BL, Delancey JO, Ashton-Miller JA, Antonakos CL. Effect of pelvic muscle exercise on transient incontinence during pregnancy and after birth. *Obstetrics and Gynecology* 1998;**91**(3):406–12. [: SR–INCONT5452]

Skelly 2004 *{published data only}*

* Skelly J, Rush J, Eyles P, Burlock S, Morrow C, Fedorkow D. Postpartum urinary incontinence: Regional prevalence and the impact of teaching pelvic muscle exercises to pregnant women with UI [Abstract 552]. Proceedings of the International Continence Society (34th Annual Meeting) and the International Urogynecology Association. Paris, 23–27 August, 2004.

Sleep 1987 *{published data only}*

* Sleep J, Grant A. Pelvic floor exercises in postnatal care. *Midwifery* 1987;**3**(4):158–64. [: SR–INCONT2623]

Stothers 2002 *{published data only}*

* Stothers L. A randomized controlled trial to evaluate intrapartum pelvic floor exercise as a method of preventing urinary incontinence [Abstract]. *Journal of Urology* 2002;**167 Suppl**(4):106. [: SR–INCONT17623]

Wilson 1998 *{published data only}*

Wilson D, Herbison P, Borland M, Grant AM. A randomised controlled trial of physiotherapy treatment of postnatal urinary incontinence. Proceedings of 26th Congress of Obstetrics and Gynaecology. Manchester, UK, 7–10 July, 1992:162.

* Wilson PD, Herbison GP. A randomized controlled trial of pelvic floor muscle exercises to treat postnatal urinary incontinence. *International Urogynecology Journal and Pelvic Floor Dysfunction* 1998;**9**(5):257–64.

Woldringh 2007 *{published data only}*

* Woldringh C, van den Wijngaart M, Albers-Heitner P, Lycklama a Nijeholt AAB, Lagro-Janssen T. Pelvic floor muscle training is not effective in women with UI in pregnancy: a randomised controlled trial. International Urogynecology Journal 2007; Vol. in press. [DOI: 10.1007/s00192-006-0175-x]

References to studies excluded from this review

Agur 2005a *{published data only}*

* Agur W, Freeman R. Do antenatal pelvic floor training affect the outcome of labour? A randomised controlled trial [Abstract]. *Neurourology and Urodynamics* 2005;**24**(5/6):510–1. [: SR–INCONT20969]

Culligan 2005 *{published data only}*

Culligan P, Blackwell L, Murphy M, Ziegler C, Heit M. A blinded, sham-controlled trial of postpartum extracorporeal magnetic innervation to restore pelvic muscle strength in primiparous patients [Abstract]. *Neurourology and Urodynamics* 2004;**23**(5/6):451. [: SR–INCONT19008]

* Culligan PJ, Blackwell L, Murphy M, Ziegler C, Heit MH. A randomized, double-blinded, sham-controlled trial of postpartum extracorporeal magnetic innervation to restore pelvic muscle strength in primiparous patients. *American Journal of Obstetrics and Gynecology* 2005;**192**(5):1578–82.

Dougherty 1989 *{published data only}*

Dougherty MC, Abrams RM, Batich CD, Bishop KR, Gimptty P. Effect of exercise on the circumvaginal muscles (CVM) [Abstract]. *Neurourology and Urodynamics* 1987;**6**(3):189–90. [: SR–INCONT16393]

* Dougherty MC, Bishop KR, Abrams RM, Batich CD, Gimotty PA. The effect of exercise on the circumvaginal muscles in postpartum women. *Journal of Nurse-Midwifery* 1989;**34**(1):8–14. [: SR–INCONT454]

Fynes 1999 *{published data only}*

* Fynes MM, Marshall K, Cassidy M, Behan M, Walsh D, O'Connell PR, et al.A prospective, randomized study comparing the effect of augmented biofeedback with sensory biofeedback alone on fecal incontinence after obstetric trauma. *Diseases of the Colon and Rectum* 1999;**42**(6):753–8.

Gouldthorpe *{published data only}*

* Gouldthorpe H. QA physiotherapy abdominal muscle assessment during and after pregnancy: Part 4 [Abstract]. Australian and New Zealand Continence Journal. 9 2003; Vol. 9, issue 4:92. [: SR–INCONT17166]

Jonasson 1989 *{published data only}*

* Jonasson A, Larsson B, Pschera H. Testing and training of the pelvic floor muscles after childbirth. *Acta Obstetricia et Gynecologica Scandinavica* 1989;**68**(4):301–4. [: SR–INCONT2638]

Jonasson A, Larsson B, Pschera H, Fianu S. Objective evaluation and training of the pelvic floor muscles after childbirth [Abstract]. Proceedings of the ? 1988. [: SR–INCONT17199]

Jonasson 1992 *{published data only}*

* Jonasson A, Fianus S, Larsson B. Vagitrim - nyatt, enkelt, hjalpmedel for effektiv traning av backenbottenmuskulatur. *Lakartioningen* 1992;**89**(38):2820.

Mahony 2004 *{published data only}*

Mahony R, Malone P, Nalty J, Cassidy M, O'Connell PR, O'Herlihy C. Prospective randomized comparison of intra-anal electromyographic biofeedback and intra-anal electromyographic biofeedback augmented with electrical stimulation of the anal sphincter. *American Journal of Obstetrics and Gynecology* 2003;**189 Suppl**(6):71.

* Mahony RT, Malone PA, Nalty J, Behan M, O'Connell PR, O'Herlihy C. Randomized clinical trial of intra-analysis electromyographic biofeedback physiotherapy with intra-anal electromyographic biofeedback augmented with electrical stimulation of the anal sphincter in the early treatment of postpartum fecal incontinence. *American Journal of Obstetrics and Gynecology* 2004;**191**(3):885–90.

Mason 1999b *{published data only}*

* Mason M. A multicentre study to evaluate different pelvic floor exercise regimes. National Research Register, 1999. [: SR–INCONT6662]

Nielsen 1988 *{published data only}*

* Nielsen CA, Sigsgaard I, Olsen M, Tolstrup M, Danneskiold-Samsoee B, Bock JE. Trainability of the pelvic floor. A prospective study during pregnancy and after delivery. *Acta Obstetricia et Gynecologica Scandinavica* 1988;**67**(5):437–40. [: SR–INCONT7395]

Norton 1990 *{published data only}*

Norton P, Baker J. Randomized prospective trial of vaginal cones versus Kegel exercises in postpartum primiparous women (Abstract). Proceedings of the American Urogynecology Society, 11th annual meeting, Oct 31-Nov 3, 1990, Tarpon Springs, Florida, USA. 1990. [: SR–INCONT14572]

* Norton P, Baker J. Randomized prospective trial of vaginal cones vs Kegel exercises in postpartum primiparous women [Abstract]. *Neurourology and Urodynamics* 1990;**9**(4):434–5. [: SR–INCONT5116]

Thorp 1994 *{published data only}*

* Thorp JM, Stephenson H, Jones LH, Cooper G. Pelvic floor (Kegel) exercises: a pilot study in nulliparous women. *International Urogynecology Journal* 1994;**5**:86–9.

Additional references

Agur 2005b

Agur W, Freeman R. Do antenatal pelvic floor training affect the outcome of labour? A randomised controlled trial [Abstract 69]. *Neurourology and Urodynamics* 2005;**24**(5/6):510–1.

Allen 1990

Allen RE, Hosker GL, Smith ARB, Warell DW. Pelvic floor damage and childbirth: a neurophysiological study. *British Journal of Obstetrics and Gynaecology* 1990;**90**:770–9.

Beck 1965

Beck RP, Hsu N. Pregnancy, childbirth, and the menopause related to the development of stress incontinence. *American Journal of Obstetrics and Gynecology* 1965;**91**:820–3.

Bo 1995

Bo K. Pelvic floor muscle exercise for the treatment of stress urinary incontinence. *International Urogynecology Journal* 1995;**6**:282–91.

Bo 2007

Bo K, Fleten AC, Nystad W. Does pelvic floor muscle training during pregnancy negatively affect labour and birth? [Abstract 95]. *Neurourology and Urodynamics* 2007;**26**(5):722.

Bø 2004

Bø K. Pelvic floor muscle training is effective in treatment of female stress urinary incontinence, but how does it work?. *International Urogynecology Journal and Pelvic Floor Dysfunction* 2004;**15**:76–84.

Christianson 2003

Christianson L, Bovbjerg V, McDavitt E, Hullfish K. Risk factors for perineal injury during delivery. *American Journal of Obstetrics and Gynecology* 2003;**189**(1):255–60.

Demirci 2001

Demirci F, Ozden S, Alpay Z, Tozk, R Demirci E, Ayas S. The effects of vaginal delivery and cesarean section on bladder neck mobility and stress urinary incontinence. *International Urogynecology Journal* 2001;**12**:129–33.

Eason 2002

Eason E, Labrecque M, Marcous S, Mondor M. Anal incontinence after childbirth. *CMAJ* 2002;**166**(3):326–30.

Farrell 2001

Farrell SA, Allen VM, Baskett TF. Parturition and urinary incontinence in primiparas. *Obstetrics and Gynecology* 2001;**97**:350–6.

Fenner 2003

Fenner DE, Genberg B, Brahma P, Marek L, DeLancey JO. Fecal and urinary incontinence after vaginal delivery with anal sphincter disruption in an obstetrics unit in the United States. *American Journal of Obstetrics and Gynecology* 2003;**189**(6):1543–9.

Foldspang 1999

Foldspang A, Mommsen S, Djurhuus JC. Prevalent urinary incontinence as a correlate of pregnancy, vaginal childbirth, and obstetric techniques. *American Journal of Public Health* 1999;**89**:209–12.

Francis 1960

Francis W. The onset of stress incontinence. *Journal of Obstetrics and Gynecology* 1960;**67**:899–903.

Hay-Smith 2002a

Hay-Smith J, Herbison P, Morkved S. Physical therapies for prevention of urinary and faecal incontinence in adults. *Cochrane Database of Systematic Reviews* 2007, Issue 4. [DOI: 10.1002/14651858.CD003191.pub2]

Hay-Smith 2002b

Hay-Smith EJC, Bø K, Berghmans LCM, Hendriks HJM, de Bie RA, van Waalwijk van Doorn ESC. Pelvic floor muscle training for urinary incontinence in women. *Cochrane Database of Systematic Reviews* 2006, Issue 1. [DOI: 10.1002/14651858.CD001407.pub2]

Hay-Smith 2006

Hay-Smith EJC, Dumoulin C. Pelvic floor muscle training versus no treatment, or inactive control treatments, for urinary incontinence in women. *Cochrane Database of Systematic Reviews* 2006, Issue 1. [DOI: 10.1002/14651858.CD005654]

Hensrud 2000

Hensrud DD. Clinical preventive medicine in primary care: background and practice: 1. Rationale and current preventive practices. *Mayo Clinic Proceedings* 2000;**75**:165–172.

Herbert 2005

Herbert RD, Bo K. Analysis of quality of interventions in systematic reviews. *BMJ* 2005;**331**(7515):507–9.

Higgins 2003

Higgins JP, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ* 2003;**327**(7414):557–60.

Higgins 2005

Higgins JPT, Green SS, editors. Cochrane Handbook for Systematic Reviews of Interventions 4.2.5 [updated May 2005]. http://www.cochrane.org/resources/handbook/hbook.htm.

Hosker 2007

Hosker G, Cody JD, Norton CC. Electrical stimulation for faecal incontinence in adults. *Cochrane Database of Systematic Reviews* 2007, Issue 3. [DOI: 10.1002/14651858.CD001310.pub2]

Hvidman 2002

Hvidman L, Foldspang A, Mommsen S, Bugge Nielsen J. Correlates of urinary incontinence in pregnancy. *International Urogynecology Journal* 2002;**13**:278–83.

Iosif 1981

Iosif S. Stress incontinence during pregnancy and puerperium. *International Journal of Gynaecology and Obstetrics* 1981;**19**:13–20.

Johanson 1996

Johanson JF, Lafferty J. Epidemiology of fecal incontinence: the silent affliction. *American Journal of Gastroenterology* 1996;**91**(1):33–6.

Kegel 1948

Kegel AH. Progressive resistance exercise in the functional restoration of the perineal muscles. *American Journal of Obstetrics and Gynecology* 1948;**56**:238–48.

MacArthur 2001

MacArthur C, Glazener CM, Wilson PD, Herbison GP, Gee H, Lang GD, Lancashire R. Obstetric practice and faecal incontinence three months after delivery. *BJOG* 2001;**108**(7):678–83.

Mason 1999a

Mason L, Glenn S, Walton I, Appleton C. The prevalence of stress incontinence during pregnancy and following delivery. *Midwifery* 1999;**15**:120–8.

Meyer 1998

Meyer S, Schreyer A, De Grandi P, Hohlfeld P. The effects of birth on urinary continence mechanisms and other pelvic-floor characteristics. *Obstetrics and Gynecology* 1998;**92**:613–8.

Morkved 1999

Morkved S, Bo K. Prevalence of urinary incontinence during pregnancy and postpartum. *International Urogynecology Journal and Pelvic Floor Disorders* 1999;**10**:394–8.

Mørkved 1997

Mørkved S, Bø K. Effect of post partum pelvic floor muscle exercise in prevention and treatment of urinary incontinence. *International Urogynecology Journal* 1997;**8**:217–22.

Norton 2006

Norton C, Cody JD, Hosker G Norton C, Cody JD, Hosker G. Biofeedback and/or sphincter exercises for the treatment of faecal incontinence in adults. *Cochrane Database of Systematic Reviews* 2006, Issue 3. [DOI: 10.1002/14651858.CD002111.pub2]

Pollack 2004

Pollack J, Nordenstam J, Brismar S, Lopez A, Altman D, Zetterstrom J. Anal incontinence after vaginal delivery: a five-year prospective cohort study. *Obstetrics and Gynecology* 2004;**104**(6):1397–402.

Rortveit 2003a

Rortveit G, Daltveit AK, Hannestad YS, Hunskaar S, the Norwegian EPICONT study. Urinary incontinence after vaginal delivery or caesarean section. *New England Journal of Medicine* 2003;**348**(10): 900–7.

Rortveit 2003b

Rortveit G, Daltveit AK, Hannestad YS, Hunskaar, S. Vaginal delivery parameters and urinary incontinence: the Norwegian EPICONT study. *American Journal of Obstetrics and Gynecology* 2003;**189**(5): 1269–74.

Signorello 2000

Signorello LB, Harlow BL, Chekos AK, Repke JT. Midline episiotomy and anal incontinence: retrospective cohort study. *BMJ* 2000;**320**(7227):86–90.

Stanton 1980

Stanton SL, Kerr-Wilson R, Grant Harris V. The incidence of urological symptoms in normal pregnancy. *Britrish Journal of Obstetrics and Gynaecology* 1980;**87**:897–900.

Stone 2002

Stone AA, Shiffman S, Schwartz JE, Broderick JE, Hufford MR. Patient non-compliance with paper diaries. *BMJ* 2002;**324**(7347): 1193–4.

Stone 2003

Stone AA, Shiffman S, Schwartz JE, Broderick JE, Hufford MR. Patient compliance with paper and electronic diaries. *Controlled Clinical Trials* 2003;**24**(2):182–99.

Sultan 1993

Sultan AH, Kamm MA, Hudson CN. Anal sphincter trauma during instrumental delivery. *International Journal of Gynecology and Obstetrics* 1993;**43**:263–70.

Sultan 1999

Sultan AH, Monga AK, Kumar D, Stanton SL. Primary repair of obstetric anal sphincter rupture using the overlap technique. *British Journal of Obstetrics and Gynaecology* 1999;**106**(3):318–23.

Thorp 1999

Thorp JM, Norton PA, Wall LL, Kuller JA, Eucker B, Wells E. Urinary incontinence in pregnancy and the puerperium: A prospective study. *American Journal of Obstetrics and Gynecology* 1999;**181**:266–73.

Viktrup 1992

Viktrup L, Lose G, Rolff M, Barfoed K. The symptom of stress incontinence caused by pregnancy or delivery in primiparas. *Obstetrics and Gynecology* 1992;**79**:945–9.

Viktrup 1993

Viktrup L, Lose G, Rolff M, Barfoed K. The frequency of urological symptoms during pregnancy and delivery in primiparae. *International Urogynecology Journal* 1993;**4**:27–30.

Viktrup 2000

Viktrup L, Lose G. Lower urinary tract symptoms 5 years after the first delivery. *International Urogynecology Journal* 2000;**11**:336–40.

Viktrup 2006

Viktrup L, Rortveit B, Lose G. Risk of stress urinary incontinence twelve years after the first pregnancy and delivery. *Obstetrics and Gynecology* 2006;**108**(2):248–54.

