



Learning about pelvic floor muscle exercises before and during pregnancy: a cross-sectional study

Deirdre Daly¹ · Cinný Cusack² · Cecily Begley^{1,3}

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Abstract

Introduction and hypothesis All pregnant women should be given advice on the benefits of pelvic floor muscle exercises (PFMEs) in preventing urinary incontinence (UI) and know how to exercise correctly. This study explored women's knowledge and practice of PFMEs, their sources of knowledge and prevalence of UI before and during pregnancy.

Methods We conducted a cross-sectional study with 567 women, 239 primiparous and 328 multiparous, recruited from one maternity hospital in Ireland. Logistic regression was used to examine associations.

Results Pre-pregnancy, 41% of women ($n = 232$) learnt to do PFMEs, 30% ($n = 172$) did exercises and 28% ($n = 159$) experienced UI. Women more likely to report UI were aged ≥ 35 years ($p = 0.03$), had a BMI ≥ 30 kg/m² ($p = 0.01$) or did PFMEs but were unsure they were exercising correctly ($p = 0.03$). During pregnancy, 50% of women ($n = 281$) received PFME information during antenatal visits and 38.6% ($n = 219$) attended antenatal classes. Women less likely to do PFMEs daily or weekly had no formal educational qualification ($p = 0.01$), did not do PFMEs pre-pregnancy ($p < 0.0001$) or did not attend the physiotherapist-led PFME education session ($p < 0.0001$). In multivariable analysis, the two factors significantly associated with UI during pregnancy were being aged 30–34 years ($p = 0.05$) and reporting UI pre-pregnancy ($p < 0.0001$).

Conclusions This benchmarking exercise revealed considerable gaps in the totality of PFME education and services offered in the site hospital. We recommend that others do likewise to enable learning from those who have addressed service deficits.

Keywords Exercise · Kegel exercises · Pelvic floor · Prenatal education · Survey · Urinary incontinence

Introduction

Pelvic floor muscle training (PFMT) performed during pregnancy may lower the risk of reporting urinary incontinence (UI) in late pregnancy and up to 6 months postpartum [1] and, although the effects are uncertain when used to treat UI, guidelines recommend that all pregnant women should be

given evidenced-based advice [2, 3]. Healthcare professionals have several opportunities to offer pregnant women advice on pelvic floor muscle exercises (PFMEs) and UI prevention. However, studies report considerable gaps in women's knowledge and information provision [4–6] and the need for service reorganisation so that all women receive high quality instruction during pregnancy [4, 6]. UI is an embarrassing and isolating condition that affects considerable proportions of women before and during pregnancy: pre-pregnancy 34.8% and 41.1% of nulliparous women reported UI symptoms and between 38.7% and 55.9% experienced symptoms during pregnancy [7, 8]. Risk factors for reporting UI during pregnancy include being aged 35 years and over, having a body mass index (BMI) of ≥ 30 kg/m² and having occasional symptoms, i.e., UI less than once per month pre-pregnancy [7, 8]. In addition, women who experience new-onset stress UI (SUI) during their first pregnancy and who are still symptomatic at 3 months postpartum have an 88% risk of still having symptoms 5 years later [9]. All of this demonstrates that many women experience feelings of embarrassment and isolation

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✉ Deirdre Daly
dalyd8@tcd.ie

¹ School of Nursing and Midwifery, Trinity College Dublin, 24 D'Olier Street, Dublin DO2 T283, Ireland

