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Antenatal Pelvic Floor Education: A Review of the Midwifery Role in Promoting Pelvic Floor Health

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ANTENATAL PELVIC FLOOR EDUCATION: A REVIEW OF THE MIDWIFERY ROLE IN PROMOTING PELVIC FLOOR HEALTH

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Abstract

Introduction: Nurse-midwives care for women from puberty until the end of life. As primary care providers, they are "with women" to help them reach optimal well-being, including pelvic floor outcomes. Pelvic floor health is important not only during menopause and aging but also throughout pregnancy and childbirth. This review examined the impact that prenatal education or training on pelvic floor muscle exercise (PFME) had on women's pelvic floors.

Methods: An integrative review was conducted after searching CINAHL, PubMed, and Scopus on the terms *antenatal*, *pregnancy*, *prenatal*, *education*, *attitudes*, *knowledge*, and *pelvic floor*. Original works from 2015–2022 examining the effects of antenatal education/training and pelvic floor health on the antepartum, intrapartum, or postpartum periods were included. Postpartum education, surgical interventions, use of devices to train the pelvic floor, and pilot studies were excluded. Articles were evaluated with the Johns Hopkins Nursing Research Appraisal Tool. Studies were categorized according to the COM-B system factors of capability, opportunity, and motivation to determine how they influenced PFME behavior.

Results: The research indicated that when PFME is taught and supported prenatally, women are more likely to report increased knowledge about their pelvic floors. They also exhibit confidence in the correct performance of PFME. Women are also more likely to be practicing adequate PFME postpartum and have less involuntary loss of urine, stool, or flatus. There may be decreased pain with vaginal delivery as well as increased perineal integrity and increased sexual function.

Discussion: Pelvic floor health encompasses outcomes such as preventing urinary and anal incontinence and pelvic organ prolapse and improving perineal integrity at delivery, postpartum

sexual function, and quality of life. These are compelling reasons for midwives to prioritize PFME education and training during prenatal visits.

Keywords: education, exercise, nurse-midwives, midwifery, pelvic floor, prenatal care, PFME

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Introduction

Midwifery care "is woman-centered and based on the premise that pregnancy and childbirth are normal life events" (International Confederation of Midwives [ICM], 2017, para. 2), and according to the ICM should be the standard for childbearing women. Midwives use evidence-based practice to focus on health promotion, disease prevention, and health education (American College of Nurse-Midwives [ACNM], 2020). A healthy pelvic floor is essential for women's well-being during pregnancy, birth, and postpartum. For example, urinary incontinence (UI) affects approximately 50% of all women in their lifetime, with 41% of women reporting UI during pregnancy alone (Minassian et al., 2012). Bowel symptoms, such as anal incontinence (AI), the leaking of stool or flatus, occurs in approximately 24%–44% of women (Everist et al., 2020) with 23%–30% of women experiencing some AI in the postpartum period. Likewise, pelvic organ prolapse (a broad term encompassing the descent of the uterus/cervix, the anterior or posterior vaginal wall, or the descent of the vagina itself) is not as common as UI (American College of Obstetricians and Gynecologists [ACOG], 2019). Prolapse ranges from mild cervical descent into the vaginal vault or the vaginal wall bulging inwards to complete protrusion of the vaginal vault exteriorly. According to ACOG, the true prevalence of prolapse is estimated to be 3%–50%, with symptomatic prolapse being troublesome and less frequent than asymptomatic prolapse.

Pelvic floor disorders affect sexual function as well. An estimated 30%–50% of women report some degree of sexual dysfunction, especially if a pelvic floor disorder is present (Ferreira

et al., 2015; Verbeek & Hayward, 2019). In addition to contributing to UI, AI, and prolapse, pelvic floor tone may influence labor progress and outcomes (Salvesen & Mørkved, 2004).

While it is known that pelvic floor muscle exercise (PFME) benefits women of all ages, the purpose of this review was to understand how pelvic floor education or training specifically during pregnancy affects women. This review was significant as certified nurse-midwives seek to empower women to achieve optimal health while using evidence-based practices to guide patient education. The capability, opportunity, and motivation influence on behavior (COM-B) system explains how capability, opportunity, and motivation factors influence behavior (Michie et al., 2011). It can be applied to pregnancy when examining factors that influence pregnant women to change their behavior (Rockliffe et al., 2021) and can be used to inform educational strategies for the prenatal period. In the present integrative review, research findings were organized according to capability, opportunity, and motivation factors.

Current evidence-based practice publications, including the Joanna Briggs Institute (JBI) and UpToDate, have published opinions on teaching PFME during pregnancy. The JBI (2011) gave antenatal PFME education a Grade A (strong support that merits application) recommendation. In UpToDate's pregnancy strength training guidelines, PFME is recommended three to five times a week (Artal, 2021). The ACNM does not have a position statement regarding prenatal PFME performance or the importance of education on pelvic floor dysfunction/PFME prenatally. Similarly, ACOG (2020) recommends postpartum PFME but does not address prenatal education/training on PFME. In contrast, the National Institute for Health and Care Excellence (2021) in the United Kingdom maintains that all pregnant women should be educated on pelvic floor dysfunction and encouraged at each prenatal visit to perform PFME.

Exercise routines designed to strengthen the pelvic floor range from training synergic muscles to increasing the size and strength of the muscles in the pelvic floor itself (Jacomo et al., 2020; Lemos et al., 2019). The levator ani muscle encircles the vagina, supporting the urethral and anal sphincters (Kegel, 1948). While elastic enough to allow the delivery of an infant, some separation of the muscle fibers inevitably occurs with birth. To encourage regeneration and reinnervation of the muscles, Arnold Kegel recommended daily sessions of repeatedly contracting and pulling the pelvic floor muscles (PFMs) upwards. Women are encouraged to perform Kegel exercises by tightening the muscles in the perineum as if they were trying to stop the flow of urine (Hackley & Kriebs, 2017). These muscles are slowly tightened and held for 10 s and then relaxed slowly; 10 repetitions are recommended three times a day.

Prenatal visits are an opportune time for education as many women are motivated to maximize their health. Also, the common schedule of regular appointments creates an opportunity to teach pelvic floor health (JBI, 2011; Rockliffe et al., 2021). Despite this, pregnant women and providers may not discuss pelvic floor health or only discuss it minimally. Geynisman-Tan et al. (2018) found that only about 50% of pregnant women had adequate education on pelvic floor health. Similarly, McLennon et al. (2006) found that only 53% of the women they surveyed had been told prenatally that PFME reduces the risk of UI and 80% denied any education on AI during their prenatal visits. Usual care is difficult to define as women report a wide range of what was covered in their prenatal education, with 46% denying any information on Kegel exercises during their prenatal visits (McLennon et al., 2006).