Wilson 1996

Wilson PD, Herbison RM, Herbison GP. Obstetric practice and the prevalence of urinary incontinence three months after delivery. *British Journal of Obstetrics and Gynaecology* 1996;**103**:154–61.

* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Chiarelli 2002

Methods	2-arm RCT. Allocation generation: random, low risk of bias. Allocation concealment: adequate, low risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome self-reported incontinence in phone interview): blind, low risk of bias. Losses to follow up at primary endpoint (3 months postpartum): less than 10%, low risk of bias. Analysed in group to which assigned: yes, low risk of bias. A priori power calculation.
Participants	720 women recruited from postnatal wards. Inclusion: forceps or ventouse delivery or birth of baby weighing 4000g or more. Exclusion: stillbirth or baby in neonatal intensive care unit, women with disabilities unable to perform PFMT, women who were not residents of Australia, women who could not speak English sufficiently to give consent. Age: 57% PFMT and 57% of controls aged 20-29 years. Parity: 57% PFMT and 57% controls primiparous. Delivery: 44% PFMT and 45% controls forceps delivery. BMI: 30% PFMT and 32% controls overweight or obese. Incontinence prior to current pregnancy: 18% PFMT and 17% controls. Setting: 3 hospitals in New South Wales, Australia.
Interventions	1. PFMT (n=370): taught one to one by physiotherapist. For details of PFMT programme see Additional table 01. Intervention also included discussion based on postnatal booklet (urinary incontinence, pelvic floor function, PFMT, good bladder habits, type and amount of fluids, perineal care) and viewing perineum with hand mirror (for perineal trauma, haemorrhoids, and to practice perineal splinting for defecation) and practice of VPFMC, the 'Knack', and transversus abdominus contraction. Postnatal pack also included red stick-up dots, poster and partner information sheet in attempts to aid exercise adherence. 2. Control (n=350): usual postnatal care, no visit from physiotherapist. Hospital brochure available with general postnatal and PFMT advice, and invitation to join postnatal physiotherapy class held on wards. No restrictions on PFMT being recommended by other healthcare professionals.
Outcomes	Measured at 3 and 12 months postpartum. Primary endpoint: 3 months postpartum. Primary outcome measure: self-reported urinary incontinence (if answered occasionally, often, or always to a series of questions about stress or urge urinary incontinence). Secondary outcome measures: incontinence severity (slight, moderate, severe), and self-reported adherence.
Notes	Losses to follow up at 3 months: PFMT 22 of 370, control 22 of 350 (total 6%). Losses to follow up at 12 months: PFMT 49 of 370, control 50 of 350 (total 14%). In addition, at 12 months 27 PFMT and 25 controls were pregnant and not included in the analysis.

Chiarelli 2002 (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	A - Adequate

Dannecker 2004

Methods	2-arm RCT. Allocation generation: method unclear, moderate risk of bias. Allocation concealment: unclear, moderate risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome not stated): blind (for primary outcome of review), low risk of bias. Losses to follow up at primary endpoint (approximately 7 months postpartum): 20% or more, high risk of bias. Analysed in group to which assigned: yes, low risk of bias.
Participants	144 primigravid women. Inclusion: primigravid women at 35 to 37 weeks gestation, anticipating vaginal birth. Exclusion: multiple pregnancy, water birth, pelvic abnormalities, anticipated birthweight >4000g, previous vaginal or perineal surgery, early bladder prolapse, term uncertainty, alcohol or drug abuse, neurological disease (diabetic neuropathy, paraplegia, multiple sclerosis, etc), regular analgesics. Age: mean age 31 years (SD 4) for PFMT and 31 years (SD 4) for controls. Parity: all primiparous. Stress incontinent at recruitment: 61% PFMT and 48% controls. Setting: not clear if single or multiple centres, Germany.
Interventions	1. PFMT (n=71): trained to use Epi-No device (inflatable and appropriately shaped vaginal balloon, a hand pump to blow up the balloon, a pressure gauge allowing visual feedback of balloon pressure, a hose connecting the balloon to the pressure gauge and safety air valve). The aim of this device was to stretch and strengthen the pelvic floor muscles. Inflated by patient to a point short of painful sensation, then VPFMC against the resistance of the balloon with visual feedback. 2. Controls (n=73): no device.
Outcomes	Measured at average of 7.4 (SD 1.9) months postpartum. Primary endpoint: approximately 7 months postpartum. Primary outcome measure: not stated. Outcome measures: questionnaire (urinary incontinence, anorectal incontinence, peri-anal pain), Oxford score for pelvic floor muscle (left and right), anal pressure measurement, endoanal sonography, bladder neck mobility.
Notes	Losses to follow up: PFMT 12 of 71, control 22 of 73 (total 24%). In addition, 2 women were excluded from analysis due to lack of delivery data.

Dannecker 2004 (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Dumoulin 2004

Methods	2-arm RCT. Stratified by severity of incontinence (5-10g urine loss, >10g urine loss) and parity (primipara, multipara). Allocation generation: random, low risk of bias. Allocation concealment: unclear, moderate risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome pad test): blind, low risk of bias. Losses to follow up at primary endpoint (9 weeks after treatment began): less than 10%, low risk of bias. Analysed in group to which assigned: unclear, moderate risk of bias. A priori power calculation.
Participants	64 postnatal women with persistent stress urinary incontinence symptoms (and urodynamic stress incontinence) 3 months or more after last delivery. Inclusion: younger than 45 years, pre-menopausal, symptoms of stress urinary incontinence once per week 3 months or more after last delivery, willing to participate in trial. Exclusion: urinary incontinence before pregnancy, previous surgery for stress incontinence, neurologic or psychiatric disease, major medical condition, taking medication that would interfere with evaluation or treatment, current pregnancy, inability to understand French or English instructions, moderate to severe pelvic organ prolapse (POPQ of stage II or more), post void residual of more than 50ml, less than 5g leakage on stress test (250ml bladder volume and 20-minute pad test with 10 jumping jacks substituted for standard jumping exercises), detrusor overactivity on urodynamics. Age: median age 36 years (IQR 23 to 39) for PFMT and 36 years (IQR 34 to 38) for controls. Parity: median 2 (IQR 2 to 3) for PFMT and 2 (IQR 1 to 3) for controls. BMI: median 24 (IQR 23 to 26) for PFMT and 24 (IQR 22 to 26) for controls. Incontinence prior to pregnancy: none (see exclusion criteria). Setting: single centre, Canada.
Interventions	1. PFMT as part of multimodal pelvic floor rehabilitation (n=21): programme taught by physiotherapist. For details of PFMT programme see Additional table 01. In addition to home PFMT this group had: 15 minutes of electrical stimulation (biphasic rectangular form, 50Hz, pulse width 250 microseconds, duty cycle 6 seconds on and 18 seconds off for first 4 weeks, then 8 seconds on and 24 seconds off for next 4 weeks, at maximal tolerated current intensity), and 25 minutes of PFMT with electromyographic biofeedback weekly for 8 weeks. 2. Control (n=20): relaxation massage of back and extremities by physiotherapist, asked not to exercise pelvic floor muscles at home. Same number of contacts with health professional as PFMT group. Offered treatment at end of study. 3. PFMT as part of multimodal pelvic floor rehabilitation and transversus abdominus muscle contraction (n=23): This comparison group not included in the review.

Dumoulin 2004 (*Continued*)

Outcomes	Measured 9 weeks after intervention began. Primary endpoint: 9 weeks. Primary outcome measure: modified 20 minute pad test with standardized bladder volume. Secondary outcome measures: perceived burden of incontinence (visual analogue scale), Urogenital Distress Inventory, Incontinence Impact Questionnaire, pelvic floor muscle dynamometry.
Notes	Losses to follow up at 9 weeks: PFMT 1 of 21, and controls 1 of 20 (and with 0 of 23 from third arm, total 3%).

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Ewings 2005

Methods	2-arm RCT. Allocation generation: random, low risk of bias. Allocation concealment: adequate, low risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome self-reported incontinence by questionnaire): unclear, moderate risk of bias. Losses to follow up at primary endpoint (6 months postpartum): 10% to 19.9%, moderate risk of bias. Analysed in group to which assigned: yes, low risk of bias. Pilot study - no a priori power calculation.
Participants	234 women recruited from postnatal wards. Inclusion: women who delivered in a 19 week period from November 2001 to March 2002, scoring 9 or higher on the 'Sandwell Incontinence Followng Childbirth Risk Assessment Tool (SIFCRAT) and/or already experiencing incontinence. Exclusion: stillbirth, baby at high risk (e.g. very low birth weight), mother less than 16 years of age, insufficient comprehension to complete study documentation, mother or midwife requesting treatment from physiotherapist for incontinence. Age: 48% of PFMT and 45% of controls aged 20 to 29 years. Parity: 39% of PFMT and 36% of controls primiparous. BMI: 35% of PFMT and 39% of controls BMI of 26 or more. Incontinence before or during most recent pregnancy: 65% of PFMT and 62% of controls. Setting: single centre, UK.

Ewings 2005 (*Continued*)

Interventions	1. PFMT (n=117): taught one to one with physiotherapist in hospital, with invitation to attend PFMT group at 2 and 4 months after delivery. No details of PFMT programme given. 2. Control (n=117): usual postnatal care including verbal promotion of postnatal PFMT and leaflet explaining how to do PFMT.
Outcomes	Measured at 6 months postpartum. Primary endpoint: 6 months postpartum. Primary outcome measure: some or no problem with stress urinary incontinence (dichotomised response from single question from Bristol Female Lower Urinary Tract Symptom questionnaire).
Notes	Losses to follow up at 6 months: PFMT 27 of 117, controls 17 of 117 (total 19%).

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	A - Adequate

Glazener 2001

Methods	2-arm RCT. Stratified by parity (less than 4, or 4 or more), method of delivery (caesarean or other), and frequency of urinary incontinence (less than once a week, or once or more per week). Allocation generation: random, low risk of bias. Allocation concealment: adequate, low risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome self-reported incontinence in anonymised questionnaire): blind, low risk of bias. Losses to follow up at primary endpoint (12 months postpartum): 20% or more, high risk of bias. Analysed in group to which assigned: yes, low risk of bias. A priori power calculation.
Participants	747 women with symptoms of urinary incontinence at 3 months postpartum. Inclusion: women with any urinary incontinence in the preceding month. Exclusion: stillbirth, neonatal death. Age: mean age 30 years (SD 5) for PFMT and 29 years (SD 5) for controls. Parity: 36% PFMT and 37% controls primiparous. Delivery: 14% PFMT and 14% controls assisted vaginal delivery, and 8% PFMT and 7% controls caesarean section. Urinary incontinence prior to index delivery: 36% PFMT and 33% controls. Setting: 3 centres (Dunedin, Aberdeen, Birmingham) in two countries (New Zealand and UK).

Glazener 2001 (*Continued*)

Interventions	1. PFMT (n=371): home visit from nurse, health visitor or continence advisor at 5, 7, and 9 months for instruction and supervision of PFMT. For details of PFMT programme see Additional table 01. Also education on pelvic floor anatomy. Frequency and urgency strategies were added at second or third visits if appropriate. Referral to primary care physician for women whose symptoms were not typical of stress, urge or mixed urinary incontinence, or had evidence of urinary tract infection. 2. Control (n=376): usual postnatal care that may have included advice on PFMT.
Outcomes	Measured at 12 months postpartum and 6 years after index delivery. Primary endpoint: 12 months postpartum. Primary outcome measure: self-reported urinary incontinence. Secondary outcome measures: severity of incontinence (visual analogue scale), faecal incontinence, use and frequency of PFMT, use of pads, general well being, Hospital Anxiety and Depression score.
Notes	Losses to follow up at 12 months: PFMT 92 of 371, control 131 of 376 (total 30%). Losses to follow up at 6 years: PFMT 108 of 371, control 123 of 376 (total 31%)

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Gorbea 2004

Methods	2-arm RCT. Allocation generation: method unclear, moderate risk of bias. Allocation concealment: adequate, low risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome self-reported urinary incontinence): unclear, moderate risk of bias. Losses to follow up at primary endpoint (6 weeks postpartum): less than 10%, low risk of bias. Analysed in group to which assigned: unclear, moderate risk of bias. A priori power calculation.
Participants	75 pregnant nulliparous women. Inclusion: aged 15 to 35 years without stress urinary incontinence at 20 weeks gestation. Exclusion: multiple pregnancy, two or more caesarean births, oligohydramnios or polyhydramnios, cervical incompetence, maternal-fetal isoimmunisation, severe pregnancy induced hypertension, chronic degenerative conditions affecting pelvic floor function such as diabetes mellitus and multiple sclerosis. Age: mean age 26 years (SD 6) for PFMT and 24 years (SD 7) for controls. Parity: mean 1.4 (SD 0.8) for PFMT and 1.4 (SD 0.7) for controls. Weight at 35 weeks gestation: mean 66kg (SD 7) for PFMT and 66kg (SD 13) for controls. Prior incontinence: none (see inclusion criteria). Setting: single centre, Mexico.

Gorbea 2004 (*Continued*)

Interventions	1. PFMT (n=38 after dropouts): taught by physiotherapist. Eight one-hour visits over 8 weeks, then weekly phone calls. For details of PFMT programme see Additional table 01. Also information about anatomy and physiology of lower urinary tract, and biofeedback from surface electromyography electrodes (either side of anus) at clinic visits. 2. Control (n=34 after dropouts): requested not to perform PFMT during pregnancy or postpartum.
Outcomes	Measured at 28 and 35 weeks gestation, and 6 weeks postpartum. Primary endpoint: 6 weeks postpartum. Primary outcome measure: urinary incontinence. Secondary outcome measures: frequency of incontinence, severity of incontinence, electromyography.
Notes	Losses to follow up: 3 of 75 (total 4%) - data not available by group.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Hughes 2001

Methods	2-arm RCT. Allocation generation: random, low risk of bias. Allocation concealment: unclear, moderate risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome self-reported incontinence on validated questionnaire): unclear, moderate risk of bias. Losses to follow up at primary endpoint (6 months postpartum): 20% or more, high risk of bias. Analysed in group to which assigned: yes, low risk of bias.
Participants	1169 pregnant nulliparous women. Inclusion: pregnant nulliparous women at 20 weeks gestation. Exclusion: diabetes, neurological conditions, previous bladder surgery or investigations. Age: median age 28 years (IQR 24-31) for PFMT and 28 years (IQR 25-31) for controls. Parity: all nulliparous. BMI: median 23.2 (IQR 21.2-26.3) for PFMT and 23.5 (IQR 21.6-25.7) for controls. Stress incontinence prior to pregnancy: 1.5% of PFMT and 1.4% of controls. Stress incontinence by 20 weeks: 22% of PFMT and 30% of controls. Setting: single centre, UK.
Interventions	1. PFMT (n=586): one individual appointment with physiotherapist that included tuition in use of perineometer, information on anatomy/physiology, and vaginal palpation of VPFMC, and one PFMT group session (maximum 6 women) with senior obstetric physiotherapist between 22 and 25 weeks.

Hughes 2001 (*Continued*)

	Written instructions for antenatal and postnatal daily home PFMT. No details of PFMT programme given. 2. Control (n=583): routine community antenatal care, including usual information about PFMT.
Outcomes	Measured at 6 weeks, 3, and 6 months postpartum. Primary endpoint: 6 months postpartum. Primary outcome measure: not stated. Outcome measures: Bristol Female Urinary Tract Symptoms Questionnaire (B-FLUTS), additional questions about bowel function.
Notes	Losses to follow up at 6 weeks postpartum: 238 of 586 PFMT and 217 of 583 controls (total 40%). Losses to follow up at 3 months postpartum: 178 of 586 PFMT and 139 of 583 controls (total 27%). Losses to follow up at 6 months postpartum: 203 of 586 PFMT and 189 of 583 controls (total 34%).