² Rotunda Hospital, Parnell Street, Dublin D01 P5W9, Ireland

³ Institute of Health and Care Sciences, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

and a diminution in their quality of life [10] because of a condition that is preventable, and potentially treatable, during pregnancy. A review of attendance at antenatal education classes in the site hospital in 2012 showed that only 25.2% ($n = 2225/8846$) of all pregnant women attended classes that include a standardised PFME education session, taught by a physiotherapist [11]. While the terms PFMT and PFMEs are often used interchangeably, the distinction is important. PFMT is progressive PFM exercises to improve strength and function that is individualised for each woman and includes three main principles: overload, specificity and reversibility [12]. The physiotherapist-led class includes education on the structural anatomy and function of the PFMs, verbal instruction on how, when and how often to do PFMEs, the potential benefits of doing PFMEs and possible consequences of not doing them. Women are also given an opportunity to practise PFMEs by doing up to ten timed repetitions, fast and slow, and the knack. They are also taught self-assessment techniques so they know if they are exercising correctly and how to progress the exercises to achieve a training effect as the pregnancy continues. Further advice is given on good bladder and bowel health and the importance of correct defecation techniques and avoiding constipation. In addition, all pregnant women booking for care at the site hospital receive a maternity pack containing a section on PFMEs.

Given that only 25.2% of all pregnant women attended antenatal classes with a focused PFME session, this study aimed to:

- (1) explore women's sources of knowledge about and practice of PFMEs before and during pregnancy;
- (2) explore associations among the variables age, BMI, education, performing PFMEs, attendance at antenatal classes, and having/not having UI symptoms before and during pregnancy.

Our purpose, ultimately, was to review the way PFME education was delivered by all maternity care professionals in the site hospital to benchmark service provision and identify ways of offering all women evidenced-based information and education.

Materials and methods

Design

We conducted a cross-sectional anonymised survey with 567 pregnant and postpartum women. Given that women's parity changed during the study, we have used the term "primiparous" throughout to refer to postnatal women who had their first baby during the study and were thus nulliparous women during their pregnancy.

Ethics

Ethical approval was granted by the university and hospital ethics boards. Consent was assumed when the woman completed and returned the anonymised survey in the addressed envelope. The research was conducted according to the principles outlined in the Declaration of Helsinki [13].

Sample and setting

The setting was a maternity hospital in Ireland with approximately 700 women birthing per month. Eligible women were ≥ 32 weeks pregnant or women who had recently birthed and were in hospital postpartum, able to read and understand English, aged ≥ 16 years and recruited during a 4-month period, March to June 2014.

Recruitment

The study information packs containing an introductory letter, an information leaflet outlining the purpose and anonymised nature of the research, an invitation to participate, the survey and an addressed envelope for returning the completed survey were available in all the hospital's clinics and wards. Women could access the information directly and choose to take part, and staff in the various clinics and wards were also asked to offer eligible women the study information.

Data collection

The anonymised survey was designed to capture (1) socio-demographic information including age (in years), height, pre-pregnancy weight, education level and number of previous pregnancies; (2) learning about and doing PFMEs before pregnancy; (3) attending antenatal classes and learning about PFMEs; (4) learning about PFMEs during antenatal visits. Women were also asked to tell us how the information was given during pregnancy, if it was just mentioned or they received verbal or physical instruction. Women were asked about the frequency of doing PFMEs before and during pregnancy, and if they believed they were exercising correctly by responding to the statement 'I knew I was doing pelvic floor muscle exercises correctly' on a Likert scale from 1 to 5, with 1 being strongly agree and 5 being strongly disagree. Women were also asked about their experience of UI symptoms and type of UI, both before and during pregnancy.

Questions on UI type [stress, urge and mixed (SUI, UUI, MUI)] were formulated according to the standards jointly recommended by the International Urogynecological Association (IUGA) and the International Continence Society (ICS) [14] and structured to identify the frequency, type and amount of UI before and during pregnancy. These questions were identical to the those pre-tested for validity and

reliability and used in the larger Maternal health And Maternal Morbidity in Ireland (MAMMI) study (<http://www.mammi.ie/>) [8].

The survey was tested for content validity with five midwives and four women's health physiotherapists and tested for face validity with ten pregnant women. Minor changes to the instructions for completion and survey's structure were required in response to participants' comments. Reliability was measured using the test-retest approach with ten women, resulting in a Cohen's kappa (*k*) statistic of 0.8, indicating satisfactory agreement.