As evidenced by this research, pelvic floor concerns are a common women's health problem. However, there are inconsistencies in current practices related to pelvic floor health education and training. The present integrative review was conducted to examine current

evidence regarding prenatal education of PFME and to determine how antenatal education or training on pelvic floor prenatally impacts pelvic floor health for women.

Methods

Whittemore and Knafl's (2005) recommendations for conducting a transparent and reproducible integrative review were applied in the current review. PubMed, CINAHL, and Scopus databases were searched on January 12, 2022, using the terms (antenatal OR pregnancy OR prenatal) AND (education OR training OR attitudes OR knowledge) AND ("pelvic floor"). The search was limited to journal articles written in English reflecting studies with female participants. Because of the scarcity of high-quality studies, the search range was expanded to 2015–2022. The final article count was 231 in PubMed, 85 in CINAHL, and 294 in Scopus. Altogether, 610 articles were uploaded to Covidence 1.0, and 220 duplicates were removed. Three hundred and ninety article titles and abstracts were screened, and 338 irrelevant articles were excluded. Fifty-two full-text articles were requested, received, and evaluated. Thirty-four articles were excluded, which resulted in identifying 18 articles for this review. An ancestry search of these articles revealed an additional three articles, which were subsequently excluded. Figure 1 illustrates this process using the preferred reporting items for systematic review and meta-analyses (PRISMA) framework (Page et al. 2021).

Articles on the effects of antenatal education/training on pelvic floor health during the antepartum, intrapartum, or postpartum period were included if they were original research. The exclusion criteria included postpartum education/training, surgical interventions, pilot/feasibility studies, use of devices to train the pelvic floor, and poorly translated or low-quality studies. This search was facilitated by consulting with faculty members at Bethel University and the university's research librarian. The Johns Hopkins nursing evidence-based practice model

(Dearholt & Dang, 2018) was used to appraise the literature and assign a quality rating of high, good or low. Finally, a matrix was used for data analysis of the studies, including application of motivational factors according to the COM-B system (Michie et al., 2011).

Results

Of the 18 articles synthesized in this review, nine were randomized controlled trials (RCTs), seven were quasi-experimental, and two were nonexperimental. Seven studies were conducted in Europe, four in the Middle East/North Africa region, five in Asia, and two in North America. Studies included both nulliparous and multiparous women with sample sizes ranging from 60–798. The heterogeneous study designs made it difficult to combine the results of these studies. Figure 2 illustrates positive outcomes identified in these studies.

Capability Factors

Michie et al. (2011) defined capability as "the individual's psychological and physical capacity to engage in the activity concerned. It includes having the necessary knowledge and skills" (p. 4). When using the COM-B system theory to evaluate literature, individual capability to perform PFME must be considered. Both written and oral education on pelvic floor anatomy and PFME performance contribute to women's capabilities by increasing their knowledge (Hyakutake et al., 2018; Leon-Larios et al., 2017; Muhammad et al., 2019; Sut & Kaplan, 2016; Walton et al., 2019). Going further, individualized PFME instruction with a provider or biofeedback verifies women's physical capacity and promotes confidence in their abilities (Dieb et al., 2020; Fritel et al., 2015; Johannessen et al., 2021; Pourkhiz et al., 2017; Prince & Seshan, 2015; Rahimi et al., 2020; Sangsawang & Sangsawang, 2016; Szumilewicz et al., 2019, 2020; Thanapongsirikul et al., 2021).

Five studies included in this review focused on written and/or oral education on prenatal PFME. Sut and Kaplan (2016) gave women (n = 30) oral education and advised them to complete daily Kegel PFME. At postpartum weeks 6 to 8, participants had higher PFM strength (p = 0.002) and more significant improvement in PFM strength (p < 0.001). Daily PFME in this group was also associated with significantly more vaginal deliveries (p = 0.018). Similarly, Leon-Larios et al. (2017) gave women (n = 254) detailed oral and written instructions on how to do PFME and perineal massage with a prescription to perform daily. Those who participated in antenatal perineal massage and PFME had higher rates of intact perinea (p = 0.003), fewer episiotomies (p < 0.001), less severe perineal trauma (p < 0.003), less epidural use (p < 0.001) and less pain (p = 0.01). These findings show that providing oral or written instructions on PFME can facilitate women's capabilities for integrating PFME as part of their lifestyles, leading to benefits in pregnancy and the postpartum period.

Group educational sessions were also found to be an effective way to increase women's knowledge on PFME and decrease distress related to pelvic floor dysfunction (Hyakutake et al., 2018; Muhammad et al., 2019; Walton et al., 2019). After participating in a prenatal pelvic floor workshop, (n = 37) women in Hyakutake et al. (2018) had increased PFME knowledge (p = 0.023), greater confidence in performing PFME correctly (p = 0.004), were more likely to do PFME daily (p = 0.002), and reported fewer bowel symptoms (p = 0.046) or no bowel symptoms (p = 0.049). Muhammad et al. (2019) found that women's (N = 121) knowledge, attitude, and practice scores increased significantly after two prenatal educational sessions (p < 0.001). Finally, Walton et al. (2019) found that two group educational sessions decreased women's (N = 35) colorectal-anal distress scores (p < 0.05), urinary distress scores (p < 0.05), and pelvic floor distress scores (p < 0.05).

After establishing PFME knowledge, provider feedback or biofeedback has a role in pelvic floor health. Ten studies included individualized PFME instruction with provider feedback or biofeedback to confirm proper performance; however, only four studies examined this as the main intervention. In a small RCT by Pourkhiz et al. (2017), women ($n = 41$) received written, verbal, and individual instruction for PFME with a digital exam to confirm proper performance. These women did PFME twice a day in the second half of pregnancy with resumption as soon after birth as possible. They reported higher sexual function and performance scores ($p < 0.001$), higher sexual quality of life scores ($p < 0.001$), and higher PFM strength scores ($p < 0.001$) in pregnancy and postpartum. Dieb et al. (2017) instructed women in late pregnancy ($n = 200$) to complete three sets of PFME per day and perineal massage three times a week. The women received perineal massage demonstration and confirmation of correct PFME. At delivery, these women were found to have less perineal tearing ($p = 0.034$), lower episiotomy rates ($p = 0.045$), and were significantly more likely to report the absence of perineal pain 15 days postpartum ($p = 0.013$).