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Meyer 2001

Methods	2-arm RCT. Allocation generation: method unclear, moderate risk of bias. Allocation concealment: unclear, moderate risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome not stated): unclear, moderate risk of bias. Losses to follow up: unclear, moderate risk of bias. Analysed in group to which assigned: unclear, moderate risk of bias. A prior power calculation.
Participants	107 pregnant nulliparous women (not clear if this is number recruited, or number analysed). Inclusion: pregnant nulliparous women between 12 and 39 weeks gestation at enrolment. Exclusion: pregnancy complications (twin gestation, diabetes, preterm labour, haemorrhage from low-lying placenta), those beginning labour, history of urinary tract infections. Age: mean 29 years (SD 4) - data not available by group. Parity: all nulliparous. Delivery: 30% PFMT and 16% controls forceps delivery. Incontinence at enrolment: 28% PFMT and 32% controls. Setting: multiple clinics in single centre, Switzerland.
Interventions	1. PFMT as part of pelvic floor muscle rehabilitation programme (n=51 after dropouts?): taught by physiotherapist. Begun at 2 months and ended at 10 months postpartum. No detail of PFMT programme given. PFMT in clinic was followed by 20 minutes of biofeedback, and 15 minutes of electrical stimulation

Meyer 2001 (*Continued*)

	(vaginal electrode, biphasic rectangular waveform, pulse width 200-400 microseconds, frequency 50Hz, intensity 15 - 15mA, contraction time 6 seconds, rest time 12 seconds). 2. Control (n=56 after dropouts?): no postpartum pelvic floor muscle rehabilitation programme.
Outcomes	Measured at 10 months postpartum. Primary endpoint: 10 months postpartum. Primary outcome measure: not stated. Outcome measures: self-reported urinary or faecal incontinence, sexual response, vaginal digital pelvic floor muscle palpation (graded 0-5), ultrasonography (bladder volume, bladder neck position at rest, on Valsalva, and with VPFMC supine and standing), urodynamics (functional urethral length, maximal urethral closure pressure at stress, area of continence at stress - area between baseline and cough spike on urethral closure pressure profile, mean value of pressure transmission ratio in central third of functional urethral length), vaginal and anal squeeze pressure.
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Morkved 2003

Methods	2-arm RCT. Allocation generation: method unclear, moderate risk of bias. Allocation concealment: adequate, low risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome self-reported symptoms): blind, low risk of bias. Losses to follow up at primary endpoint (3 months postpartum: less than 10%, low risk of bias. Analysis in group to which assigned: yes, low risk of bias. A priori power calculation.
Participants	301 pregnant nulliparous women. Inclusion: 18 weeks gestation, 18 years or older, single live fetus at 18 week ultrasound. Exclusion: pregnancy complications, high risk for preterm labour, pain during VPFMC, ongoing urinary tract infection, diseases that could interfere with participation, lived too far from centre to attend weekly class. Age: mean 28 years (SD 5) for PFMT and 27 years (SD 4) for controls. Parity: all nulliparous. BMI before pregnancy: mean 23 (SD 3) for PFMT and 23 (SD 4) for controls. Incontinence before intervention began: 32% PFMT and 31% controls. Setting: single centre, Norway.

Morkved 2003 (*Continued*)

Interventions	1. PFMT (n=148): individual instruction in pelvic floor anatomy from physiotherapist. 60-minute class (10-15 women) once per week with physiotherapist for 12 weeks from 20 to 36 weeks gestation. Class included PFMT (see Additional table 01 for details) and body awareness, breathing, relaxation, and strength training for abdominal, back, and thigh muscles. 2. Control (N=153): customary information given by midwife or general practitioner. Not discouraged from doing PFMT on their own.
Outcomes	Measured at 36 weeks gestation and 3 months postpartum. Primary endpoint: 3 months postpartum. Primary outcome measure: self-reported incontinence. Secondary outcome measures: leakage episodes (3 day urinary diary), change in leakage (Likert scale), vaginal digital palpation, vaginal squeeze pressure.
Notes	Losses to follow up at 3 months postpartum: PFMT 5 of 148, controls 7 of 153 (total 4%).

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Reilly 2002

Methods	2-arm RCT. Allocation generation: random, low risk of bias. Allocation concealment: unclear, moderate risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome self-reported incontinence): blind, low risk of bias. Losses to follow up at primary endpoint (3 months postpartum): 10% to 19.9%, moderate risk of bias. Analysed in group to which assigned: yes, low risk of bias. A priori power calculation.
Participants	268 primigravid women. Inclusion: 20 weeks gestation, bladder neck hypermobility (more than 5mm linear movement following standardised Valsalva) on perineal ultrasound. Exclusion: pre-pregnancy urinary incontinence, neurological disorder. Age: median 27 years (range 17-42) for PFMT and 29 years (range 16-47) for controls. Parity: all primigravid. BMI: mean 25 (SD 4) for PFMT and 24 (SD 4) for controls. Prior incontinence: none. Setting: Single centre, UK.

Reilly 2002 (*Continued*)

Interventions	1. PFMT (n=139): taught by physiotherapist. One to one monthly appointments until delivery. For details of PFMT programme see Additonal table 01. Also likely to have received verbal advice on PFMT from midwives at antenatal classes. Instructed to use VPFMC with every cough and sneeze. Those unable to follow PFMT protocol due to inability to contract the pelvic floor muscles had an individualised programme until able to follow the study regimen. 2. Control (n=129): likely to have received verbal advice on PFMT from midwives at antenatal classes. Probably monthly clinic visits for measurement of bladder neck mobility and vaginal squeeze pressure (perineometry).
Outcomes	Measured monthly from 20 weeks (vaginal squeeze pressure, bladder neck mobility and joint hypermobility, and urinary symptoms at 34 weeks gestation), and 3 months postpartum. Primary endpoint: 3 months postpartum. Primary outcome measure: self-reported stress urinary incontinence. Secondary outcome measures: one-hour ICS pad test at home, vaginal squeeze pressure, bladder neck mobility with perineal US, joint hypermobility, striae (graded 1 to 3), SF36, King's Health Questionnaire.
Notes	Losses to follow up at 3 months postpartum: PFMT 19 of 139, control 19 of 129 (total 14% for primary outcome).

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Sampselle 1998

Methods	2-arm RCT. Allocation generation: random, low risk of bias. Allocation concealment: adequate, low risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome not stated): blind (for primary outcome of review), low risk of bias. Losses to follow up at primary endpoint (12 months postpartum): 20% or more, high risk of bias. Analysed in group to which assigned: yes, low risk of bias.
Participants	72 primigravid women. Inclusion: 20 weeks gestation, no history of genitourinary pathology, plan to remain in region for 12 months postpartum, ability to read and understand English. Exclusion: history of genitourinary pathology (including severe incontinence) or neuromuscular pathology. Age: mean 28 years (SD 6) for PFMT and 26 years (SD 5) for controls. Parity: all primigravid. Positive standing stress test when recruited: 23% PFMT and 21% controls.

Sampselle 1998 (*Continued*)

	Setting: single centre, USA.
Interventions	1. PFMT (n=34): standardised instruction in PFMT. For details of PFMT programme see Additional table 01. 2. Control (n=38): usual care with no systematic PFMT programme.
Outcomes	Measured at 35 weeks gestation, 6 weeks postpartum, 6 and 12 months postpartum. Primary endpoint: 12 months postpartum. Primary outcome measure: not stated. Outcome measures: best of two maximal VPFMC measured using instrumented speculum (Newtons), severity of incontinence (average score from questionnaire where 0=none, 1=damp, 2=wet and 3=soaked with gentle cough, hard cough, sneeze and laugh), self-reported adherence.
Notes	Losses to follow up at 12 months postpartum: PFMT 12 of 34, control 14 of 38 (total 36%).

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	A - Adequate

Skelly 2004

Methods	2-arm RCT. Allocation generation: method unclear, moderate risk of bias. Allocation concealment: unclear, moderate risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome self-reported incontinence by questionnaire): unclear, moderate risk of bias. Losses to follow up: unclear, moderate risk of bias. Analysed in group to which assigned: unclear, moderate risk of bias.
Participants	Unspecified number of women with antenatal urinary incontinence. Inclusion: none stated in addition to above. Exclusion: none stated. Age: not stated. Parity: not stated. Setting: single centre, Canada.
Interventions	1. PFMT (n=?): one to one teaching about PFMT. No further details given. 2. Control (n=?): handout information about PFMT.

Skelly 2004 (*Continued*)

Outcomes	Measured at 1, 6, and 12 months postpartum. Primary endpoint: not stated. Primary outcome measure: urinary incontinence. Secondary outcome measures: not stated.
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Sleep 1987

Methods	2-arm RCT. Allocation generation: method unclear, moderate risk of bias. Allocation concealment: unclear, moderate risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome not stated): unclear, moderate risk of bias. Losses to follow up at primary endpoint (3 months postpartum): 10% to 19.9%, moderate risk of bias. Analysed in group to which assigned: yes, low risk of bias. A priori power calculation.
Participants	1800 women recruited from postnatal wards. Inclusion: within 24 hours of delivery, vaginal delivery. Exclusion: stillbirth or seriously ill baby. Age: mean 27.1 years (SD 5.3) PFMT and 26.2 years (SD 5.3) controls. Parity: 49% PFMT and 50% controls primiparous. Delivery: 20% PFMT and 16% controls instrumental delivery. Antenatal incontinence: 32% PFMT and 29% controls. Setting: single centre, UK.
Interventions	1. PFMT (n=900): one individual session daily with midwife coordinator while in hospital. Four-week health diary including section recommending specific exercise each week that integrated VPFMC with activities of daily living. No further details of PFMT programme. 2. Control (n=900): usual antenatal and postnatal care that included instruction in PFMT at antenatal class and by obstetric physiotherapist in postnatal classes on the ward. PFMT instruction included awareness, VPFMC as often as remembered, and midstream urine stop. Four-week health diary without additional section on PFMT.
Outcomes	Measured at 3 and 12 months postpartum. Primary endpoint: 3 months postpartum. Primary outcome measure: not stated.

Sleep 1987 (*Continued*)

	Outcome measures: use of PFMT, self-reported urinary incontinence, frequency of leakage, perineal pain and severity of pain, time to resume sexual intercourse, dyspareunia, faecal incontinence, general wellbeing.
Notes	Losses to follow up at 3 months postpartum: PFMT 81 of 900, control 108 of 900 (total 11%).

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Stothers 2002

Methods	2-arm RCT. Allocation generation: method unclear, moderate risk of bias. Allocation concealment: unclear, moderate risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome pad test): blind, low risk of bias. Losses to follow up at primary endpoint (6 months postpartum): unclear, moderate risk of bias. Analysed in group to which assigned: unclear, moderate risk of bias.
Participants	86 pregnant women (not clear if this is number recruited, or number analysed). Inclusion: no further criteria stated. Exclusion: multiple birth, pre-existing incontinence, medical conditions preventing exercise regimes during pregnancy. Age: range 24-42 years. Parity: not stated. Pre-existing incontinence: none. Setting: single centre, Canada.
Interventions	1. PFMT (n=43): seen twice monthly during pregnancy and every 3 months postpartum for one year. By physiotherapist? No further details given. 2. Control (n=43): same number of contacts. Treatment described as "other (placebo) including no pelvic floor exercises".
Outcomes	Measured at 6 and 12 months postpartum. Primary endpoint: 6 months postpartum. Primary outcome measure: mean urine loss on stress test with standardised bladder volume. Secondary outcome measures: not stated.
Notes	

Risk of bias

Stothers 2002 (*Continued*)

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Wilson 1998

Methods	2-arm RCT (NB: usual care versus individual treatment; the individual treatment group was further randomised into 3 producing 4 comparison groups in total). Stratified by parity (1 to 3, 4 or more), number of leakage episodes (less than 1 per day, 1 or more per day), and type of delivery (vaginal, caesarean). Allocation generation: random, low risk of bias. Allocation concealment: adequate, low risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome not stated): unclear (for primary outcomes of review), moderate risk of bias. Losses to follow up at primary endpoint (12 months postpartum): 20% or more, high risk of bias. Analysed in group to which assigned: yes, low risk of bias.
Participants	230 women with urinary incontinence symptoms 3 months postpartum. Inclusion: none stated in addition to above. Exclusion: none stated. Age: mean 29 years (95% CI 28.8-29.2) for individual treatment and 27.8 (95% CI 27.0-28.7) for controls. Parity: 28% of individual treatment and 33% of controls primiparous. Delivery: 50% PFMT and 56% controls perineal trauma, and 18% PFMT and 17% controls caesarean section. Less than 1 leakage episode per day: 89% PFMT and 89% controls. Setting: single centre, New Zealand.
Interventions	1. Individual treatment (n=113): further randomised into (a) individualised PFMT (n=39), (b) individualised PFMT with vaginal cones (n=38), and (c) vaginal cones. In group (a) the PFMT comprised individual instruction by physiotherapist at 3, 4, 6 and 9 months postpartum with use of perineometer at each visit for biofeedback. For details of PFMT programme see Additional table 01. 2. Control (n=117): usual care comprising PFMT as taught by physiotherapists in antenatal classes (one occasion) or daily classes on the postnatal wards (or audiotape at the weekend).
Outcomes	Measured at 12 months postpartum. Primary endpoint: 12 months postpartum. Primary outcome measure: not stated. Outcome measures: vaginal squeeze pressure (perineometer, mean of three maximal contractions), urinary and faecal incontinence, frequency of incontinence, frequency and amount of PFMT, general wellbeing, sexual satisfaction, home pad test.

Wilson 1998 (*Continued*)

Notes	Losses to follow up at 12 months: individual treatment 59 of 113 (20 of 38 PFMT, 24 of 38 PFMT with cones, 15 of 36 cones), control 26 of 117 (total 37%).

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Woldringh 2007

Methods	2-arm RCT. Stratified by midwife centre. Allocation generation: method unclear, moderate risk of bias. Allocation concealment: unclear, moderate risk of bias. Blinding of participants: not feasible, high risk of bias. Blinding of therapist: not feasible, high risk of bias. Blinded outcome assessment (primary outcome severity of incontinence): unclear, moderate risk of bias. Losses to follow up at primary endpoint (12 months postpartum): 20% or more, high risk of bias. Analysed in group to which assigned: yes, low risk of bias. A priori power calculation.
Participants	264 pregnant women. Inclusion: already affected by urinary incontinence (at least two leakage episodes in the last month). Exclusion: already receiving treatment for urinary incontinence, co-morbidity (type(s) not stated), insufficient knowledge of Dutch language. Age: mean age 31.9 years (95% CI 31.1-32.7) for PFMT and 32.6 years (95% CI 32.0-33.3) for controls. Parity: 38% of PFMT and 34% of controls nulliparous. BMI: mean 24.0 (95% CI 23.2-24.8) for PFMT and 23.5 (95% CI 22.9-24.1) for controls. Urinary incontinence before pregnancy: 53% PFMT and 52% controls. Setting: multiple centre, The Netherlands.
Interventions	1. PFMT (n=112): taught by physiotherapists specialised in PFMT (using a treatment manual prepared for the study in accordance with guidelines from the Dutch Society of Physiotherapists). Four half-hour visits - three between 23 and 30 weeks gestation and one 6 weeks postpartum. Included observation and palpation of perineal body with VPFMC, information to raise awareness of pelvic floor muscles and encourage PFMT, self palpation encouraged. Also 40-page handbook with information about incontinence, pelvic floor muscle function, detailed instructions on PFMT. No further details of PFMT. 2. Control (n=152): routine care for pregnant women. Nearly two thirds received some instruction on PFMT.
Outcomes	Measured at 35 weeks, 8 weeks postpartum, 6 months, and 12 months postpartum. Primary endpoint: 12 months postpartum. Primary outcome measure: severity of urinary incontinence (combination of severity of urine loss from 7-day bladder diary and score from PRAFAB questionnaire).

Woldringh 2007 (*Continued*)

	Secondary outcome measure: Incontinence Impact Questionnaire.
Notes	Losses to follow up at 35 weeks: PFMT 19 of 112, control 21 of 152 (total 15%). Losses to follow up at 8 weeks postpartum: PFMT 25 of 112, control 27 of 152 (total 20%). Losses to follow up at 6 months postpartum: PFMT 33 of 112, control 44 of 152 (total 29%). Losses to follow up at 12 months postpartum: PFMT 47 of 112, control 53 of 152 (total 38%).

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

BMI - body mass index kg/m sq., CI - confidence interval, ICS - International Continence Society, IQR - interquartile range, PFMT - pelvic floor muscle training, POPQ - pelvic organ prolapse quantified, RCT - randomised controlled trial, SD - standard deviation, VPFMC - voluntary pelvic floor muscle contraction.

Characteristics of excluded studies *[ordered by study ID]*

Agur 2005a	RCT. Pregnant women. Usual care versus PFMT. Excluded because did not collect data on urinary or faecal incontinence. Primary outcome of interest was duration of second-stage labour.
Culligan 2005	RCT. Primigravid women. Sham versus active extracorporeal magnetic innervation after delivery; both groups did PFMT during pregnancy. Excluded because comparison of sham and active stimulation.
Dougherty 1989	RCT. Postnatal women within 6-11 weeks of vaginal delivery. PFMT with intravaginal balloon device versus no treatment. Excluded because did not collect data on urinary or faecal incontinence.
Fynes 1999	RCT. Postnatal women with faecal incontinence following obstetric trauma. Sensory feedback versus audiovisual feedback (including electrical stimulation); both groups did PFMT. Excluded because comparison of two types of feedback.