Sample size calculations

A minimum sample size of 500 was estimated using local data on the proportion of women who attended antenatal classes and the proportion of primiparous women with UI. This would include approximately 125 women who had attended PFME education classes, 160 women who experienced UI pre-pregnancy and 190 women who experienced UI during pregnancy and enable associations between doing PFMEs, attending classes and reporting UI to be tested with the criterion for significance set at $p < 0.05$. Based on previous experience of conducting research at the site hospital, we estimated that 50% of women would be offered the survey and approximately 40% of these would complete the survey resulting in a sample of 550 women during the study period.

Data analysis

Data were analysed using IBM Statistical Package for Social Sciences (SPSS) version 22 (New York, NY, USA). Two researchers checked the values for each variable in the SPSS database, alongside the paper copies of the surveys, and conducted the analyses. Analyses were checked and verified by the third researcher. Descriptive analyses are presented as proportions. Univariate and multivariable logistic regression analyses were used to examine associations among the variables age, BMI, education, performing PFMEs, attendance at antenatal classes and having/not having UI symptoms and are presented using crude and/or adjusted odds ratios (AOR) with 95% confidence intervals (CI).

Results

Two thousand surveys were distributed during the 4-month period and 570 (28.5%) women responded. A total of 378 women (66.3%) completed the survey during pregnancy and 189 (33.2%) completed it postpartum. Three women (0.05%) did not state their parity and their data were excluded from the analysis resulting in a sample of 567 women, 239 primiparous and 328 multiparous.

Socio-demographic characteristics

Compared with the site hospital's population [11], the study sample was broadly representative for most age categories but under-represented for primiparous women aged 16–24 years (8.9% compared with 12.6%) (S1), included a greater proportion of women with a BMI $< 18.5 \text{ kg/m}^2$ (3.7% versus 1.9%), fewer women with a BMI between 25 kg/m^2 and 34.99 kg/m^2 (23.4% compared with 36.8%) and a similar proportion of women with a BMI $\geq 35 \text{ kg/m}^2$ (3.7% versus 4.6%).

Pre-pregnancy

Pre-pregnancy, two-thirds of women (67%, $n = 380/567$) had heard about PFMEs, the most common source of information being exercise or yoga classes (25%, $n = 93/380$). Forty-one percent of women learnt to do PFMEs ($n = 232/567$) but less than one-third (30%, $n = 172/567$) did them. Of the 172 women who did PFMEs, only 24% ($n = 41$) exercised daily or several times a week.

Women were asked to respond to the statement 'Before I ever became pregnant, I knew I was doing Pelvic Floor Muscle Exercises correctly' on a Likert scale from 1 to 5, with 1 being strongly agree and 5 being strongly disagree. Combining the strongly agree/agree categories, and excluding those with neutral responses, half of the 72 primiparous women (50%, $n = 36$) and 52% ($n = 52$) of the 100 multiparous women who did PFMEs believed they were exercising correctly.

More than a quarter of the 239 primiparous women (27.2%, $n = 65$) and 28.6% ($n = 94$) of the 328 multiparous women reported UI before pregnancy, 58.5% ($n = 38$) and 60.6% ($n = 57$) of whom experienced SUI symptoms.