Similarly, Thanapongsirikul et al. (2021) taught women ($n = 52$) PFME performance using mirror-assisted training to give feedback and confirm correct performance. The women were then instructed to continue PFME at home. At 36–38 weeks gestation, these women reported less UI ($p = 0.01$) and less impact of UI on physical activity ($p = 0.02$), travel ($p = 0.04$), and emotion ($p = 0.04$). Prince and Sheshan (2015) studied the effect of video education on breathing techniques, relaxation exercises, and PFME in a quasi-experimental study. Return demonstration of PFME was completed, and the women were instructed to perform the techniques and exercises at home for 15–34 days. The intervention group reported significantly less pain in labor ($p < 0.01$).

Opportunity Factors

Michie et al. (2011) defined opportunity as "all the factors that lie outside the individual that make the behavior possible or prompt it" (p. 4). Women not only need the confidence and skill to perform PFME (capability factors), they also need opportunities for performance and practice. Studies on opportunities for women to participate in exercise groups that included PFME reflected the next step beyond teaching women the skills necessary to perform PFME. Exercise groups provide a designated space and time for practicing PFME that women might not otherwise have access to. These formal training opportunities are external provisions for making PFME possible or prompting participation in PFME training. Overall, the number of group exercise sessions included in the study protocols ranged from two 90-min educational sessions with group exercise (Walton et al., 2019) to 18 sessions of aerobic high/low impact exercises incorporating PFME into the workouts (Szumilewicz et al., 2020).

Five studies (Fritel et al., 2015; Johannessen et al., 2021; Rahimi et al., 2020; Sangsawang & Sangsawang, 2016; Szumilewicz et al., 2020) included education on PFME or feedback on correct performance and supplying an opportunity for women to practice PFME in a group with other pregnant women. Johannessen et al. (2021), Sangsawang and Sangsawang (2016), and Szumilewicz et al. (2020) found significantly less UI reported in the late pregnancy/postpartum periods or less impact on these women's lives from stress urinary incontinence (SUI) after education and group exercise that incorporated PFME. In contrast, Fritel et al. (2015) found no significant difference in SUI severity or frequency reported at the end of pregnancy in women who participated in their exercise group. While Fritel et al. found no difference in reported PFME frequency at the end of pregnancy and Johannessen et al. (2021) found no difference in PFME frequency at 3 months postpartum, significantly more

women ($p < 0.001$) participating in the prenatal exercise group reported doing PFME postpartum in Szumilewicz et al.

In addition to decreased UI, prenatal group exercise with PFME has been associated with other positive outcomes. In Feria-Ramírez et al. (2021), women participating in a Pilates program with PFME twice a week for 4 weeks had fewer perineal tears ($p = 0.006$). Rahimi et al. (2020) reported increased sexual satisfaction at 3 months postpartum ($p < 0.001$) after eight group sessions followed by perineal stretching and PFME at home. Finally, Walton et al. (2019) found that participants had significantly decreased scores for colorectal-anal distress ($p < 0.05$), urinary distress ($p < 0.05$) and pelvic floor distress ($p < 0.05$) after two 90-min educational sessions on PFME and core strength training with instructions for continuing exercises at home.

Motivational Factors

Motivational factors are powerful behavior influencers (Rockliffe et al., 2021). According to Michie et al. (2011), "Motivation is defined as all those brain processes that energize and direct behavior, not just goals and conscious decision-making. It includes habitual processes, emotional responding, as well as analytical decision-making" (p. 4). Rockliffe et al., (2021) expound further by describing motivation as behavior that is driven by emotion or desire (automatic) or driven by past experience (reflective). Women are motivated by many different factors. Similar to the overlap with capability and opportunity, there was convergence of motivational factors with capability or opportunity factors in several studies. Several studies illustrate the intervention's motivational impact or motivational characteristics internal to the participants.

Nine of the studies in this review highlighted the power of motivation to influence women's behavior in performing PFME (Chen et al., 2020; Hyakutake et al., 2018; Johannessen

et al., 2021; Leon-Larios et al., 2017; Pourkhiz et al., 2017; Sangsawang & Sangsawang, 2016; Stafne et al., 2021; Szumilewicz et al., 2020; Thanapongsirikul et al., 2021). Two studies, Chen et al. (2020) and Stafne et al. (2021), had no capability or opportunity factors and focused on women's reported PFME performance.

Chen et al. (2020) followed 798 pregnant women to evaluate self-reported PFME performance in pregnancy and SUI at 6 weeks postpartum. The women had received no special education or training on PFME, and only 8.5% of these women reported doing adequate (greater than weekly) PFME (Chen et al., 2020). Women performing PFME reported that SUI during pregnancy was a motivation to perform PFME; however, self-reported, unsupervised PFME was not found to be significantly effective in preventing postpartum SUI (Chen et al., 2020). Stafne et al. (2021) followed up with participants of a 12-week PFME training RTC 7 years later and found no statistical difference in frequency of performing PFME between the intervention and control groups. The intervention group had a lower percentage of women reporting UI 7 years later but it was not statistically significant.

Whereas self-reported and unsupervised PFME may not be adequate to effectively support pelvic floor health (Chen et al., 2020), having the necessary knowledge may influence motivation to perform PFME. Hyakutake et al. (2018) found that women reported more confidence in performing PFME correctly ($p = 0.004$) and were more likely to perform PFME daily ($p = 0.002$) after a workshop on PFME. Szumilewicz et al. (2020) also found that women were more likely to perform PFME in the postpartum period after PFME education and group exercise; whereas Johannessen et al. (2021) found no significant difference in PFME frequency postpartum, and Stafne et al. (2021) found no significant difference 7 years after a 12-week PFME training.

Findings in Leon-Larios et al. (2017), Pourkhiz et al. (2017), Sangsawang and Sangsawang (2016), and Thanapongsirikul et al. (2021) showed that women who were motivated to adhere to the study protocol of independent PFME at home or the group exercise were more likely to experience benefits. When comparing subgroups of women who had high compliance rates to their study protocol, Leon-Larios et al. found that the women who completed the recommended daily PFME and massage were more likely to have an intact perineum ($p = 0.006$) than those participating only a couple times a week. Szumilewicz et al. (2020) found that after participating in a pelvic floor training program, 83% of the women reported performing PFME by 8 weeks postpartum ($p < 0.001$), which may reflect good motivation to continue. This contrasts with the findings of Johannessen et al. (2021), who noted that although the women who received the PFME education and participated in group exercise had less SUI, they were not more likely to continue PFME postpartum (88% versus 85%).