(*Continued*)

Gouldthorpe	RCT. Primiparous women. Abdominal muscle exercise versus no abdominal exercise. Excluded because not PFMT.
Jonasson 1989	RCT. Postnatal women "without complications" at 8 weeks following delivery PFMT versus vaginal cones. Excluded because did not collect data on urinary or faecal incontinence.
Jonasson 1992	RCT. "Healthy" postnatal women following uncomplicated vaginal delivery. PFMT versus vaginal cones. Excluded because did not collect data on urinary or faecal incontinence.
Mahony 2004	RCT. Postnatal women with faecal incontinence. Biofeedback versus biofeedback augmented with stimulation; both groups did PFMT. Excluded because comparison of two types of feedback.
Mason 1999b	RCT. Primiparous women recruited from postnatal wards. Conventional versus intensive physiotherapy. Excluded because cannot find any trial report (only record of trial on Medical Research Council trials database) and no response to letter to primary author.
Nielsen 1988	RCT. Primiparous women. PFMT versus no PFMT. Excluded because did not collect data on urinary or faecal incontinence.
Norton 1990	RCT. Primiparous women 6 weeks postnatal. PFMT versus vaginal cones versus controls. Excluded because did not collect data on urinary or faecal incontinence.
Thorp 1994	RCT. Nulliparous women recruited through advertisement. Not clear if PFMT or vaginal cones versus controls. Excluded because it was not clear whether the intervention was PFMT or vaginal cones, nor were data on urinary or faecal incontinence collected.

RCT - randomised controlled trial.

DATA AND ANALYSES

Comparison 1. PFMT versus control for prevention of incontinence

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery)	3	307	Risk Ratio (M-H, Fixed, 95% CI)	0.44 [0.30, 0.65]
1.1 Began supervised PFMT antenatally	3	307	Risk Ratio (M-H, Fixed, 95% CI)	0.44 [0.30, 0.65]
2 Urinary incontinence early postnatal period (less than 12 weeks)	2	118	Risk Ratio (M-H, Fixed, 95% CI)	0.50 [0.31, 0.80]
2.1 Began supervised PFMT antenatally	2	118	Risk Ratio (M-H, Fixed, 95% CI)	0.50 [0.31, 0.80]
2.2 Began supervised PFMT postnatally	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months)	4	553	Risk Ratio (M-H, Fixed, 95% CI)	0.71 [0.52, 0.97]
3.1 Began supervised PFMT antenatally	4	553	Risk Ratio (M-H, Fixed, 95% CI)	0.71 [0.52, 0.97]
3.2 Began supervised PFMT postnatally	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months)	1	44	Risk Ratio (M-H, Fixed, 95% CI)	1.20 [0.65, 2.21]
4.1 Began supervised PFMT antenatally	1	44	Risk Ratio (M-H, Fixed, 95% CI)	1.20 [0.65, 2.21]
4.2 Began supervised PFMT postnatally	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5 Faecal incontinence postnatal period	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.1 Began supervised PFMT antenatally	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.2 Began supervised PFMT postnatally	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6 Quality of life and health status measures			Other data	No numeric data
6.1 Began supervised PFMT antenatally			Other data	No numeric data
7 Incontinence severity			Other data	No numeric data
7.1 Began supervised PFMT antenatally			Other data	No numeric data
8 Pelvic floor muscle function			Other data	No numeric data

8.1 Began supervised PFMT antenatally		Other data	No numeric data
9 Delivery outcome		Other data	No numeric data
9.1 Began supervised PFMT antenatally		Other data	No numeric data

Comparison 2. PFMT versus control for treatment of incontinence

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery)	1	224	Risk Ratio (M-H, Fixed, 95% CI)	0.92 [0.82, 1.04]
1.1 Began supervised PFMT antenatally	1	224	Risk Ratio (M-H, Fixed, 95% CI)	0.92 [0.82, 1.04]
2 Urinary incontinence early postnatal period (less than 12 weeks)	1	212	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.77, 1.22]
2.1 Began supervised PFMT antenatally	1	212	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.77, 1.22]
2.2 Began supervised PFMT postnatally	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months)	1	187	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.70, 1.24]
3.1 Began supervised PFMT antenatally	1	187	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.70, 1.24]
3.2 Began supervised PFMT postnatally	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months)	4	837	Risk Ratio (M-H, Fixed, 95% CI)	0.81 [0.73, 0.91]
4.1 Began supervised PFMT antenatally	1	164	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.68, 1.19]
4.2 Began supervised PFMT postnatally	3	673	Risk Ratio (M-H, Fixed, 95% CI)	0.79 [0.70, 0.90]
5 Faecal incontinence postnatal period	2	620	Risk Ratio (M-H, Fixed, 95% CI)	0.52 [0.31, 0.87]
5.1 Began supervised PFMT antenatally	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.2 Began supervised PFMT postnatally	2	620	Risk Ratio (M-H, Fixed, 95% CI)	0.52 [0.31, 0.87]
6 Quality of life and health status measures			Other data	No numeric data
6.1 Began supervised PFMT antenatally			Other data	No numeric data

6.2 Began supervised PFMT postnatally	Other data	No numeric data
7 Incontinence severity	Other data	No numeric data
7.1 Began supervised PFMT antenatally	Other data	No numeric data
7.2 Began supervised PFMT postnatally	Other data	No numeric data
8 Pelvic floor muscle function	Other data	No numeric data
8.1 Began supervised PFMT antenatally	Other data	No numeric data
8.2 Began supervised PFMT postnatally	Other data	No numeric data

Comparison 3. PFMT versus control for (mixed) prevention and treatment of incontinence

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery)	3	1525	Risk Ratio (M-H, Fixed, 95% CI)	0.88 [0.81, 0.96]
1.1 Began supervised PFMT antenatally	3	1525	Risk Ratio (M-H, Fixed, 95% CI)	0.88 [0.81, 0.96]
2 Urinary incontinence early postnatal period (less than 12 weeks)	1	51	Risk Ratio (M-H, Fixed, 95% CI)	0.82 [0.48, 1.40]
2.1 Began supervised PFMT antenatally	1	51	Risk Ratio (M-H, Fixed, 95% CI)	0.82 [0.48, 1.40]
2.2 Began supervised PFMT postnatally	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months)	6	4003	Risk Ratio (M-H, Fixed, 95% CI)	0.93 [0.85, 1.02]
3.1 Began supervised PFMT antenatally	3	1528	Risk Ratio (M-H, Fixed, 95% CI)	0.89 [0.78, 1.02]
3.2 Began supervised PFMT postnatally	3	2475	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.85, 1.09]
4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months)	4	851	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.79, 1.13]
4.1 Began supervised PFMT antenatally	2	175	Risk Ratio (M-H, Fixed, 95% CI)	0.96 [0.70, 1.32]
4.2 Began supervised PFMT postnatally	2	676	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.75, 1.16]
5 Faecal incontinence postnatal period	3	1837	Risk Ratio (M-H, Fixed, 95% CI)	0.91 [0.52, 1.57]
5.1 Began supervised PFMT antenatally	1	121	Risk Ratio (M-H, Fixed, 95% CI)	0.92 [0.06, 14.38]

5.2 Began supervised PFMT postnatally	2	1716	Risk Ratio (M-H, Fixed, 95% CI)	0.91 [0.52, 1.58]
6 Quality of life and health status measures			Other data	No numeric data
6.1 Began supervised PFMT antenatally			Other data	No numeric data
6.2 Began supervised PFMT postnatally			Other data	No numeric data
7 Incontinence severity			Other data	No numeric data
7.1 Began supervised PFMT antenatally			Other data	No numeric data
7.2 Began supervised PFMT postnatally			Other data	No numeric data
8 Pelvic floor muscle function			Other data	No numeric data
8.1 Began supervised PFMT antenatally			Other data	No numeric data
8.2 Began supervised PFMT postnatally			Other data	No numeric data
9 Delivery outcome			Other data	No numeric data
9.1 Began supervised PFMT antenatally			Other data	No numeric data
9.2 Began supervised PFMT postnatally			Other data	No numeric data

Analysis 1.1. Comparison 1 PFMT versus control for prevention of incontinence, Outcome 1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 1 PFMT versus control for prevention of incontinence

Outcome: 1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Gorbea 2004	0/38	14/34		25.9 %	0.03 [0.00, 0.50]
Morkved 2003	13/94	30/99		49.5 %	0.46 [0.25, 0.82]
Sampselle 1998	10/16	19/26		24.5 %	0.86 [0.55, 1.34]
Total (95% CI)	**148**	**159**		**100.0 %**	**0.44 [0.30, 0.65]**
Total events: 23 (PFMT), 63 (Control)					
Heterogeneity: Chi^2 = 11.85, df = 2 (P = 0.003); I^2 =83%					
Test for overall effect: Z = 4.16 (P = 0.000031)					

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 1 PFMT versus control for prevention of incontinence

Outcome: 1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Gorbea 2004	0/38	14/34		25.9 %	0.03 [0.00, 0.50]
Morkved 2003	13/94	30/99		49.5 %	0.46 [0.25, 0.82]
Sampselle 1998	10/16	19/26		24.5 %	0.86 [0.55, 1.34]

Analysis 1.2. Comparison 1 PFMT versus control for prevention of incontinence, Outcome 2 Urinary incontinence early postnatal period (less than 12 weeks).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 1 PFMT versus control for prevention of incontinence

Outcome: 2 Urinary incontinence early postnatal period (less than 12 weeks)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Gorbea 2004	6/38	16/34		53.3 %	0.34 [0.15, 0.76]
Sampselle 1998	9/20	17/26		46.7 %	0.69 [0.39, 1.20]
Subtotal (95% CI)	**58**	**60**		**100.0 %**	**0.50 [0.31, 0.80]**
Total events: 15 (PFMT), 33 (Control)					
Heterogeneity: Chi^2 = 2.17, df = 1 (P = 0.14); I^2 =54%					
Test for overall effect: Z = 2.89 (P = 0.0039)					
2 Began supervised PFMT postnatally					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (PFMT), 0 (Control)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Total (95% CI)	**58**	**60**		**100.0 %**	**0.50 [0.31, 0.80]**

(*Continued* . . .)

(. . . *Continued*)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Total events: 15 (PFMT), 33 (Control)					
Heterogeneity: Chi² = 2.17, df = 1 (P = 0.14); I² =54%					
Test for overall effect: Z = 2.89 (P = 0.0039)					

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 1 PFMT versus control for prevention of incontinence

Outcome: 2 Urinary incontinence early postnatal period (less than 12 weeks)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Gorbea 2004	6/38	16/34		53.3 %	0.34 [0.15, 0.76]
Sampselle 1998	9/20	17/26		46.7 %	0.69 [0.39, 1.20]
Subtotal (95% CI)	**58**	**60**		**100.0 %**	**0.50 [0.31, 0.80]**
Total events: 15 (PFMT), 33 (Control)					
Heterogeneity: Chi² = 2.17, df = 1 (P = 0.14); I² =54%					
Test for overall effect: Z = 2.89 (P = 0.0039)					

Analysis 1.3. Comparison 1 PFMT versus control for prevention of incontinence, Outcome 3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 1 PFMT versus control for prevention of incontinence

Outcome: 3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months)

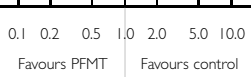
Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Morkved 2003	9/94	13/99		18.4 %	0.73 [0.33, 1.63]
Reilly 2002	23/120	36/110		54.5 %	0.59 [0.37, 0.92]
Sampselle 1998	9/18	13/26		15.4 %	1.00 [0.55, 1.82]
Stothers 2002	7/43	8/43		11.6 %	0.88 [0.35, 2.20]
Subtotal (95% CI)	**275**	**278**		**100.0 %**	**0.71 [0.52, 0.97]**
Total events: 48 (PFMT), 70 (Control)					
Heterogeneity: Chi^2 = 2.14, df = 3 (P = 0.54); I^2 =0.0%					
Test for overall effect: Z = 2.13 (P = 0.033)					
2 Began supervised PFMT postnatally					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (PFMT), 0 (Control)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Total (95% CI)	**275**	**278**		**100.0 %**	**0.71 [0.52, 0.97]**
Total events: 48 (PFMT), 70 (Control)					
Heterogeneity: Chi^2 = 2.14, df = 3 (P = 0.54); I^2 =0.0%					
Test for overall effect: Z = 2.13 (P = 0.033)					

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 1 PFMT versus control for prevention of incontinence

Outcome: 3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Morkved 2003	9/94	13/99		18.4 %	0.73 [0.33, 1.63]
Reilly 2002	23/120	36/110		54.5 %	0.59 [0.37, 0.92]
Sampselle 1998	9/18	13/26		15.4 %	1.00 [0.55, 1.82]
Stothers 2002	7/43	8/43		11.6 %	0.88 [0.35, 2.20]
Subtotal (95% CI)	**275**	**278**		**100.0 %**	**0.71 [0.52, 0.97]**
Total events: 48 (PFMT), 70 (Control)					
Heterogeneity: Chi^2 = 2.14, df = 3 (P = 0.54); I^2 =0.0%					
Test for overall effect: Z = 2.13 (P = 0.033)					



Analysis 1.4. Comparison 1 PFMT versus control for prevention of incontinence, Outcome 4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 1 PFMT versus control for prevention of incontinence

Outcome: 4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Sampselle 1998	10/19	11/25		100.0 %	1.20 [0.65, 2.21]
Subtotal (95% CI)	**19**	**25**		**100.0 %**	**1.20 [0.65, 2.21]**
Total events: 10 (PFMT), 11 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.57 (P = 0.57)					
2 Began supervised PFMT postnatally					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (PFMT), 0 (Control)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Total (95% CI)	**19**	**25**		**100.0 %**	**1.20 [0.65, 2.21]**
Total events: 10 (PFMT), 11 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.57 (P = 0.57)					

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 1 PFMT versus control for prevention of incontinence

Outcome: 4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Sampselle 1998	10/19	11/25		100.0 %	1.20 [0.65, 2.21]
Subtotal (95% CI)	**19**	**25**		**100.0 %**	**1.20 [0.65, 2.21]**
Total events: 10 (PFMT), 11 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.57 (P = 0.57)					

Quality of life and health status measures

Began supervised PFMT antenatally				
Reilly 2002	Kings Health Questionnaire	Not reported	Not reported	"No difference between the study groups on any of the 8 scales, and all mean scores were low"
Reilly 2002	SF36, general health	Mean 84.4, standard deviation 13.5, n=76	Mean 77.2, standard deviation 16.3, n=72	Mean difference 7.2 (95% CI 2.36 to 12.04)

Began supervised PFMT antenatally

Reilly 2002	Kings Health Questionnaire	Not reported	Not reported	"No difference between the study groups on any of the 8 scales, and all mean scores were low"
Reilly 2002	SF36, general health	Mean 84.4, standard deviation 13.5, n=76	Mean 77.2, standard deviation 16.3, n=72	Mean difference 7.2 (95% CI 2.36 to 12.04)

Incontinence severity

Began supervised PFMT antenatally					
Gorbea 2004	Frequency of leakage	Less than weekly, weekly or daily urinary incontinence (not clear if self-reported or from urinary diary)	4 less than weekly, 2 weekly and none with daily leakage, of 38 at 6 weeks postpartum	6 less than weekly, 8 weekly and 2 with daily leakage, of 34 at 6 weeks postpartum	Not calculated as validity/reliability of this measure not known.
Gorbea 2004	Amount of leakage	Positive cough test	None of 38 at 6 weeks postpartum	6 of 34 at 6 weeks postpartum	Relative risk 0.07 (95% CI 0.00 to 1.18)
Gorbea 2004	Other leakage severity	Grade I, II or III leakage, where I=loss of urine with coughing or lifting, II=urine leakage when walking, and III=urine leakage when upright	6 grade I, and none with grade II or III leakge, of 38 at 6 weeks postpartum	10 grade I, 6 grade II, and none grade III leakage, of 34 at 6 weeks postpartum	Not calculated as validity/reliability of this measure not known.
Reilly 2002	Frequency of leakage	Not measured			

Incontinence severity (*Continued*)

Reilly 2002	Amount of leakage	One hour ICS pad test at home, number with pad weight gain 1g or more	7 of 74 at 3 months postpartum	8 of 74 at 3 months postpartum	Relative risk 0.88 (95% CI 0.33 to 2.29)
Reilly 2002	Other leakage severity	Mild, moderate or severe urinary incontinence (not clear how categorised)	19 mild, 3 moderate and 1 severe, of 74 at 3 months postpartum	30 mild, 5 moderate and 1 severe, of 74 at 3 months post partum	Not calculated as validity/reliability of this measure not known.
Sampselle 1998	Frequency of leakage	Not measured			
Sampselle 1998	Amount of leakage	Not measured			
Sampselle 1998	other leakage severity	Average score from questionnaire re urine leakage with gentle cough, hard cough, sneeze and laugh scored 0 for none, 1 for dampness, 2 for wetness and 3 for soaked	Mean 0.30, standard deviation 0.44, n=16 at 12 months postpartum	Mean 0.32, standard deviation 0.41, n=21 at 12 months postpartum	Not calculated as validity/reliability of this measure not known.
Stothers 2002	Frequency of leakage	Leakage episodes in 5 days	Mean 3.4, standard deviation not reported, n=7 at 6 months postpartum	Mean 6.0, standard deviation not reported, n=8 at 6 months postpartum	Not calculable
Stothers 2002	Amount of leakage	Volume of urine loss, in grams, on stress test with standardised bladder volume	Mean 18g, standard deviation not reported, n=? at 6 months postpartum	Mean 38g, standard deviation not reported, n=? at 6 months postpartum	Not calculable
Stothers 2002	Other leakage severity	Not measured			

Began supervised PFMT antenatally

Gorbea 2004	Frequency of leakage	Less than weekly, weekly or daily urinary incontinence (not clear if self-reported or from urinary diary)	4 less than weekly, 2 weekly and none with daily leakage, of 38 at 6 weeks postpartum	6 less than weekly, 8 weekly and 2 with daily leakage, of 34 at 6 weeks postpartum	Not calculated as validity/reliability of this measure not known.