During pregnancy

Women were asked about learning to do PFMEs during their current pregnancy, either from antenatal classes or during their antenatal clinic visits at the site hospital (Table 1). Forty-one percent ($n = 98$) of the 239 primiparous and 36.9% ($n = 121$) of the 328 multiparous women attended classes: of the 190 women who stated how PFME information was given during the physiotherapist-led class, 65.9% ($n = 56$) primiparous and 62.9% ($n = 66$) multiparous women were given physical instruction (an opportunity to practice PFMEs). All women attending the site hospital receive a maternity pack containing information on PFMEs, yet almost half (49.6%, $n = 281$) of all 567 women in this study said they did not receive this information. During their antenatal clinic visits, less than half of all women (44.4%, $n = 252$) were given information on PFMEs: most got the information from midwives and midwifery students (70.6%, $n = 178$) and only 6.7% ($n = 17$) received information from doctors. Of the women who were given

Table 1 PFME information and education at the study site

	Primiparous women	Multiparous women
Attendance at antenatal (AN) classes at site hospital during this pregnancy	<i>n</i> = 239 (%)	<i>n</i> = 328 (%)
Did not attend	139 (58.2)	202 (61.7)
Antenatal class with PFME session led by physiotherapist	87 (36.4)	108 (32.9)
Community midwives' class - physiotherapist not present	2 (0.8)	5 (1.5)
Pelvic girdle pain class - led by physiotherapist	8 (3.3)	5 (1.5)
Not stated	3 (1.3)	8 (2.4)
Received information on PFMEs during antenatal clinic visits	<i>n</i> = 239 (%)	<i>n</i> = 328 (%)
Yes	112 (46.8)	140 (42.7)
No	118 (49.4)	163 (49.7)
Not stated	9 (3.8)	25 (7.6)
Urinary incontinence during pregnancy	<i>n</i> = 239 (%)	<i>n</i> = 328 (%)
No	100 (41.8)	138 (42.1)
Stress UI	90 (37.7)	104 (31.7)
Urge UI	20 (8.4)	26 (7.9)
Mixed UI	25 (10.5)	51 (15.6)
Not stated	4 (1.6)	9 (2.7)
Frequency of doing PFMEs now	<i>n</i> = 239 (%)	<i>n</i> = 328 (%)
Every day	47 (19.7)	56 (17.1)
Several times a week	51 (21.3)	69 (21.0)
Several times a month	6 (2.5)	26 (7.9)
Only when I think of them	81 (33.9)	96 (29.3)
Never	33 (13.8)	47 (14.3)
Not stated	21 (8.8)	34 (10.4)
Source of information on PFMEs during antenatal clinic visits*	<i>n</i> = 112 (%)	<i>n</i> = 140 (%)
Midwife	80 (71.4)	98 (70.0)
Midwifery student	12 (10.7)	14 (10.0)
Doctor	6 (5.4)	11 (7.9)
Unsure	21 (18.7)	25 (17.9)
How information on PFMEs was given during AN clinic visits*	<i>n</i> = 112 (%)	<i>n</i> = 140 (%)
Mentioned	61 (54.5)	72 (51.4)
Given a leaflet	56 (50.0)	69 (49.3)
Given verbal instruction	20 (17.9)	32 (22.9)
Given physical instruction	1 (0.9)	7 (5.0)
Not stated	9 (3.8)	25 (7.6)
How information on PFMEs was given during physiotherapist-led session*	<i>n</i> = 87 (%)	<i>n</i> = 108 (%)
Mentioned	19 (21.8)	15 (13.9)
Given a leaflet	44 (50.6)	60 (55.6)
Given verbal instruction	70 (80.5)	87 (80.6)
Given physical instruction (opportunity to practise PFMEs)	56 (64.4)	66 (61.1)
Other	4 (4.6)	2 (1.9)
Not stated	2 (2.3)	3 (2.8)
Believed I was doing PFMEs correctly (after attending physiotherapist-led session)	<i>n</i> = 85	<i>n</i> = 105
Strongly agree/agree	65 (76.5)	78 (74.3)
Neutral/strongly disagree/disagree	20 (23.5)	24 (22.9)
Not stated	0	3 (2.8)

*Multiple responses possible on who gave information and how information was given

Includes demonstration/practical video, demonstration and guidance, PFME focus group, used pelvic model and imagery, observed doing PFMEs by physiotherapist

information, one-fifth (20.6%, $n = 52$) received verbal instruction, and only eight (3.2%) received physical instruction (an opportunity to practice).