Summary of COM-B Factors

When all three components of the COM-B system are present, a behavior is more likely to occur (Michie et al., 2011). At the basic level, providing written or oral education on PFME increases women's knowledge of PFME, which is the basic requirement for capability (Hyakutake et al., 2018; Muhammad et al., 2019). PFME training with provider or biofeedback confirms correct performance and increases capability (Dieb et al., 2020; Fritel et al., 2015; Johannessen et al., 2021; Pourkhiz et al., 2017; Prince & Seshan, 2015; Rahimi et al., 2020; Sangsawang & Sangsawang, 2016; Szumilewicz et al., 2019, 2020; Thanapongsirikul et al., 2021). Opportunity is important for supporting PFME behavior (Michie et al., 2011). Motivation from past experiences, habits, emotional responses, or other internal processes also influences adherence to recommendations and long-term incorporation of PFME into one's lifestyle

(Rockliffe et al., 2022). It is clear that there are many potential benefits of education and training on PFME in the antenatal period.

Discussion

Using an integrative methodology was an effective way to explore prenatal PFME education/training, as the current research is limited and heterogeneous in nature. The PubMed, CINAHL, and Scopus databases were systematically searched, and inclusion and exclusion criteria were used to reduce bias when screening studies. Using the COM-B system (Michie et al., 2011) to categorize the studies assisted in understanding PFME's impact on women's pelvic floor health. Women's health providers can use this understanding to inform educational approaches for prenatal education.

Studies on the effectiveness of prenatal education (written, oral, or demonstration with feedback) emphasized the need for a foundational knowledge to be in place prior to initiating a behavioral intervention. This review showed that educating women on their pelvic floor with guidance on toning it during pregnancy and the postpartum period increased PFME performance (Hyakutake et al., 2018; Szumilewicz et al., 2020) and pelvic floor tone (Pourkhitz et al., 2017; Sut & Kaplan, 2016). Women benefit when the opportunity to perform PFME is supported. Participating in group exercise with pelvic floor training may influence women's consistency in performing PFME during pregnancy and postpartum (Szumilewicz et al., 2020). Participating in group exercise with PFME was shown to decrease SUI symptoms (Johannessen et al., 2021; Sangsawang & Sangsawang, 2016; Szumilewicz et al., 2020). Finally, adherence to PFME recommendations, both prenatally and postpartum, may reflect motivation levels for participating in and continuing PFME postpartum. Motivation factors may not be as easily supported as

capability or opportunity factors; this reflects the need for internalizing the benefits that PFME provides as well as integrating past experiences, emotions, or desires.

This review provided a current, comprehensive analysis of prenatal education and PFME training's positive effects on pelvic floor health. It focused on outcomes beyond UI and AI. Several new studies have been conducted since 2015 that provide additional insights into the effects of prenatal PFME. Woodley et al. (2020) conducted the most recent Cochrane review on perinatal PFME. They examined PFME's effects in both the prenatal and postpartum periods but excluded studies examining only labor and delivery outcomes. In contrast, the present review included research on perineal integrity and discomfort in labor after antenatal PFME.

Comparison With Previous Reviews

Multiple researchers have evaluated the effectiveness of prenatal PFME education and training in enhancing pelvic floor health because the pelvic floor intimately affects quality of life. In contrast to the present review, a meta-analysis completed by Du et al. (2015) showed no statistically significant decrease in either episiotomies or perineal lacerations. This difference may be because this review included studies in which both PFME and perineal massage were used (Dieb et al., 2020; Leon-Larios et al., 2017). It is possible that PFME alone is not effective in increasing perineal integrity. Du et al. also reported a decrease in the first and second stages of labor, which was not an effect found in this review.

The present integrative review is also comparable to the work by Soave et al. (2019) on PFME's effects on the prevention and treatment of UI both prenatally and postpartum. However, Soave et al. included research they considered to be low quality and extended their search range to include earlier studies. Similar to this analysis, Soave et al. noted that the available research was heterogeneous and difficult to synthesize.

Soave et al. (2019) found that prenatal PFME training was effective in reducing UI incidence and severity and improved the quality of life related to UI in the third trimester. Only one study in this integrative review (Thanapongsirikul et al., 2021) reported improvement in quality of life specifically related to UI, and it was also in the third trimester. This writer also found improvements in quality of life related to both sexual function and bowel function in the literature reviewed. Soave et al. did not examine any other outcomes in addition to UI prevention or treatment.

In a recent narrative review, Woodley and Hay-Smith (2021) explored why PFME education should be provided prenatally. They drew from their earlier work (Woodley et al., 2020) and from Du et al. (2015) and Sobhgol et al. (2020). Similar to the present integrative review, they reported that continent women participating in prenatal PFME may experience a reduction in their risk for UI at the end of their pregnancies as well as decreased UI in the postpartum period. They also noted that the benefits of prenatal PFME performance may extend to decreased AI, a potential for decreased episiotomies or perineal lacerations, and increased sexual function.

While these researchers discussed women's health providers' roles in enhancing facilitation of capability, opportunity, and motivation factors for performing PFME, their work differs from the present review by focusing on how providers can integrate these factors rather than examining how different educational or training interventions support each COM-B category. The present integrative review confirmed their findings and provided additional insights on how group education and exercise might enhance women's opportunities for learning and performing PFME. This review also included recent studies that Woodley and Hay-Smith (2021) did not include to support their work.

The systematic Cochrane review by Woodley et al. (2020) focused on UI prevention and treatment and AI prevention and treatment prenatally and postpartum. Their work is more complex than this review due to including older literature and creating subgroups of studies examining women who were continent at baseline, incontinent at baseline, or that included both continent and incontinent women. The present integrative review confirmed their findings that prenatal PFME may be helpful in preventing UI in pregnancy and early postpartum and may reduce the incidence of incontinence.

Woodley et al. (2020) also found that PFME may increase sexual function long term, but not in pregnancy or early postpartum. However, Woodley et al.'s findings diverge from the present review on the effectiveness of prenatal education and training on the prevention/treatment of AI, which they found was inconclusive. Another divergence is that Woodley et al. included studies examining pelvic floor integrity as an outcome but excluded studies that only examined labor and delivery outcomes and found no difference in the incidence of perineal lacerations and episiotomies after doing prenatal PFME. Woodley et al.'s findings also contrast with this review, as they found no statistical difference in PFM strength in women who were continent at baseline but some improvement when both continent and incontinent women were included.