Began supervised PFMT antenatally (*Continued*)

Gorbea 2004	Amount of leakage	Positive cough test	None of 38 at 6 weeks postpartum	6 of 34 at 6 weeks postpartum	Relative risk 0.07 (95% CI 0.00 to 1.18)
Gorbea 2004	Other leakage severity	Grade I, II or III leakage, where I=loss of urine with coughing or lifting, II=urine leakage when walking, and III=urine leakage when upright	6 grade I, and none with grade II or III leakge, of 38 at 6 weeks postpartum	10 grade I, 6 grade II, and none grade III leakage, of 34 at 6 weeks postpartum	Not calculated as validity/reliability of this measure not known.
Reilly 2002	Frequency of leakage	Not measured			
Reilly 2002	Amount of leakage	One hour ICS pad test at home, number with pad weight gain 1g or more	7 of 74 at 3 months postpartum	8 of 74 at 3 months postpartum	Relative risk 0.88 (95% CI 0.33 to 2.29)
Reilly 2002	Other leakage severity	Mild, moderate or severe urinary incontinence (not clear how categorised)	19 mild, 3 moderate and 1 severe, of 74 at 3 months postpartum	30 mild, 5 moderate and 1 severe, of 74 at 3 months post partum	Not calculated as validity/reliability of this measure not known.
Sampselle 1998	Frequency of leakage	Not measured			
Sampselle 1998	Amount of leakage	Not measured			
Sampselle 1998	other leakage severity	Average score from questionnaire re urine leakage with gentle cough, hard cough, sneeze and laugh scored 0 for none, 1 for dampness, 2 for wetness and 3 for soaked	Mean 0.30, standard deviation 0.44, n=16 at 12 months postpartum	Mean 0.32, standard deviation 0.41, n=21 at 12 months postpartum	Not calculated as validity/reliability of this measure not known.
Stothers 2002	Frequency of leakage	Leakage episodes in 5 days	Mean 3.4, standard deviation not reported, n=7 at 6 months postpartum	Mean 6.0, standard deviation not reported, n=8 at 6 months postpartum	Not calculable
Stothers 2002	Amount of leakage	Volume of urine loss, in grams, on stress test with standardised bladder volume	Mean 18g, standard deviation not reported, n=? at 6 months postpartum	Mean 38g, standard deviation not reported, n=? at 6 months postpartum	Not calculable

Began supervised PFMT antenatally (*Continued*)

Stothers 2002	Other leakage severity	Not measured			

Pelvic floor muscle function

Began supervised PFMT antenatally				
Gorbea 2004	A nil or minimal contraction on electromyography (not clear what type of electromyography or how categorised)	14 of 14 at 6 weeks postpartum	10 of 12 at 6 weeks postpartum	Not calculated as validity/reliability of this measure not known.
Reilly 2002	Vaginal squeeze pressure, in cm water	Mean 11.5, standard deviation 7.9, n=68 at 3 months postpartum	Mean 10.5, standard deviation 5.5, n=64 at 3 months postpartum	Mean difference 1.00 (95% CI -1.31 to 3.31)

Began supervised PFMT antenatally

Gorbea 2004	A nil or minimal contraction on electromyography (not clear what type of electromyography or how categorised)	14 of 14 at 6 weeks postpartum	10 of 12 at 6 weeks postpartum	Not calculated as validity/reliability of this measure not known.
Reilly 2002	Vaginal squeeze pressure, in cm water	Mean 11.5, standard deviation 7.9, n=68 at 3 months postpartum	Mean 10.5, standard deviation 5.5, n=64 at 3 months postpartum	Mean difference 1.00 (95% CI -1.31 to 3.31)

Delivery outcome

Began supervised PFMT antenatally				
Gorbea 2004	Type of delivery	16 vaginal and 22 caesarean deliveries, n=38	22 vaginal and 12 caesarean deliveries, n=38	Relative risk 1.83 (95% CI 1.07 to 3.15)

Began supervised PFMT antenatally

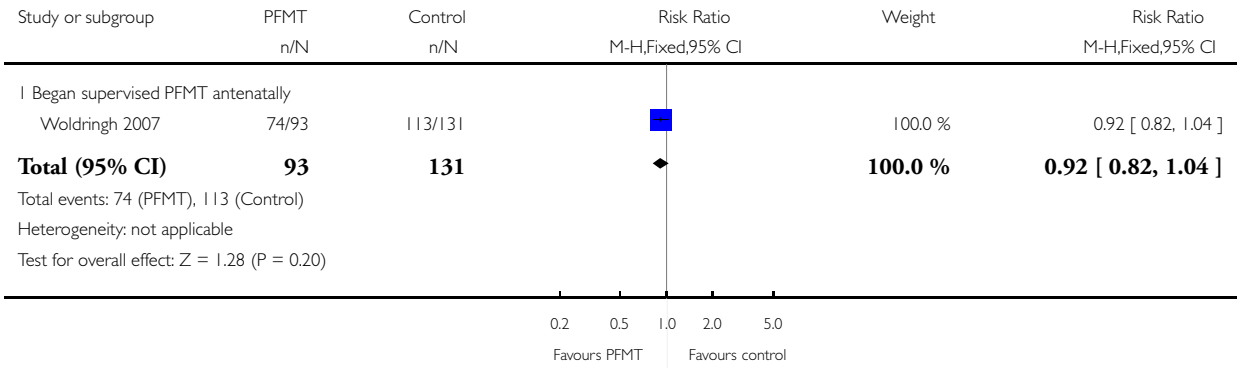
Gorbea 2004	Type of delivery	16 vaginal and 22 caesarean deliveries, n=38	22 vaginal and 12 caesarean deliveries, n=38	Relative risk 1.83 (95% CI 1.07 to 3.15)

Analysis 2.1. Comparison 2 PFMT versus control for treatment of incontinence, Outcome 1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 2 PFMT versus control for treatment of incontinence

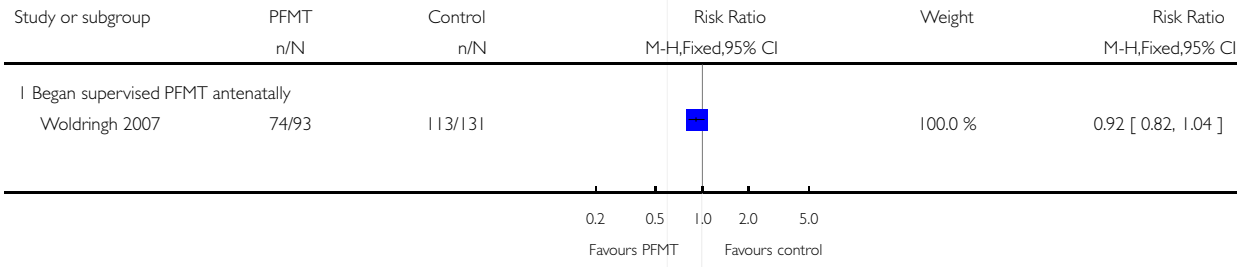
Outcome: 1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery)



Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 2 PFMT versus control for treatment of incontinence

Outcome: 1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery)

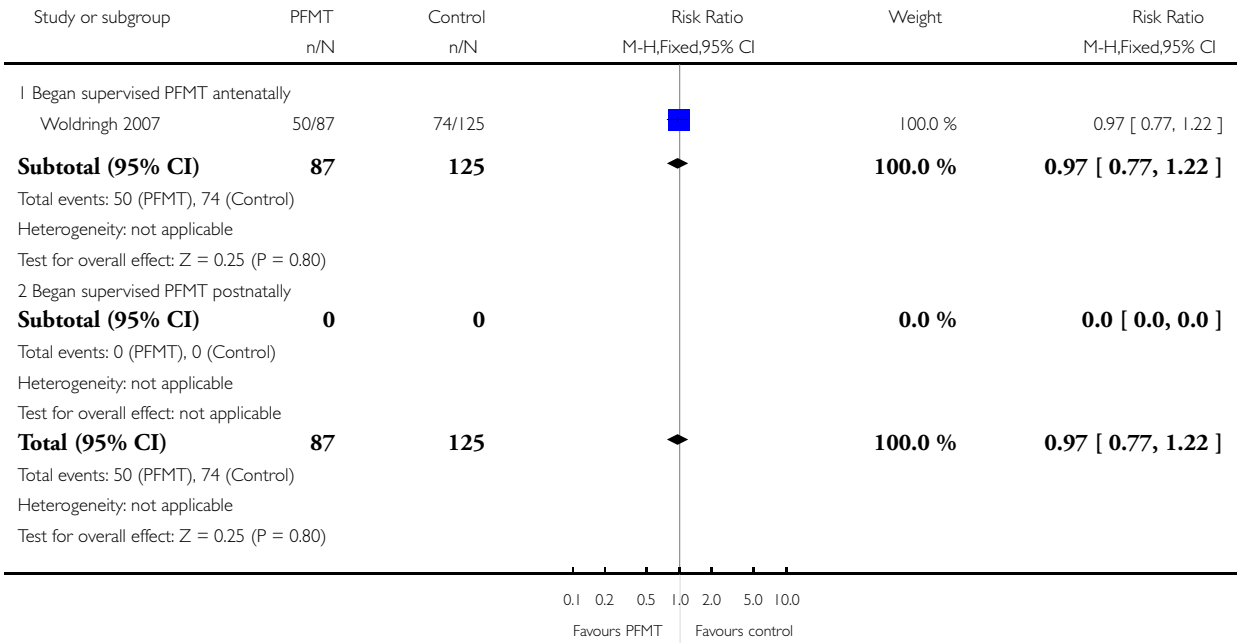


Analysis 2.2. Comparison 2 PFMT versus control for treatment of incontinence, Outcome 2 Urinary incontinence early postnatal period (less than 12 weeks).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 2 PFMT versus control for treatment of incontinence

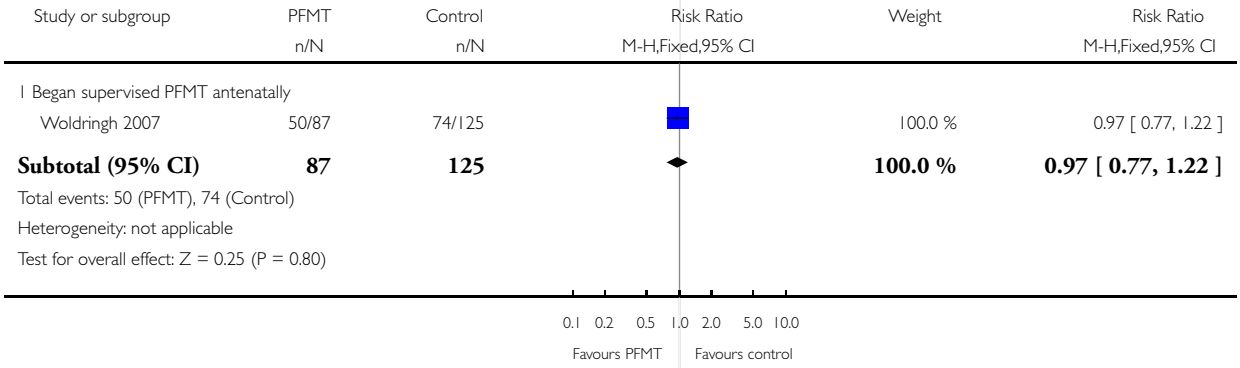
Outcome: 2 Urinary incontinence early postnatal period (less than 12 weeks)



Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 2 PFMT versus control for treatment of incontinence

Outcome: 2 Urinary incontinence early postnatal period (less than 12 weeks)



Analysis 2.3. Comparison 2 PFMT versus control for treatment of incontinence, Outcome 3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 2 PFMT versus control for treatment of incontinence

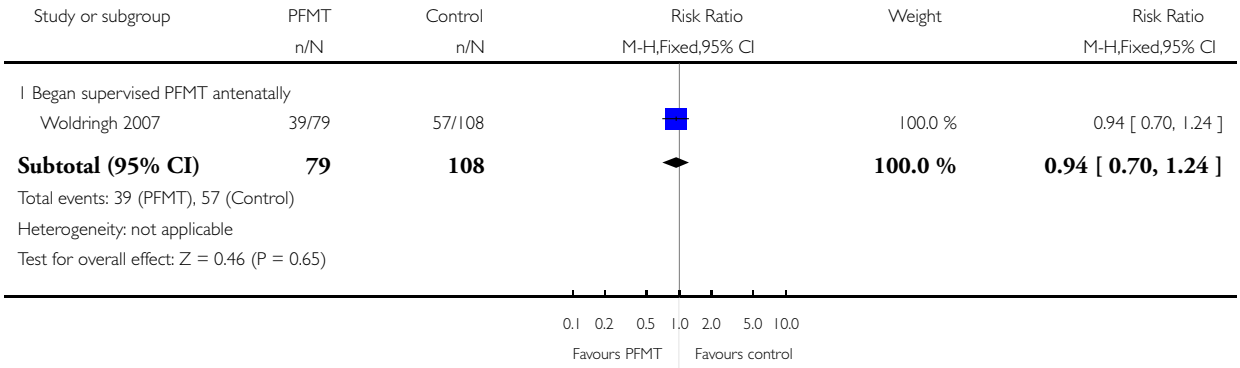
Outcome: 3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Woldringh 2007	39/79	57/108		100.0 %	0.94 [0.70, 1.24]
Subtotal (95% CI)	**79**	**108**		**100.0 %**	**0.94 [0.70, 1.24]**
Total events: 39 (PFMT), 57 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.46 (P = 0.65)					
2 Began supervised PFMT postnatally					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (PFMT), 0 (Control)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Total (95% CI)	**79**	**108**		**100.0 %**	**0.94 [0.70, 1.24]**
Total events: 39 (PFMT), 57 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.46 (P = 0.65)					

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 2 PFMT versus control for treatment of incontinence

Outcome: 3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months)

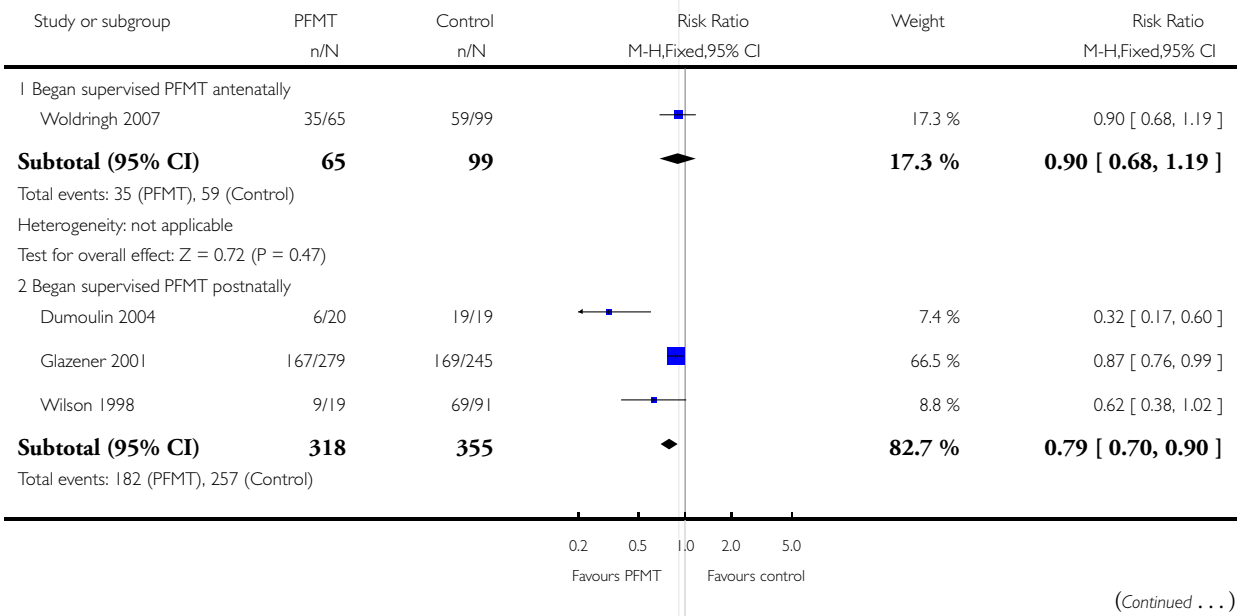


Analysis 2.4. Comparison 2 PFMT versus control for treatment of incontinence, Outcome 4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 2 PFMT versus control for treatment of incontinence

Outcome: 4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months)



(*Continued* . . .)