Two-fifths of both primiparous (41.0% ($n = 98$)) and multiparous women (38.1%, $n = 125$) did PFMEs daily or several times a week. Seventy-five percent of the 190 women ($n = 143$) who did PFMEs daily or weekly, and attended the physiotherapist-led class, believed they were exercising correctly.

More than half of all women experienced UI symptoms during pregnancy. Ninety of the 135 primiparous women with UI (66.7%) and 104 of the 181 multiparous women with UI (57.5%) experienced SUI symptoms, and 18.5% ($n = 25$) of primiparous and 28.2% of multiparous women ($n = 51$) had MUI symptoms.

Factors associated with doing PFMEs

In univariate analysis, there was no significant association between any of the factors explored and doing PFMEs pre-pregnancy (Table 2). Multiparous women with no formal educational qualification were less likely to attend antenatal education classes at the site hospital [$p = 0.03$, odds ratio (OR) 0.25, 95% CI 0.07–0.89] (Table 3) but, due to small numbers, this finding must be interpreted with caution. Because the numbers in some of the age, BMI and educational qualifications categories were too low to use multivariable regression analysis [15], we combined data for primi- and multiparous

women (Table 4). Compared with the relevant reference categories, women significantly less likely to do PFMEs daily or weekly during pregnancy had: no formal educational qualification [$p = 0.01$, adjusted OR (AOR) 0.14, 95% CI 0.02–0.72], did not do PFMEs pre-pregnancy ($p < 0.0001$, AOR 0.33 95% CI 0.20–0.52) or did not attend the physiotherapist-led PFME education session ($p < 0.0001$, AOR 0.30 95% CI 0.19–0.47).

Factors associated with UI

In the final analyses, we explored factors associated with UI before and during pregnancy in all women (Tables 5 and 6). Women more likely to report UI pre-pregnancy were aged ≥ 35 years ($p = 0.03$, OR 1.85, 95% CI 1.05–3.23) or had a BMI of ≥ 30 kg/m² ($p = 0.01$, OR 2.14, 95% CI 1.19–3.84). Women who did PFMEs but were unsure they were exercising correctly were more likely to report UI compared with women who believed they exercised correctly ($p = 0.03$, OR 2.05, 95% CI 1.05–3.98). Numbers in several categories were too few to perform multivariable regression [15].

Factors associated with UI during pregnancy were: being aged 30–34 years ($p = 0.02$, OR 1.67, 95% CI 1.05–2.64), having a pre-pregnancy BMI ≥ 25 kg/m² ($p = 0.04$, OR 1.65, 95% CI 1.02–2.69; $p = 0.03$, OR 1.88, 95% CI 1.03–3.43) and reporting UI pre-pregnancy ($p < 0.0001$, OR 12.1, 95% CI 6.88–21.40) (Table 6). In multivariable analysis, the two factors