Implications

Nurse-midwives are primary care providers for women and seek to promote the "utilization of health promotion, disease prevention, and health education" (ACNM, 2020, p. 3). After exploring the benefits of education or training on PFME during the prenatal period, midwives should be able to recognize the need for prioritizing this topic during prenatal visits. According to the National Institute for Health and Care Excellence, (2021), all pregnant women

should be educated on and encouraged to perform PFME during prenatal visits. Midwives should begin with providing written and oral education on PFME and its benefits and offer feedback to confirm proper performance. They also can promote exercise groups or classes that include PFME, such as prenatal Pilates with PFME. Finally, they should consider referral to specialized pelvic floor therapy if a woman has symptoms that do not respond to routine PFME.

Which PFME protocol has the greatest effectiveness in promoting pelvic floor health is unknown. While some standardized protocols have been developed for PFME in incontinence treatment for women out of the perinatal period, the studies in the present review were not uniform in their recommendations for PFME performance. While the findings of possible increased perineal integrity, reduced AI and UI, and improved sexual function are in agreement with findings in other reviews, further research should be conducted to confirm this. Likewise, because motivation is a notable influence in the practice of PFME, further studies should focus on how to facilitate motivation in pregnant women.

Limitations

This analysis provides evidence that prenatal education on PFME is important for pelvic health and enhances a woman's quality of life, especially related to sexual and bowel function. However, the conclusiveness of each effect is difficult to determine due to sparse supporting studies. Variations in standard prenatal care also make it difficult to compare the effectiveness of PFME education. There is some risk for bias due to smaller sample sizes in some studies and inability to double blind. Additionally, while research examining the effect of prenatal PFME on sexual function has increased, there were only two studies that met inclusion criteria for this review. Conducting further studies on all outcomes is important since previous reviews have conflicting conclusions on PFME's effectiveness in preventing/treating UI and AI, increasing

perineal integrity, and improving sexual function. None of the studies in this review included results on length of labor. Finally, investigating motivation factors is complicated because of the internal aspect of motivation. One must consider whether women who are motivated to engage with PFME experience benefit or if those experiencing benefit are more motivated to adhere to recommendations. This is a limitation when evaluating motivational factors for PFME.

Conclusion

When capability, opportunity, and motivation to perform PFME in pregnancy are supported, women benefit. Education on PFME followed by provider feedback or biofeedback confirming correct performance reinforces women's PFME skills. Prenatal education and confirmation of skills followed by home PFME regimens can have a positive effect on perineal integrity, sexual function, decreased pain in labor and postpartum, and less UI (Dieb et al., 2020; Pourkhiz et al., 2017; Prince & Seshan, 2015; Thanapongsirikul et al., 2021). Women may experience an increase in pelvic floor strength (Sut & Kaplan, 2016; Szumilewicz et al., 2019). They may have decreased SUI symptoms or occurrence (Johannessen et al., 2021; Sangsawang & Sangsawang, 2016; Szumilewicz et al., 2020; Thanapongsirikul et al., 2021; Walton et al., 2019) as well as decreased AI or impact on life from AI (Hyakutake et al., 2018; Walton et al., 2019). Unfortunately, women report that they receive inadequate education during their prenatal visits on PFME's benefits and how to properly perform it (Geynisman-Tan et al., 2018; McLennon et al., 2006). Midwives should prioritize PFME education during prenatal appointments because pelvic floor health is a unique part of women's health and directly impacts quality of life.

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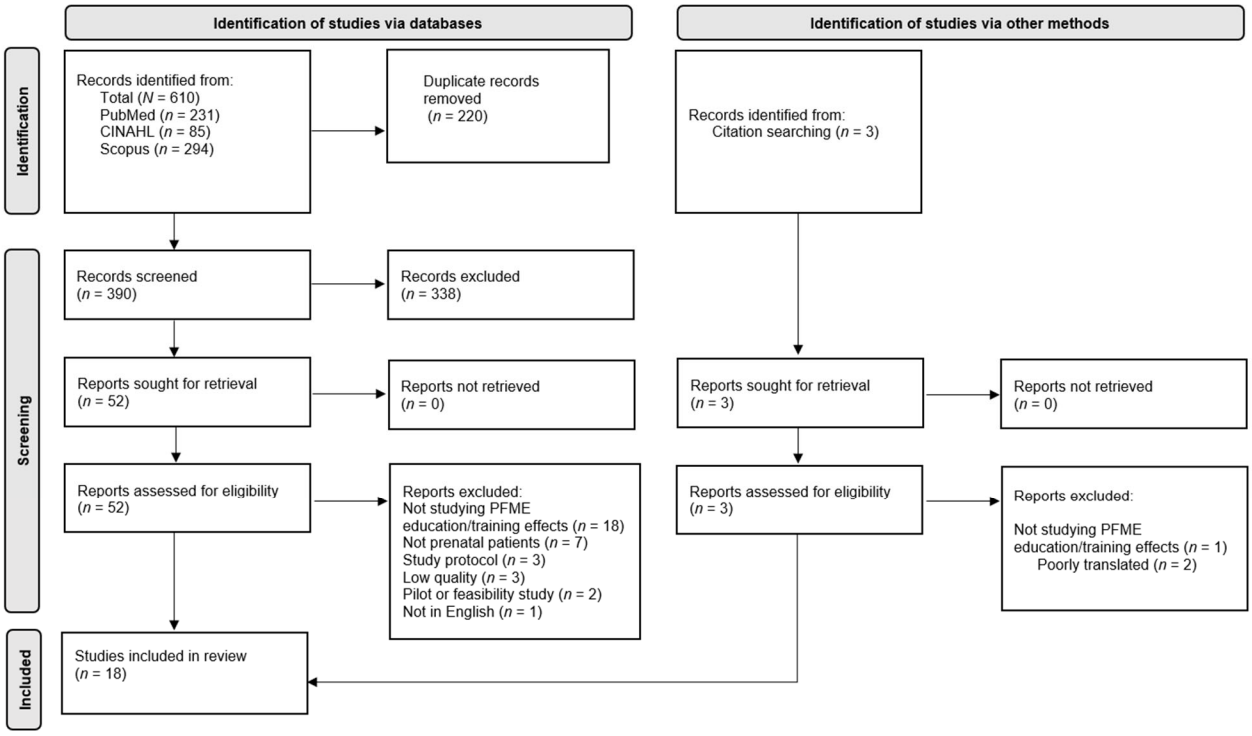
Figure 1

PRISMA Flow Chart



Note. PFME = pelvic floor muscle exercises. This flow chart was adapted from the example in M. J. Page et al. (2021, p. 5), "The PRISMA 2020 statement: An updated guideline for reporting systematic reviews," *BMJ*, *372*(71). https://doi.org/10.1136/bmj.n71. Copyright 2021 by BMJ.