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Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Heterogeneity: Chi² = 10.63, df = 2 (P = 0.005); I² =81%					
Test for overall effect: Z = 3.72 (P = 0.00020)					
Total (95% CI)	**383**	**454**	◆	**100.0 %**	**0.81 [0.73, 0.91]**
Total events: 217 (PFMT), 316 (Control)					
Heterogeneity: Chi² = 10.92, df = 3 (P = 0.01); I² =73%					
Test for overall effect: Z = 3.64 (P = 0.00027)					

0.2 0.5 1.0 2.0 5.0

Favours PFMT Favours control

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 2 PFMT versus control for treatment of incontinence

Outcome: 4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Woldringh 2007	35/65	59/99	■	17.3 %	0.90 [0.68, 1.19]
Subtotal (95% CI)	**65**	**99**	◆	**17.3 %**	**0.90 [0.68, 1.19]**
Total events: 35 (PFMT), 59 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.72 (P = 0.47)					

0.2 0.5 1.0 2.0 5.0

Favours PFMT Favours control

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 2 PFMT versus control for treatment of incontinence

Outcome: 4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
2 Began supervised PFMT postnatally					
Dumoulin 2004	6/20	19/19		7.4 %	0.32 [0.17, 0.60]
Glazener 2001	167/279	169/245		66.5 %	0.87 [0.76, 0.99]
Wilson 1998	9/19	69/91		8.8 %	0.62 [0.38, 1.02]
Subtotal (95% CI)	**318**	**355**		**82.7 %**	**0.79 [0.70, 0.90]**
Total events: 182 (PFMT), 257 (Control)					
Heterogeneity: Chi^2 = 10.63, df = 2 (P = 0.005); I^2 =81%					
Test for overall effect: Z = 3.72 (P = 0.00020)					

Analysis 2.5. Comparison 2 PFMT versus control for treatment of incontinence, Outcome 5 Faecal incontinence postnatal period.

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 2 PFMT versus control for treatment of incontinence

Outcome: 5 Faecal incontinence postnatal period

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (PFMT), 0 (Control)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
2 Began supervised PFMT postnatally					
Glazener 2001	12/273	25/237		76.4 %	0.42 [0.21, 0.81]
Wilson 1998	20/91	5/19		23.6 %	0.84 [0.36, 1.95]
Subtotal (95% CI)	**364**	**256**		**100.0 %**	**0.52 [0.31, 0.87]**
Total events: 32 (PFMT), 30 (Control)					

(*Continued* . . .)

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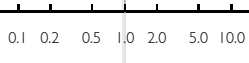
Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Heterogeneity: Chi² = 1.64, df = 1 (P = 0.20); I² =39%					
Test for overall effect: Z = 2.48 (P = 0.013)					
Total (95% CI)	**364**	**256**		**100.0 %**	**0.52 [0.31, 0.87]**
Total events: 32 (PFMT), 30 (Control)					
Heterogeneity: Chi² = 1.64, df = 1 (P = 0.20); I² =39%					
Test for overall effect: Z = 2.48 (P = 0.013)					

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 2 PFMT versus control for treatment of incontinence

Outcome: 5 Faecal incontinence postnatal period

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
2 Began supervised PFMT postnatally					
Glazener 2001	12/273	25/237		76.4 %	0.42 [0.21, 0.81]
Wilson 1998	20/91	5/19		23.6 %	0.84 [0.36, 1.95]
Subtotal (95% CI)	**364**	**256**		**100.0 %**	**0.52 [0.31, 0.87]**
Total events: 32 (PFMT), 30 (Control)					
Heterogeneity: Chi² = 1.64, df = 1 (P = 0.20); I² =39%					
Test for overall effect: Z = 2.48 (P = 0.013)					



Quality of life and health status measures

Began supervised PFMT antenatally

Quality of life and health status measures (*Continued*)

Woldringh 2007	Incontinence Impact Questionnaire (IIQ), and data then dichotomised into impact versus not impact in four subscales - impact on social relations, impact on emotional health, impact on recreational activities, and impact on physical activities (not clear how this was done)	Impact on social relations 2 of 65, on emotional health 11 of 65, on recreational activities 10 of 65 and on physical activities 4 of 65, at 12 months postpartum	Impact on social relations 5 of 99, on emotional health 14 of 99, on recreational activities 10 of 99 and on physical activities 7 of 99, at 12 months postpartum	Not calculated as validity/reliability of this measure not known.
Woldringh 2007				
Began supervised PFMT postnatally				
Dumoulin 2004	Change in Urogenital Distress Inventory Score (maximum score 57)	Median change 7, interquartile range 3 to 8, n=20 after 9 weeks PFMT	Median change 0, interquartile range -2.3 to 6.5, n=19 after 9 weeks of control condition	Not calculable
Dumoulin 2004	Change in Incontinence Impact Questionnaire (maximum score 90)	Median change 13, interquartile range 6 to 25 n=20 after 9 weeks PFMT	Median change 0.5, interquartile range -6.5 to 5, n=19 after 9 weeks of control condition	Not calculable
Glazener 2001	Hospital Anxiety and Depression Score - anxiety score	Mean 6.1, 95% CI 5.6 to 6.5, n=238 at 12 months	Mean 6.8, 95% CI 6.3 to 7.3, n=219 at 12 months postpartum	Mean difference -0.79 (95% CI -1.43 to -0.05)
Glazener 2001	Hospital Anxiety and Depression Score - depression score	Mean 4.8, 95% CI 4.4 to 5.3, n=238 at 12 months postpartum	Mean 5.2, 95% CI 4.7 to 5.7, n=219 at 12 months postpartum	Mean difference -0.37 (95% CI -1.02 to 0.28)

Began supervised PFMT antenatally

Woldringh 2007	Incontinence Impact Questionnaire (IIQ), and data then dichotomised into impact versus not impact in four subscales - impact on social relations, impact on emotional health, impact on recreational activities, and impact on physical activities (not clear how this was done)	Impact on social relations 2 of 65, on emotional health 11 of 65, on recreational activities 10 of 65 and on physical activities 4 of 65, at 12 months postpartum	Impact on social relations 5 of 99, on emotional health 14 of 99, on recreational activities 10 of 99 and on physical activities 7 of 99, at 12 months postpartum	Not calculated as validity/reliability of this measure not known.
Woldringh 2007				

Began supervised PFMT postnatally

Dumoulin 2004	Change in Urogenital Distress Inventory Score (maximum score 57)	Median change 7, interquartile range 3 to 8, n=20 after 9 weeks PFMT	Median change 0, interquartile range -2.3 to 6.5, n=19 after 9 weeks of control condition	Not calculable
Dumoulin 2004	Change in Incontinence Impact Questionnaire (maximum score 90)	Median change 13, interquartile range 6 to 25 n=20 after 9 weeks PFMT	Median change 0.5, interquartile range -6.5 to 5, n=19 after 9 weeks of control condition	Not calculable
Glazener 2001	Hospital Anxiety and Depression Score - anxiety score	Mean 6.1, 95% CI 5.6 to 6.5, n=238 at 12 months	Mean 6.8, 95% CI 6.3 to 7.3, n=219 at 12 months postpartum	Mean difference -0.79 (95% CI -1.43 to -0.05)
Glazener 2001	Hospital Anxiety and Depression Score - depression score	Mean 4.8, 95% CI 4.4 to 5.3, n=238 at 12 months postpartum	Mean 5.2, 95% CI 4.7 to 5.7, n=219 at 12 months postpartum	Mean difference -0.37 (95% CI -1.02 to 0.28)

Incontinence severity

Began supervised PFMT antenatally					
Woldringh 2007	Frequency of leakage	7 day urinary diary	Not reported	Not reported	
Woldringh 2007	Amount of leakage	Not measured			

Incontinence severity (*Continued*)

Woldringh 2007	Other leakage severity	A combination of data from a 7 day bladder diary and a questionnaire (PRAFAB, Vierhout 1990), ending with a score between 0 and 10. Mild urinary incontinence 0 to 4, and moderate to severe incontinence 5 to 10.	9 of 65 with moderate to severe leakage at 12 months postpartum	8 of 99 with moderate to severe leakage at 12 months postpartum	Not calculated as validity/reliability of this measure not known.
Began supervised PFMT postnatally					
Dumoulin 2004	Frequency of leakage	Not measured			
Dumoulin 2004	Amount of leakage	Change, in grams, in 20 minute pad test with standardised bladder volume	Median change 8, interquartile range 4 to 25.3, n=20 after 9 weeks of PFMT	Median change 0, interquartile range -3 to 9.8, n=19 after 9 weeks of control condition	Not calculable
Dumoulin 2004	Other leakage severity	Change in visual analogue scale for perceived burden of incontinence (Stach-Lempinen et al 2001)	Median change 2.5, interquartile range 0.8 to 5, n=20 after 9 weeks of PFMT	Median change 0, interquartile range -0.1 to 0.02, n=19 after 9 weeks of control condition	Not calculable
Glazener 2001	Frequency of leakage	Not measured			
Glazener 2001	Amount of leakage	Using absorbent pads	41 of 276 at 12 months postpartum	55 of 245 at 12 months postpartum	Relative risk 0.66 (95% CI 0.46, 0.95)
Glazener 2001	Other leakage severity	Visual analogue scale for severity of urine leakage	Mean 2.8, 95% CI 2.4 to 3.1, n=142 at 12 months postpartum	Mean 3.6, 95% CI 3.1 to 4.0, n=142 at 12 months postpartum	Mean difference -0.80 (95% CI -1.37 to -0.23)
Wilson 1998	Frequency of leakage	Not measured			
Wilson 1998	Amount of leakage	Urine loss on home pad test (Wilson et al 1989), in grams	Mean 2.1, 95% CI -0.3 to 4.5, n=18 at 12 months postpartum	Mean 2.6, 95% CI 0.1 to 5.1, n=82 at 12 months postpartum	Mean difference -0.50 (95% CI -3.81 to 2.81)
Wilson 1998	Other leakage severity	Not measured			

Began supervised PFMT antenatally

Woldringh 2007	Frequency of leakage	7 day urinary diary	Not reported	Not reported	
Woldringh 2007	Amount of leakage	Not measured			
Woldringh 2007	Other leakage severity	A combination of data from a 7 day bladder diary and a questionnaire (PRAFAB, Vierhout 1990), ending with a score between 0 and 10. Mild urinary incontinence 0 to 4, and moderate to severe incontinence 5 to 10.	9 of 65 with moderate to severe leakage at 12 months postpartum	8 of 99 with moderate to severe leakage at 12 months postpartum	Not calculated as validity/reliability of this measure not known.

Began supervised PFMT postnatally

Dumoulin 2004	Frequency of leakage	Not measured			
Dumoulin 2004	Amount of leakage	Change, in grams, in 20 minute pad test with standardised bladder volume	Median change 8, interquartile range 4 to 25.3, n=20 after 9 weeks of PFMT	Median change 0, interquartile range -3 to 9.8, n=19 after 9 weeks of control condition	Not calculable
Dumoulin 2004	Other leakage severity	Change in visual analogue scale for perceived burden of incontinence (Stach-Lempinen et al 2001)	Median change 2.5, interquartile range 0.8 to 5, n=20 after 9 weeks of PFMT	Median change 0, interquartile range -0.1 to 0.02, n=19 after 9 weeks of control condition	Not calculable
Glazener 2001	Frequency of leakage	Not measured			
Glazener 2001	Amount of leakage	Using absorbent pads	41 of 276 at 12 months postpartum	55 of 245 at 12 months postpartum	Relative risk 0.66 (95% CI 0.46, 0.95)
Glazener 2001	Other leakage severity	Visual analogue scale for severity of urine leakage	Mean 2.8, 95% CI 2.4 to 3.1, n=142 at 12 months postpartum	Mean 3.6, 95% CI 3.1 to 4.0, n=142 at 12 months postpartum	Mean difference -0.80 (95% CI -1.37 to -0.23)
Wilson 1998	Frequency of leakage	Not measured			

Began supervised PFMT postnatally (*Continued*)

Wilson 1998	Amount of leakage	Urine loss on home pad test (Wilson et al 1989), in grams	Mean 2.1, 95% CI -0.3 to 4.5, n=18 at 12 months postpartum	Mean 2.6, 95% CI 0.1 to 5.1, n=82 at 12 months postpartum	Mean difference -0.50 (95% CI -3.81 to 2.81)
Wilson 1998	Other leakage severity	Not measured			

Pelvic floor muscle function

Began supervised PFMT postnatally				
Dumoulin 2004	Maximal strength in newtons (using pelvic floor dynamometer, Dumoulin et al 2003)	Median change 0.5, interquartile range -0.6 to 2.5, n=20 after 9 weeks PFMT	Median change -0.5, interquartile range -1.7 to 1, n=19 after 9 weeks PFMT	Not calculable
Dumoulin 2004	Maximal force rate in newtons per second (using pelvic floor dynamometer, Dumoulin et al 2003)	Median change 0.3, interquartile range -1.1 to 1.9, n=20 after 9 weeks PFMT	Median change -0.5, interquartile range -2.1 to 0.8, n=19 after 9	Not calculable
Wilson 1998	Maximal vaginal squeeze pressure, in cm water	Mean 13.6, 95% CI 9.8 to 17.4, n=19 at 12 months postpartum	Mean 13.1, 95% CI 11.3 to 14.9, n=79 at 12 months postpartum	Mean difference 0.50 (95%CI -3.46 to 4.46)
Wilson 1998	Sustained vaginal squeeze pressure, in cm water	Mean 7.9, 95% CI 5.3 to 10.6, n=19 at 12 months postpartum	Mean 6.7, 95% CI 5.4 to 8.1, n=79 at 12 months postpartum	Mean difference 1.20 (95% CI -1.61 to 4.01)

Began supervised PFMT postnatally

Dumoulin 2004	Maximal strength in newtons (using pelvic floor dynamometer, Dumoulin et al 2003)	Median change 0.5, interquartile range -0.6 to 2.5, n=20 after 9 weeks PFMT	Median change -0.5, interquartile range -1.7 to 1, n=19 after 9 weeks PFMT	Not calculable
Dumoulin 2004	Maximal force rate in newtons per second (using pelvic floor dynamometer, Dumoulin et al 2003)	Median change 0.3, interquartile range -1.1 to 1.9, n=20 after 9 weeks PFMT	Median change -0.5, interquartile range -2.1 to 0.8, n=19 after 9	Not calculable
Wilson 1998	Maximal vaginal squeeze pressure, in cm water	Mean 13.6, 95% CI 9.8 to 17.4, n=19 at 12 months postpartum	Mean 13.1, 95% CI 11.3 to 14.9, n=79 at 12 months postpartum	Mean difference 0.50 (95%CI -3.46 to 4.46)

Began supervised PFMT postnatally (*Continued*)

Wilson 1998	Sustained vaginal squeeze pressure, in cm water	Mean 7.9, 95% CI 5.3 to 10.6, n=19 at 12 months postpartum	Mean 6.7, 95% CI 5.4 to 8.1, n=79 at 12 months postpartum	Mean difference 1.20 (95% CI -1.61 to 4.01)

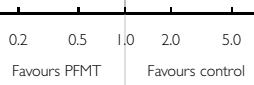
Analysis 3.1. Comparison 3 PFMT versus control for (mixed) prevention and treatment of incontinence, Outcome 1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

Outcome: 1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery)