Table 2 Factors associated with doing PFMEs before pregnancy

	Primiparous women					Multiparous women				
	n	No	Yes	<i>p</i> value	Unadjusted odds ratio (95% CI)	n	No	Yes	<i>p</i> value	Unadjusted odds ratio (95% CI)
Age	232	163	69			315	216	99		
16–24 years	20	19	1	0.09	0.16 (0.02–1.34)	28	19	9	0.95	0.97 (0.37–2.50)
25–29 years	49	37	12	1 (ref)	–	64	43	21	1 (ref)	–
30–34 years	104	68	36	0.21	1.63 (0.75–3.51)	120	87	33	0.45	0.77 (0.40–1.50)
≥ 35 years	59	39	20	0.28	1.58 (0.67–3.68)	103	67	36	0.77	1.10 (0.56–2.13)
BMI category (kg/m²)	204	142	62			282	194	88		
< 18.5 kg/m ²	8	8	0	0.99	0.00	12	7	5	0.45	1.57 (0.48–5.17)
18.5–24.99 kg/m ²	127	93	34	1 (ref)	–	186	128	58	1 (ref)	–
25–29.99 kg/m ²	43	26	17	0.11	1.78 (0.86–3.69)	51	36	15	0.80	0.92 (0.46–1.81)
≥ 30 kg/m ²	26	15	11	0.11	2.00 (0.83–4.79)	33	23	10	0.92	0.96 (0.42–2.14)
Educational qualifications	225	157	68			311	215	96		
No formal qualifications	16	14	2	0.12	0.29 (0.06–1.37)	22	19	3	0.62	0.30 (0.08–1.06)
Secondary school/apprenticeship	72	50	22	0.78	0.91 (0.48–1.72)	91	64	27	0.44	0.80 (0.46–1.39)
Diploma level education	20	14	6	0.82	0.89 (0.31–2.50)	26	19	7	0.45	0.70 (0.28–1.77)
College/professional qualification	117	79	38	1 (ref)	–	172	113	59	1 (ref)	–
Urinary incontinence before pregnancy	233	162	71			313	214	99		
No	169	122	47	1 (ref)	–	221	152	69	1 (ref)	–
Yes	64	40	24	0.15	1.55 (0.84–2.86)	92	62	30	0.81	1.06 (0.63–1.79)

Table 3 Factors associated with attendance at antenatal classes at site hospital

	Primiparous women					Multiparous women				
	<i>n</i>	No	Yes	<i>p</i> value	Unadjusted odds ratio (95% CI)	<i>n</i>	No	Yes	<i>p</i> value	Unadjusted odds ratio (95% CI)
Age	231	136	95			315	197	118		
16–24 years	19	13	6	0.58	0.72 (0.23–2.24)	29	21	8	0.26	0.57 (0.22–1.50)
25–29 years	49	30	19	1 (ref)		63	38	25	1 (ref)	–
30–34 years	105	52	53	0.17	1.60 (0.80–3.21)	119	70	49	0.84	1.06 (0.57–1.98)
≥ 35 years	58	41	17	0.30	0.65 (0.29–1.46)	104	68	36	0.51	0.80 (0.42–1.53)
BMI category	203	117	86			284	175	109		
< 18.5 kg/m ²	9	3	6	0.16	2.75 (0.65–11.51)	12	7	5	0.76	1.19 (0.36–3.90)
18.5–24.99 kg/m ²	126	73	53	1 (ref)	–	187	117	70	1 (ref)	–
25–29.99 kg/m ²	43	27	16	0.57	0.81 (0.40–1.66)	52	29	23	0.37	1.32 (0.71–2.47)
≥ 30 kg/m ²	25	14	11	0.85	1.08 (0.45–2.57)	33	22	11	0.65	0.83 (0.38–1.82)
Educational qualifications	224	130	94			311	195	116		
No formal qualifications	16	13	3	0.05	0.28 (0.07–1.05)	20	17	3	0.03	0.25 (0.07–0.89)
Secondary school/apprenticeship	72	42	30	0.67	0.87 (0.48–1.59)	91	60	31	0.26	0.74 (0.43–1.26)
Diploma level education	20	11	9	0.98	1.00 (0.38–2.61)	27	16	11	0.97	0.98 (0.43–2.25)
College/professional qualification	116	64	52	1 (ref)	–	173	102	71	1 (ref)	–
Urinary incontinence before pregnancy	233	136	97			313	193	120		
No	168	96	72	1 (ref)	–	222	129	93	1 (ref)	–
Yes	65	40	25	0.54	0.83 (0.46–1.49)	91	64	27	0.45	(0.58 (0.34–0.98))
Urinary incontinence during pregnancy	234	138	96			316	198	118		
No	100	59	41	1 (ref)	–	137	88	49	1 (ref)	–
Yes	134	79	55	0.99	1.00 (0.59–1.69)	179	110	69	0.61	1.12 (0.71–1.78)
Did PFMEs before pregnancy	236	139	97			319	200	119		
Yes	71	39	32	1 (ref)	–	98	57	41	1 (ref)	–
No	165	100	65	0.41	1.26 (0.71–2.21)	221	143	78	0.26	1.31 (0.81–2.14)