Figure 2

Benefits of Pelvic Floor Muscle Exercise (PFME) Education/Training

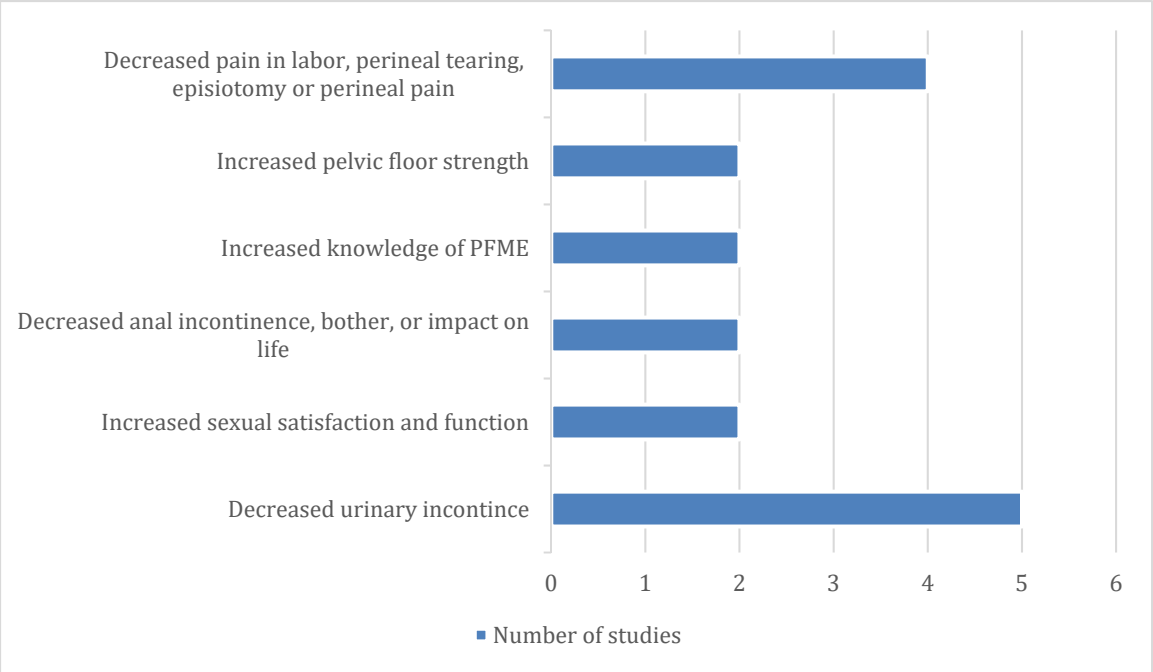


Table 1

Literature Review Matrix

Author, year, location	Focus	Level, quality, limitations	Design and sample	Key results	Capability, opportunity, or motivational factors?
Chen et al. (2020) Shenzhen, Guangdong, China	Effectiveness of unsupervised antenatal PFME on PP SUI.	Level: III Quality: good Limitations: Possible recall bias for the amount PFME was performed during pregnancy. Only 8.5% of women in this study reported doing adequate (greater than weekly) PFME.	Prospective cohort study; continent pregnant women (N = 798) given questionnaires to evaluate self-reported PFME performance in pregnancy and SUI at 6 weeks PP.	Self-reported, unsupervised PFME was not significantly effective in preventing PP SUI.	Motivational factor reported by the women was SUI during pregnancy. No special education or training done = no opportunity.
Dieb et al. (2020) Cairo, Egypt	Effect of antenatal PFME and perineal massage on perineal lacerations, duration of second stage of labor, need for episiotomy or C/S birth.	Level: 1 Quality: good Limitations: More women allocated to the intervention group had higher levels of education; no long-term follow up.	RCT; women ages ≥ 35 years at 35 weeks GA (N = 400) assigned to routine education on PFD or to routine education and provider-demonstrated perineal massage and PFME with instructions for massage 3x/week and PFME 3x sets/day.	Intervention group had less perineal tearing overall (p = 0.034), lower episiotomy rates (p = 0.045), and was significantly more likely to report no perineal pain 15 days PP (p = 0.013).	Capability: Teaching PFME in person and confirming that it was performed correctly.
Feria-Ramírez et al. (2021) Huelva and Seville, Spain	Effect of prenatal Pilates on incidence and degree of intrapartum perineal injuries.	Level: II Quality: good Limitations: Originally 107 women total; those who delivered by C/S (32% C/S rate overall) were excluded from final analysis.	Quasi-experimental trial (N = 72); Intervention: 1-hr Pilates class 2x/week for 4 weeks in addition to prenatal education.	Women in Pilates group had less perineal tearing (p = 0.006)	Opportunity: Participating in Pilates class.

Author, year, location	Focus	Level, quality, limitations	Design and sample	Key results	Capability, opportunity, or motivational factors?
Fritel et al. (2015) France	Effectiveness of supervised prenatal PFME compared to written education on SUI on the incidence of PP SUI.	Level: I Quality: good Limitations: Sample size inadequate to show significance due to an unexpectedly large SD on the questionnaire. Low adherence to PFME in the intervention group.	Single-blind RCT; Women (N = 190) received written education on pelvic floor anatomy and PFME. Intervention group also received 8 weekly PFME training sessions with pelvic floor contraction assessment. 2 questionnaires and a 24-hr pad test were used to measure outcomes.	No significant difference in SUI severity or frequency or in the frequency of reported PFME at the end of pregnancy between the groups.	Capability: Intervention group received PFME feedback. Opportunity: The intervention group participated in a weekly training session.
Hyakutake et al. (2018) Vancouver, British Columbia	Effectiveness of prenatal workshop on pelvic floor health on PP pelvic floor health, knowledge, performance of PFME, pelvic symptoms and condition-specific quality of life, mode of delivery, and satisfaction.	Level: I Quality: good Limitations: Instruments for measuring knowledge regarding pelvic floor not completely validated. Large dropout rate for both control and intervention groups.	RCT; control group (n = 37) and workshop group (n = 37) completed PP evaluation with questionnaires.	Intervention group had higher scores on PFME knowledge (p = 0.023), confidence in performing correctly (p = 0.004), and likelihood to perform PFME daily (p = 0.002) and reported less bother from bowel symptoms (p = 0.046) or no bowel symptoms (p = 0.049). No significant differences in bladder symptoms, mode of delivery, episiotomy, or perineal laceration.	Capability: Workshop provided knowledge on how to perform PFME. Motivational: Women in the intervention group were statistically more likely to perform PFME daily and believe they were performing correctly.
Johannessen et al. (2021) Norway	Effects of antenatal exercise program (including PFME) on PP	Level: I Quality: good Limitations: Results may not be generalizable, women in this study were educated, healthy White women.	RCT; intervention group (n = 384) received 12 weeks of weekly group exercise sessions with PFME, 2 at-home exercise sessions and individual education on	Intervention group had significantly less UI than in the control group in late pregnancy (p = 0.03) and at 3 months PP (p = 0.01). No significant difference in	Capability: Intervention group had PFME performance feedback. Opportunity:

Author, year, location	Focus	Level, quality, limitations	Design and sample	Key results	Capability, opportunity, or motivational factors?
	UI at 3 months PP and learn more about factors associated with UI PP.		pelvic floor anatomy with a vaginal exam to evaluate pelvic floor strength. Control group (n = 365) received standard care including a booklet on PFME.	the percentage of women performing PFME 3 months PP (88% versus 85%, p = .185)	Intervention group participated in weekly group exercises. Motivational: Both groups reported similar PFME performance PP.
Leon-Larios et al. (2017) Seville, Spain	Effect of prenatal PFME and perineal massage training on perineal integrity at birth.	Level: II Quality: good Limitations: high attrition rate (36%), More of the intervention group were attended by midwives, which may have predisposed them to delivering unmedicated and in alternate positions. Adherence to intervention was significantly lower in women who did not have a university degree (p < 0.001).	Single-blind quasi-randomized controlled trial (N = 466); Intervention group instructed to perform perineal massage daily and PFME twice daily, starting at 32 weeks. Data were analyzed by intention to treat (n = 254) and control group (n = 212). Perineal data were analyzed without the C/S deliveries in both groups: intervention group (n = 193) and control group (n = 160).	Women in the intervention group who completed daily PFME and massage were more likely to have an intact perineum (p = 0.006). The intervention group had more intact perineums (p = 0.003), fewer episiotomies (p < 0.001), severe perineal trauma (p < 0.003), epidural use (p < 0.001) and pain (p = 0.01).	Capability: Education was provided on performing PFME. Motivational: Women who adhered to the intervention had higher motivation to be consistent with the program.
Muhammad et al. (2019) Malaysia	Effectiveness of prenatal PFME education class on PFME knowledge, attitudes, and performance.	Level: II Quality: good Limitations: Authors indicated that they should have had a sample size of 138. Only 121 women participated.	Quasi-experimental; Pregnant women (N = 121) received two educational sessions on pelvic floor health and PFME, including lecture and demonstrations.	PFME knowledge, attitude, and practice scores increased significantly after the educational sessions (p < 0.001).	Capability: Pregnant women without previous PFME knowledge reported increased

Author, year, location	Focus	Level, quality, limitations	Design and sample	Key results	Capability, opportunity, or motivational factors?
			Questionnaire used to measure PFME knowledge, attitudes, and performance before and after intervention.		knowledge of pelvic floor health and how to perform PFME.
Pourkhiz et al. (2017) Iran	How PFME during pregnancy and PP affects sexual function, sexual quality of life, and PFM strength.	Level: I Quality: high Limitations: Only nulliparous women included; findings may not be generalizable to all pregnant women.	Single-blind RCT; PFME group (n = 41) received written, verbal, and practical instructions to perform PFME 2x/day from 17–37 weeks GA and resume after birth. Control group (n = 41) received education on hygiene. 2 questionnaires administered before and after intervention. PFM strength evaluated by a midwife by digital exam.	Women in intervention group had higher sexual function and performance scores ($p < 0.001$), higher sexual quality of life scores ($p < 0.001$), and higher PFM strength scores ($p < 0.001$) in pregnancy and PP.	Capability: Education provided on PFME; participants received a digital exam to confirm proper performance. Motivational: Women performed twice-daily PFME at home, adding the exercises to their daily lives.
Prince & Seshan (2015) Karnataka, South India	Effect of selected prenatal exercises on labor in primigravidas.	Level: II Quality: good Limitations: Neither researchers nor participants were blinded. Participants self-reported hours spent on each exercise.	Quasi-experimental; N = 600 primigravidas. Intervention group received video education on breathing techniques, relaxation exercises, and PFME. Return demonstration was completed; women were instructed to perform techniques and exercises at home (15–34 days).	Women receiving education on breathing, relaxation, and PFME and participating in home practice reported significantly less pain in labor ($p < 0.01$); 24.7% reported doing 200–300 hr of PFME, 52.3% reported doing greater than 400 hr of PFME, less than 25% reported doing less than 200 hr of PFME.	Capability: Participants were taught PFME exercises and did return demonstrations to confirm that they were performing properly.

Author, year, location	Focus	Level, quality, limitations	Design and sample	Key results	Capability, opportunity, or motivational factors?
Rahimi et al. (2020) Iran	Effect of prenatal education on PP sexual satisfaction in nulliparous women.	Level II Quality: good Limitations: Translation into English was poor, making study difficult to understand. 6 participants in the intervention group dropped out and were replaced.	Quasi-experimental; $N = 150$ pregnant women. Intervention group received materials on sexual function, pelvic floor health, and PFME and participated in 8 group sessions with 30 min of exercises and return demonstration of exercises for the midwife. Participants asked to do 15 min of stretching and exercise daily. Questionnaire used to measure sexual satisfaction before educational program and 3 months after delivery.	Women in the intervention group reported an increase in sexual satisfaction compared to the control group ($p < 0.001$).	Capability: Women received education and did return demonstration to confirm proper PFME. Opportunity: 8 sessions of group education/group exercise provided to the intervention group.
Sangsawang & Sangsawang (2016) Thailand	Effectiveness of 6-week prenatal PFE program supervised by a midwife in preventing SUI in late pregnancy.	Level: I Quality: high Limitations: none	RCT; $N = 63$ pregnant women. Intervention group received a booklet on PFME, three 45-min group training sessions, correct performance of PFME was confirmed, and participants were instructed to follow PFME protocol 2x/day for 6 weeks at home. SUI evaluated with a log and visual analog scale.	Significantly fewer women in the intervention group reported SUI at 38 weeks ($p = 0.018$) and had significantly less frequency ($p < 0.001$), perceived severity ($p < 0.01$), and amount ($p = 0.03$).	Capability: Correct PFME performance taught and confirmed. Opportunity: Group education sessions. Motivational: Women performed PFME protocol at home after learning about SUI prevention.