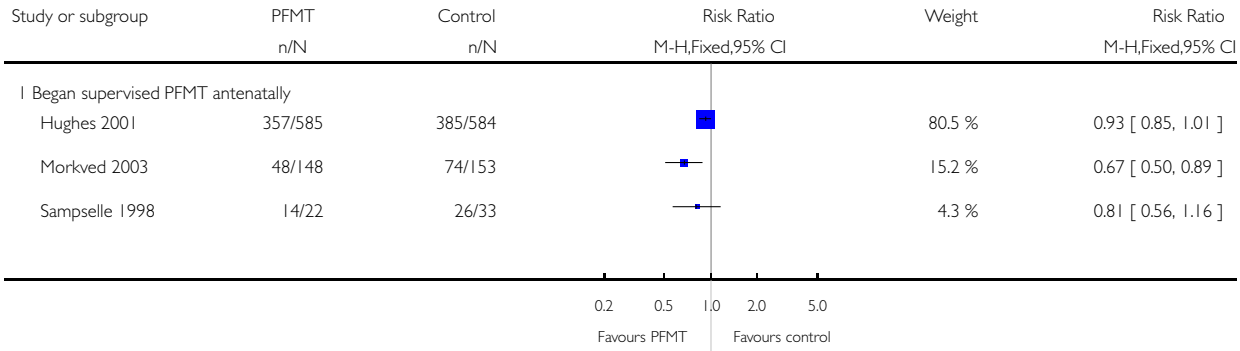
Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Hughes 2001	357/585	385/584		80.5 %	0.93 [0.85, 1.01]
Morkved 2003	48/148	74/153		15.2 %	0.67 [0.50, 0.89]
Sampselle 1998	14/22	26/33		4.3 %	0.81 [0.56, 1.16]
Total (95% CI)	**755**	**770**		**100.0 %**	**0.88 [0.81, 0.96]**
Total events: 419 (PFMT), 485 (Control)					
Heterogeneity: Chi^2 = 4.98, df = 2 (P = 0.08); I^2 =60%					
Test for overall effect: Z = 2.99 (P = 0.0028)					



Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

Outcome: 1 Urinary incontinence in late pregnancy (34 weeks gestation up to delivery)

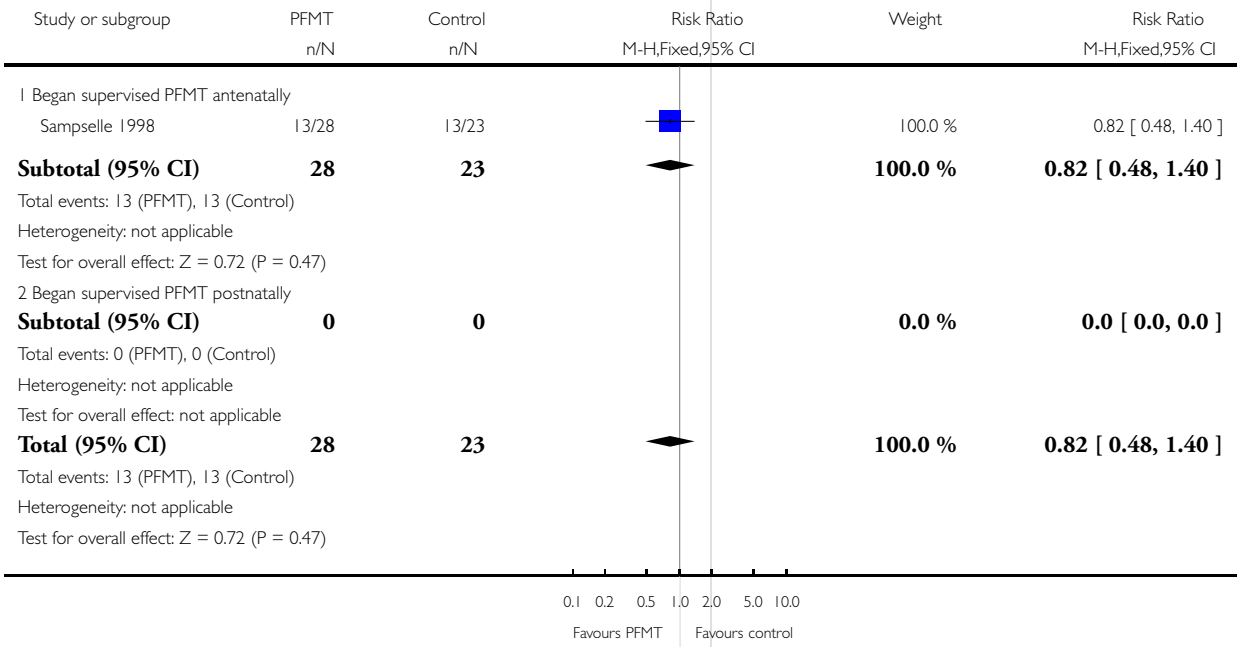


Analysis 3.2. Comparison 3 PFMT versus control for (mixed) prevention and treatment of incontinence, Outcome 2 Urinary incontinence early postnatal period (less than 12 weeks).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

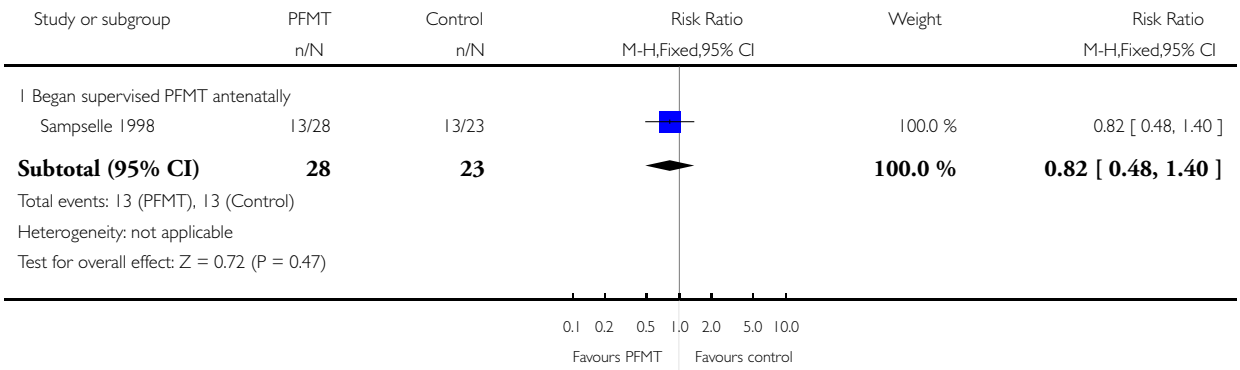
Outcome: 2 Urinary incontinence early postnatal period (less than 12 weeks)



Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

Outcome: 2 Urinary incontinence early postnatal period (less than 12 weeks)



Analysis 3.3. Comparison 3 PFMT versus control for (mixed) prevention and treatment of incontinence, Outcome 3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

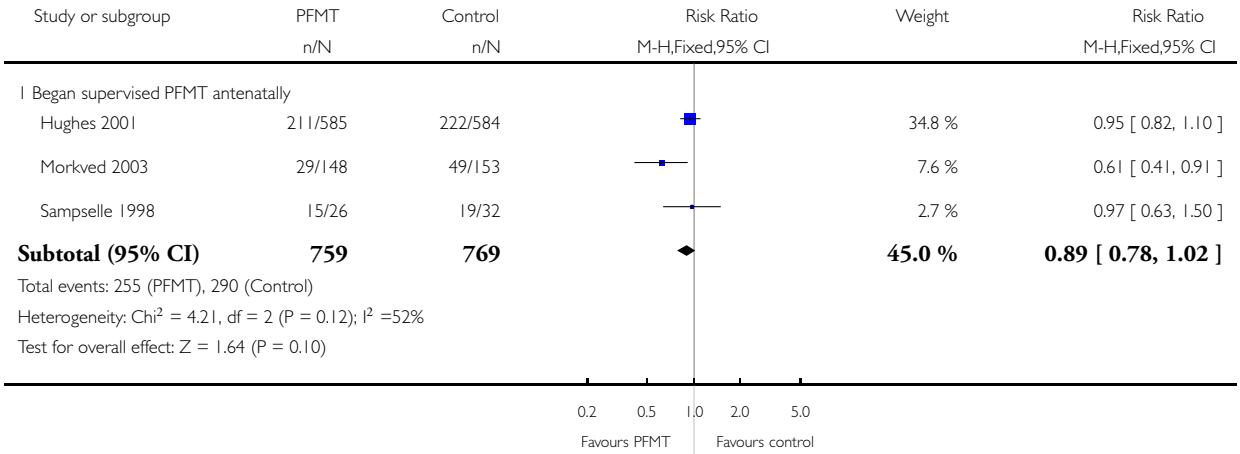
Outcome: 3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months)

Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Hughes 2001	211/585	222/584		34.8 %	0.95 [0.82, 1.10]
Morkved 2003	29/148	49/153		7.6 %	0.61 [0.41, 0.91]
Sampselle 1998	15/26	19/32		2.7 %	0.97 [0.63, 1.50]
Subtotal (95% CI)	**759**	**769**		**45.0 %**	**0.89 [0.78, 1.02]**
Total events: 255 (PFMT), 290 (Control)					
Heterogeneity: Chi^2 = 4.21, df = 2 (P = 0.12); I^2 =52%					
Test for overall effect: Z = 1.64 (P = 0.10)					
2 Began supervised PFMT postnatally					
Chiarelli 2002	108/348	125/328		20.2 %	0.81 [0.66, 1.00]
Ewings 2005	54/90	47/100		7.0 %	1.28 [0.98, 1.67]
Sleep 1987	180/816	175/793		27.8 %	1.00 [0.83, 1.20]
Subtotal (95% CI)	**1254**	**1221**		**55.0 %**	**0.97 [0.85, 1.09]**
Total events: 342 (PFMT), 347 (Control)					
Heterogeneity: Chi^2 = 6.86, df = 2 (P = 0.03); I^2 =71%					
Test for overall effect: Z = 0.53 (P = 0.59)					
Total (95% CI)	**2013**	**1990**		**100.0 %**	**0.93 [0.85, 1.02]**
Total events: 597 (PFMT), 637 (Control)					
Heterogeneity: Chi^2 = 11.79, df = 5 (P = 0.04); I^2 =58%					
Test for overall effect: Z = 1.47 (P = 0.14)					

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

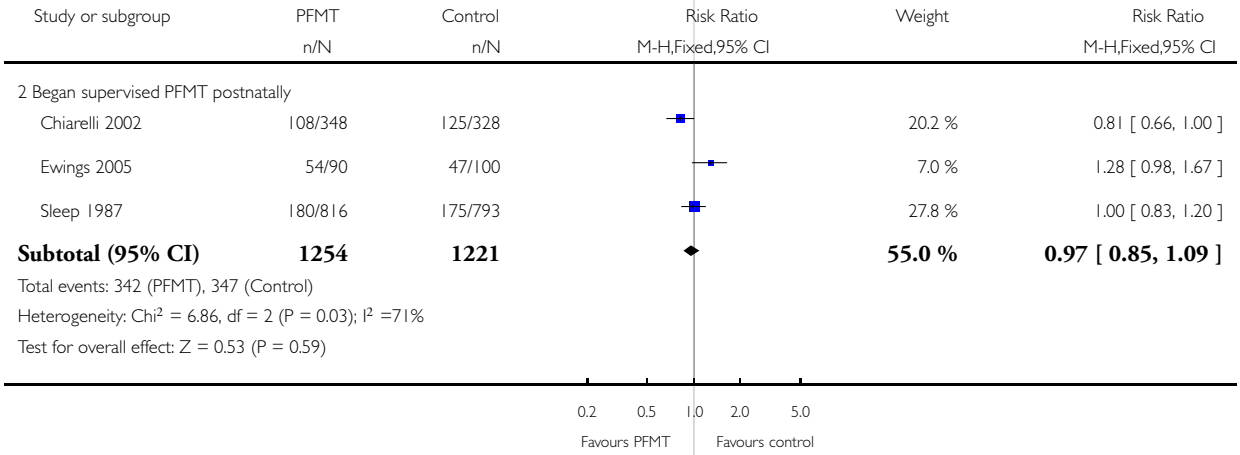
Outcome: 3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months)



Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

Outcome: 3 Urinary incontinence mid-postnatal period (12 weeks up to and including 6 months)



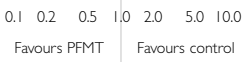
Analysis 3.4. Comparison 3 PFMT versus control for (mixed) prevention and treatment of incontinence, Outcome 4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months).

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

Outcome: 4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months)

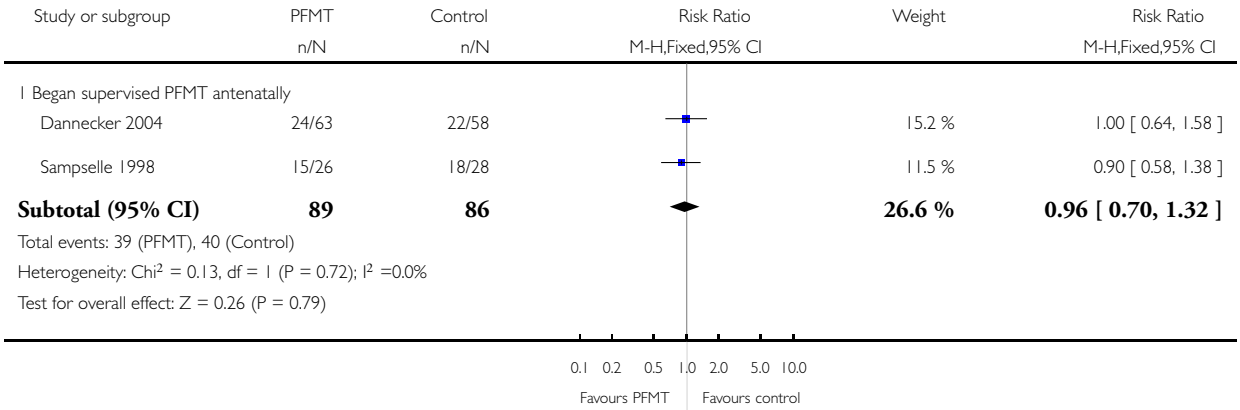
Study or subgroup	PFMT n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Began supervised PFMT antenatally					
Dannecker 2004	24/63	22/58		15.2 %	1.00 [0.64, 1.58]
Sampselle 1998	15/26	18/28		11.5 %	0.90 [0.58, 1.38]
Subtotal (95% CI)	**89**	**86**		**26.6 %**	**0.96 [0.70, 1.32]**
Total events: 39 (PFMT), 40 (Control)					
Heterogeneity: Chi^2 = 0.13, df = 1 (P = 0.72); I^2 =0.0%					
Test for overall effect: Z = 0.26 (P = 0.79)					
2 Began supervised PFMT postnatally					
Chiarelli 2002	101/294	100/275		68.3 %	0.94 [0.76, 1.18]
Meyer 2001	6/51	8/56		5.0 %	0.82 [0.31, 2.21]
Subtotal (95% CI)	**345**	**331**		**73.4 %**	**0.94 [0.75, 1.16]**
Total events: 107 (PFMT), 108 (Control)					
Heterogeneity: Chi^2 = 0.07, df = 1 (P = 0.79); I^2 =0.0%					
Test for overall effect: Z = 0.59 (P = 0.55)					
Total (95% CI)	**434**	**417**		**100.0 %**	**0.94 [0.79, 1.13]**
Total events: 146 (PFMT), 148 (Control)					
Heterogeneity: Chi^2 = 0.20, df = 3 (P = 0.98); I^2 =0.0%					
Test for overall effect: Z = 0.65 (P = 0.52)					



Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

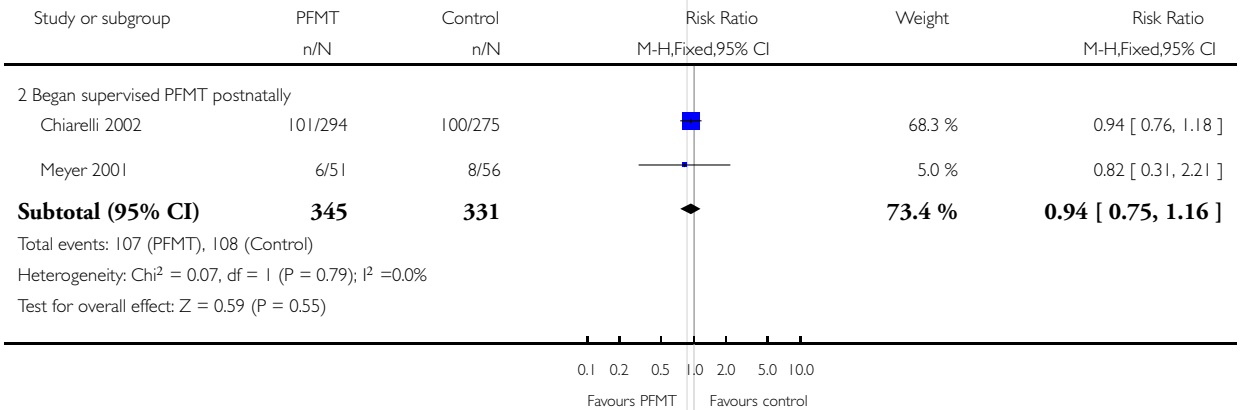
Outcome: 4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months)



Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

Outcome: 4 Urinary incontinence long-term postnatal period (more than 6 months up to and including 12 months)

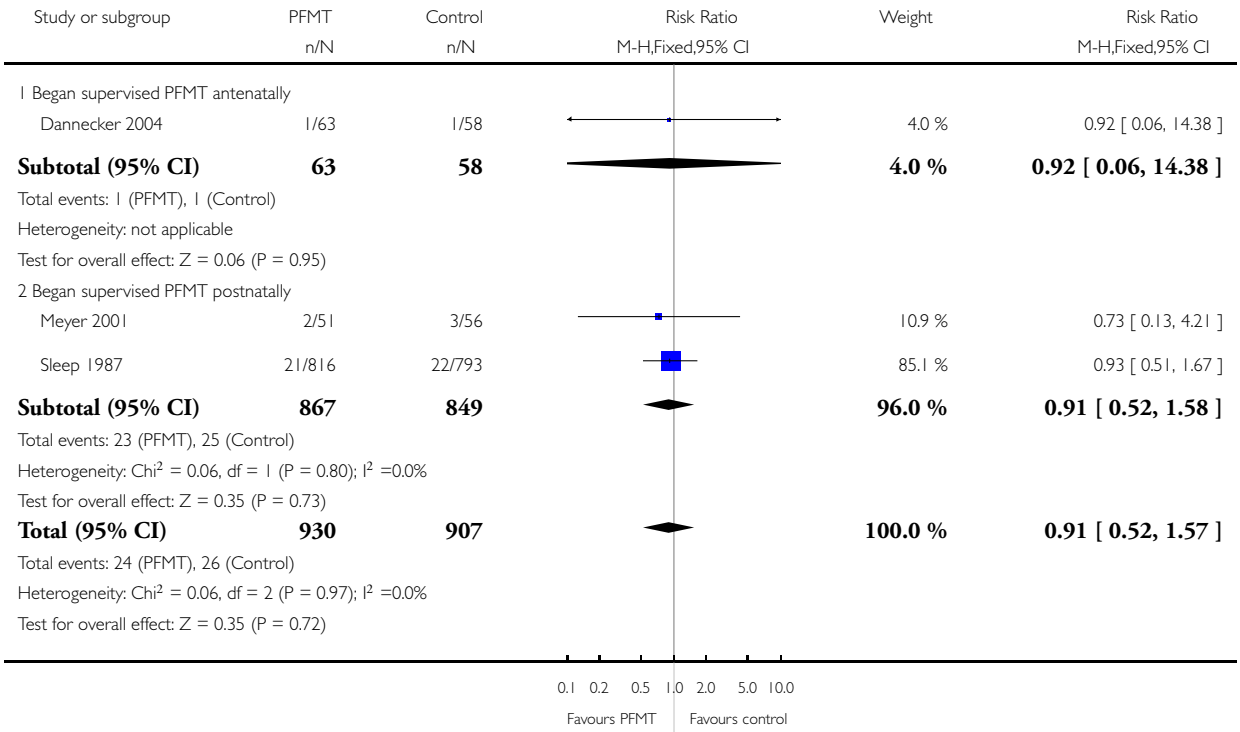


Analysis 3.5. Comparison 3 PFMT versus control for (mixed) prevention and treatment of incontinence, Outcome 5 Faecal incontinence postnatal period.

Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

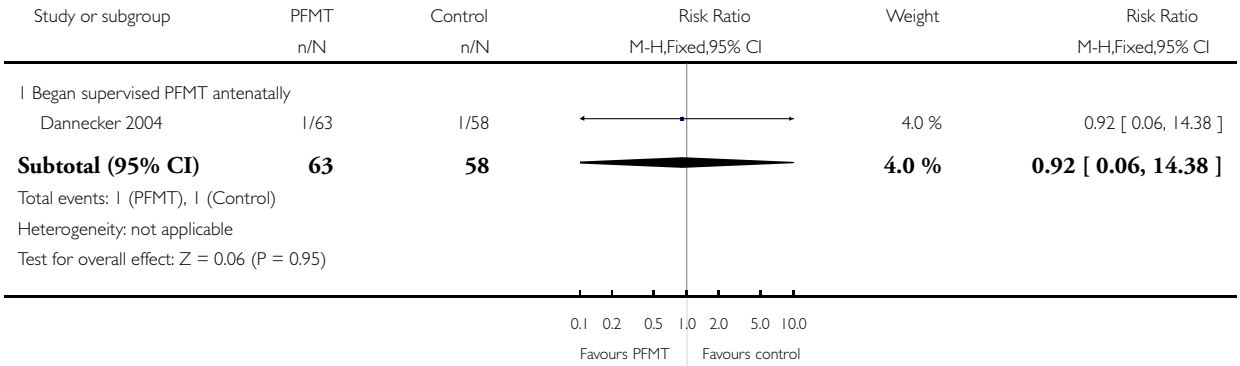
Outcome: 5 Faecal incontinence postnatal period



Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

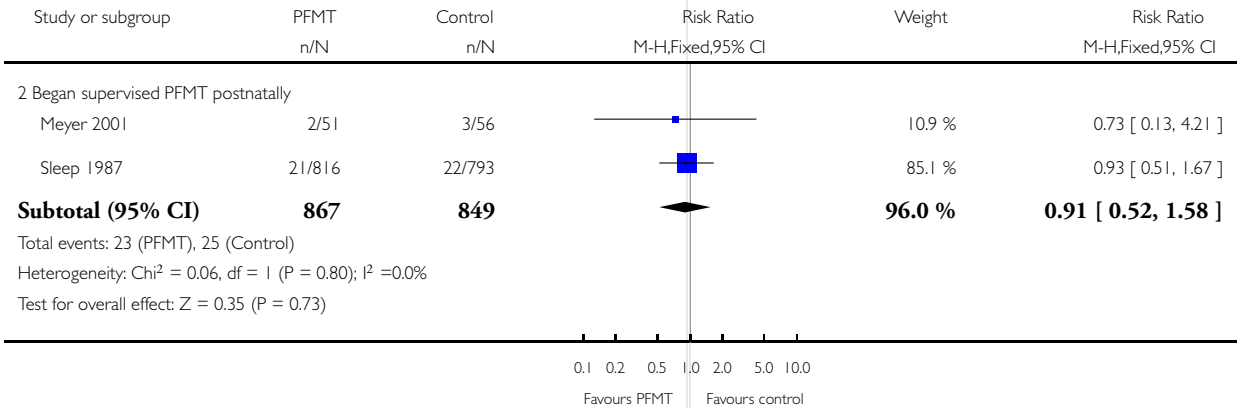
Outcome: 5 Faecal incontinence postnatal period



Review: Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women

Comparison: 3 PFMT versus control for (mixed) prevention and treatment of incontinence

Outcome: 5 Faecal incontinence postnatal period



Quality of life and health status measures

Began supervised PFMT antenatally				
Hughes 2001	Bristol Female Lower Urinary Tract Symptoms questionnaire	Overall score not reported	Overall score not reported	
Hughes 2001	Bristol Female Lower Urinary Tract Symptoms questionnaire: a negative effect on exercise in response to question "does incontinence affect physical activity?"	47 of 585 at 6 months postpartum	41 of 584 at 6 months postpartum	Relative risk 1.14 (95% CI 0.76 to 1.71)
Began supervised PFMT postnatally				
Sleep 1987	5 point Likhert scale in response to question "how are you feeling generally?"	11 feeling not very well or not at all well, of 816 at 3 months postpartum	18 feeling not very well or not at all well, of 793 at 3 months postpartum	Not calculated as validity/reliability of this measure not known.
Sleep 1987	5 point Likhert scale in response to "Some women feel depressed at this time. Do you feel?"	71 feeling very or quite depressed, of 816 at 3 months postpartum	84 feeling very or quite depressed, of 793 at 3 months postpartum	Not calculated as validity/reliability of this measure not known.

Began supervised PFMT antenatally

Hughes 2001	Bristol Female Lower Urinary Tract Symptoms questionnaire	Overall score not reported	Overall score not reported	
Hughes 2001	Bristol Female Lower Urinary Tract Symptoms questionnaire: a negative effect on exercise in response to question "does incontinence affect physical activity?"	47 of 585 at 6 months postpartum	41 of 584 at 6 months postpartum	Relative risk 1.14 (95% CI 0.76 to 1.71)

Began supervised PFMT postnatally

Sleep 1987	5 point Likhert scale in response to question "how are you feeling generally?"	11 feeling not very well or not at all well, of 816 at 3 months postpartum	18 feeling not very well or not at all well, of 793 at 3 months postpartum	Not calculated as validity/reliability of this measure not known.	
Sleep 1987	5 point Likhert scale in response to "Some women feel depressed at this time. Do you feel?"	71 feeling very or quite depressed, of 816 at 3 months postpartum	84 feeling very or quite depressed, of 793 at 3 months postpartum	Not calculated as validity/reliability of this measure not known.	

Incontinence severity

Began supervised PFMT antenatally					
Hughes 2001	Frequency of leakage	Experiencing occasional or more than occasional urine leakage (not clear how measured)	217 of 585 at 3 months postpartum	210 of 584 at 3 months postpartum	Relative risk 1.03 (95% CI 0.89 to 1.20)
Hughes 2001	Amount of leakage	Experiencing a drop or more than a drop of urine leakage (not clear how measured)	228 of 585 at 3 months postpartum	234 of 584 at 3 months postpartum	Relative risk 0.97 (95% CI 0.84 to 1.12)
Hughes 2001	Other leakage severity	Not measured			
Sampselle 1998	Frequency of leakage	Not measured			
Sampselle 1998	Amount of leakage	Not measured			
Sampselle 1998	Other leakage severity	Average score from questionnaire re urine leakage with gentle cough, hard cough, sneeze and laugh scored 0 for none, 1 for dampness, 2 for wetness and 3 for soaked	Mean 0.38, standard deviation 0.56, n=22 at 12 months postpartum	Mean 0.42, standard deviation 0.49, n=24 at 12 months postpartum	Not calculated as validity/reliability of this measure not known.
Began supervised PFMT postnatally					
Sleep 1987	Frequency of leakage	Urine leakage once or more per week	64 of 816 at 3 months postpartum	57 of 793 at 3 months postpartum	Relative risk 1.09 (95% CI 0.77 to 1.54)

Incontinence severity (*Continued*)

Sleep 1987	Amount of leakage	Using absorbent pads sometimes or always	38 of 815 at 3 months postpartum	43 of 793 at 3 months postpartum	Relative risk 0.86 (95% CI 0.56 to 1.32)
Sleep 1987	Other leakage severity	Not measured			

Began supervised PFMT antenatally

Hughes 2001	Frequency of leakage	Experiencing occasional or more than occasional urine leakage (not clear how measured)	217 of 585 at 3 months postpartum	210 of 584 at 3 months postpartum	Relative risk 1.03 (95% CI 0.89 to 1.20)
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Began supervised PFMT postnatally

Sleep 1987	Frequency of leakage	Urine leakage once or more per week	64 of 816 at 3 months postpartum	57 of 793 at 3 months postpartum	Relative risk 1.09 (95% CI 0.77 to 1.54)
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Began supervised PFMT postnatally (*Continued*)

Sleep 1987	Other leakage severity	Not measured			

Pelvic floor muscle function

Began supervised PFMT antenatally				
Dannecker 2004	Oxford scale, score of 0 to 5	13 of 59 with score of 0 to 3, at about 7 months postpartum	14 of 51 with score of 0 to 3, at about 7 months postpartum	Relative risk 0.80 (95% CI 0.42 to 1.55)
Morkved 2003	Vaginal squeeze pressure, in cm water	Mean 29.5, 95% CI 26.8 to 32.2, n=143 at 3 months postpartum	Mean 25.6, 95% CI 23.2 to 27.9, n=146 at 3 months postpartum	Mean difference 3.90 (95% CI 0.35 to 7.45)
Began supervised PFMT postnatally				
Meyer 2001	Vaginal squeeze pressure, in cm water	Mean 33, standard deviation 22, at 10 months postpartum, n=51	Mean 41, standard deviation 27, at 10 months postpartum, n=56	Mean difference -8.00 (95% CI -17.30 to 1.30)

Began supervised PFMT antenatally

Dannecker 2004	Oxford scale, score of 0 to 5	13 of 59 with score of 0 to 3, at about 7 months postpartum	14 of 51 with score of 0 to 3, at about 7 months postpartum	Relative risk 0.80 (95% CI 0.42 to 1.55)
Morkved 2003	Vaginal squeeze pressure, in cm water	Mean 29.5, 95% CI 26.8 to 32.2, n=143 at 3 months postpartum	Mean 25.6, 95% CI 23.2 to 27.9, n=146 at 3 months postpartum	Mean difference 3.90 (95% CI 0.35 to 7.45)

Began supervised PFMT postnatally

Meyer 2001	Vaginal squeeze pressure, in cm water	Mean 33, standard deviation 22, at 10 months postpartum, n=51	Mean 41, standard deviation 27, at 10 months postpartum, n=56	Mean difference -8.00 (95% CI -17.30 to 1.30)

Delivery outcome

Began supervised PFMT antenatally				
Dannecker 2004	Type of delivery	42 normal vaginal deliveries, 7 ventouse, 4 forceps, 2 elective caesarean	40 normal vaginal deliveries, 10 ventouse, 3 forceps, 2 elective caesarean	Relative risk for normal vaginal delivery 1.08 (95% CI 0.81 to 1.43)

Delivery outcome (*Continued*)

		section, 16 emergency caesarean section, n=71	section, 18 emergency caesarean section,n=73	
Dannecker 2004	Perineal trauma	38 without intact perineum, n=71	43 without intact perineum, n=73	Relative risk for not intact perineum 0.91 (95% CI 0.68 to 1.21)
Dannecker 2004	Duration 2nd stage labour, in minutes	Not measured		
Morkved 2003	Type of delivery (excluding twin pregnancy, preterm delivery, planned caesarean section and induced labour)	91 normal vaginal deliveries, 15 operative vaginal deliveries, 5 emergency caesarean section, n=111	91 normal vaginal deliveries, 19 operative vaginal deliveries, 3 emergency caesarean section, n=113	Relative risk for normal vaginal delivery 1.02 (95% CI 0.90 to 1.15)
Morkved 2003	Perineal trauma	56 with episiotomy, and 7 with third or fourth degree tears, n=111	72 with episiotomy, and 9 with third or fourth degree tears, n=113	Relative risk for episiotomy 0.79 (95% CI 0.63 to 1.00)
Morkved 2003	Duration 2nd stage labour, in minutes	Mean 40, 95% CI 33 to 47, n=111	Mean 45, 95% CI 38 to 52, n=113	Mean difference -5.00 (95% CI -14.79 to 4.79)

Began supervised PFMT antenatally

Dannecker 2004	Type of delivery	42 normal vaginal deliveries, 7 ventouse, 4 forceps, 2 elective caesarean section, 16 emergency caesarean section, n=71	40 normal vaginal deliveries, 10 ventouse, 3 forceps, 2 elective caesarean section, 18 emergency caesarean section,n=73	Relative risk for normal vaginal delivery 1.08 (95% CI 0.81 to 1.43)
Dannecker 2004	Perineal trauma	38 without intact perineum, n=71	43 without intact perineum, n=73	Relative risk for not intact perineum 0.91 (95% CI 0.68 to 1.21)
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Began supervised PFMT antenatally (*Continued*)

Morkved 2003	Duration 2nd stage labour, in minutes	Mean 40, 95% CI 33 to 47, n=111	Mean 45, 95% CI 38 to 52, n=113	Mean difference -5.00 (95% CI -14.79 to 4.79)

WHAT'S NEW

Last assessed as up-to-date: 22 April 2008.

18 April 2008	Amended	Converted to new review format.

HISTORY

Review first published: Issue 4, 2008

3 March 2008	New citation required and conclusions have changed	Substantive amendment

CONTRIBUTIONS OF AUTHORS

JHS and KF screened all trials for eligibility, extracted and cross checked the data. KF did most of the data entry, which was cross checked by JHS. JHS wrote the first draft of the protocol and review, with assistance from PH and SM.

DECLARATIONS OF INTEREST

SM was the first author of one included trial, and PH was an author of two included trials. Neither SM nor PH were involved in the process of screening for eligibility, assessment of susceptibility to bias, or data extraction for the trials with which they were associated.

SOURCES OF SUPPORT

Internal sources

- University of Otago, New Zealand.

External sources

- No sources of support supplied

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Not applicable