Author, year, location	Focus	Level, quality, limitations	Design and sample	Key results	Capability, opportunity, or motivational factors?
Stafne et al. (2021) Norway	Long-term effects of prenatal exercise program including PMFE on UI and what other factors are associated with UI.	Level: III Quality: good Limitations: Several women had pregnancies and births since original study. Women currently pregnant and recently delivered not included in analysis.	Nonexperimental; follow up of a 12-week PFME training RTC; questionnaires sent to participants to measure SUI prevalence 7 years after the study. 262 questionnaires analyzed.	35% of original study participants responded. Although a lower percentage of women in the intervention group reported UI 7 years later, it was not statistically significant. No statistical differences between the groups in frequency of performing PFME 7 years later.	Motivational: 7 years after the intervention, there was no difference in frequency of PFME performance.
Sut & Kaplan (2016) Turkey	Effects of prenatal and PP PFME on pelvic floor muscle activity and voiding functions.	Level: I Quality: good Limitations: Results may not be generalizable.	RCT; $N = 60$ pregnant women. Intervention group instructed to do Kegel PFME, 10 sets 3x/day. 3 questionnaires, perineometry, and uroflowmetry used to measure outcomes.	Intervention group had significantly more vaginal deliveries ($p = 0.018$), higher PFM strength at PP Weeks 6–8 ($p = 0.002$), greater PFM strength improvement ($p < 0.001$). No difference in frequency and urgency PP. Both groups reported UI improved PP.	Capability: Women in the PFME group received education on Kegels.
Szumilewicz et al. (2019) Poland	If a high-low exercise program with PFME improves neuromuscular activity of the pelvic floor without decreasing quality of life related to	Level: I Quality: high Limitations: Unclear which exercise intervention influenced PFM functions as they are not studied separately.	RCT; $N = 97$ pregnant women. Intervention group participated 6-week exercise program 3x/week, with aerobic high/low impact and were taught to contract pelvic floor before impact, and to contract PFM in coordination with other exercises and then isolated PFME at the end of the exercise session.	Quality of life related to incontinence did not change significantly in either group. Intervention group had significant increases in quick flick contraction strength ($p = 0.014$) and an increase in ability to relax ($p = 0.013$) compared to baseline; control group did not.	Capability: Education and feedback on proper PFME. Opportunity: 6-week group exercises.

Author, year, location	Focus	Level, quality, limitations	Design and sample	Key results	Capability, opportunity, or motivational factors?
	incontinence in pregnancy.		Both groups had sEMG evaluation before and after intervention. Questionnaire used to evaluate quality of life affected by UI.		
Szumilewicz et al. (2020) Poland	Effectiveness of prenatal PFME education in reducing SUI in women participating in high–low impact exercise prenatally.	Level: II Quality: good Limitations: Authors did not state how many subjects needed for results to be significant. Statistically significant difference in mean age of the groups.	Quasi-experimental; $N = 270$ pregnant women. Intervention group received weekly education on pelvic floor, PFME training with biofeedback and participated in aerobic exercise followed by PFME 3 x/week from the second trimester until birth. Questionnaire used to measure UI impact.	Intervention group reported less impact on their lives from UI at 8 weeks PP ($p = 0.03$) and 1 year ($p = 0.005$); however, if asymptomatic women were excluded from the analysis, the difference in impact was not significant. More women from the intervention group reported performing PFME by 8 weeks pp ($p < 0.001$).	Capability: Education and feedback on proper PFME. Opportunity: Aerobic/PFME exercise 3x/week until delivery.
Thanapongsirikul et al. (2021) Thailand	Effect of PFME training using verbal and mirror feedback on UI in late pregnancy.	Level: I Quality: good Limitations: PFME strength not measured.	RCT; $N = 107$ women educated on PFME and how to do PFME at home and logged their PFME performance and incontinence episodes. All instructed to perform 3 PFME sessions 3x/week. Intervention group ($n = 52$) also received 10 min of individualized, physician-directed, verbal feedback training with a mirror in the	At 36–38 weeks GA, fewer women who received mirror-assisted training reported UI ($p = 0.01$); they also reported less impact on physical activity ($p = 0.02$), travel ($p = 0.04$), and emotion ($p = 0.04$).	Capability: All participants received education on proper PFME; intervention group received mirror-assisted feedback. Motivational: Participants were given logs and requested to perform PFME at home.

Author, year, location	Focus	Level, quality, limitations	Design and sample	Key results	Capability, opportunity, or motivational factors?
			first session, and evaluation every 4 weeks for 12 weeks. Questionnaires used to evaluate severity of symptoms and quality of life before and after the intervention.		
Walton et al. (2019) Midwest United States	Effects of a community nutrition and exercise program focused on pelvic floor and core stability, healthy nutrition, and breastfeeding counseling on pelvic floor outcomes for antenatal and PP women in low resource areas.	Level: II Quality: good Limitations: Authors did not state a minimum sample size needed, small sample size, 46% attrition rate	Prospective quasi-experimental study; 35 women participated in an 8-week program with two 90-min educational sessions that included PT-taught PFME, core strength training and education on contracting PFM and transverse abdominals when lifting as well as home instruction for exercise. Questionnaire used to measure pelvic floor dysfunction/incontinence before and after educational program.	Participants had significantly decreased scores for colorectal-anal distress ($p < 0.05$), urinary distress ($p < 0.05$) and pelvic floor distress ($p < 0.05$) after the intervention. No significant decrease in pelvic organ prolapse scores.	Capability: Women were taught proper PFME (but not confirmed with biofeedback or digital exam) Opportunity: 2 supervised group educational exercise sessions with PT.

Note. PP = postpartum; PFME = pelvic floor muscle exercise; SUI = stress urinary incontinence; C/S = Cesarean section; GA = gestational age, PFD = pelvic floor disorders, RCT = randomized controlled trial, UI = urinary incontinence; SD = standard deviation; PFM = pelvic floor muscle; sEMG = surface electromyography; PT = physical therapist.