that remained significantly associated with UI during pregnancy were being aged 30–34 years ($p = 0.05$, AOR 1.82, 95% CI 1.00–3.34) and reporting UI pre-pregnancy ($p < 0.0001$, AOR 11.21, 95% CI 5.70–22.05). There was no association between doing PFMEs during pregnancy and being continent, but numbers were too small to explore associations in women who were continent pre-pregnancy and remained continent during pregnancy.

Discussion

This study recruited 567 women who were pregnant or had recently birthed and explored their knowledge and practice of PFMEs and UI before and during pregnancy. Pre-pregnancy, 67% of women had heard about and 41% learnt to do PFMEs. Of those who learnt PFMEs, only 17% did them daily or several times per week, and only half believed they were exercising correctly. Women with no formal educational qualification were significantly less likely to do PFMEs daily or weekly before or

during pregnancy or attend the physiotherapist-led PFME education session. Previous studies exploring nulliparous women's knowledge of their pelvic floor function found that women have considerable information needs [16] but many do not seek out information themselves [17]. Others found that few women practise PFMEs pre-pregnancy even though many may know about them [5]. Addressing this 'disconnect' between knowledge and practice is challenging but important given that the considerable proportion of primiparous women who experience UI symptoms pre-pregnancy are more likely to experience UI during pregnancy [7, 8]. The most common source of pre-pregnancy PFME information was exercise or yoga classes, yet less than half of these women did PFMEs. During pregnancy, less than half of all women received information on PFMEs during antenatal visits, and most reported that the information was just mentioned or that they were given a leaflet, which has been shown not to be successful [6, 18]. Only one-fifth received verbal instruction, and just eight women received physical instruction. While Guerrero [19] found that the majority of

Table 4 Factors associated with doing PFMEs daily or weekly during pregnancy

All women							
	<i>n</i>	No	Yes	<i>p</i> value	Unadjusted odds ratio (95% CI)	<i>p</i> value	Adjusted odds ratio (95% CI)
Age	500	281	219				
16–24 years	38	26	12	0.18	0.58 (0.26–1.29)	0.79	0.86 (0.29–2.54)
25–29 years	100	56	44	1 (ref)	–	1 (ref)	–
30–34 years	210	117	93	0.96	1.10 (0.62–1.63)	0.77	0.91 (0.50–1.67)
≥ 35 years	152	82	70	0.74	1.08 (0.65–1.80)	0.86	1.05 (0.55–1.99)
BMI category (kg/m²)	449	246	203				
< 18.5 kg/m ²	19	10	9	0.69	1.20 (0.47–3.06)	0.56	1.35 (0.47–3.83)
18.5–24.99 kg/m ²	228	165	123	1 (ref)	–	1 (ref)	–
25–29.99 kg/m ²	85	42	43	0.20	1.37 (0.84–2.23)	0.07	1.64 (0.94–2.87)
≥ 30 kg/m ²	57	29	28	0.37	1.29 (0.73–2.28)	0.26	1.46 (0.75–2.85)
Educational qualifications	496	279	217				
No formal qualifications	32	26	6	0.04	0.25 (0.10–0.64)	0.01	0.14 (0.02–0.72)
Secondary school/apprenticeship	148	85	63	0.35	0.82 (0.55–1.23)	0.66	0.89 (0.53–1.48)
Diploma level education	43	24	19	0.70	0.88 (0.46–1.68)	0.60	0.82 (0.39–1.70)
College/professional qualification	273	144	129	1 (ref)	–	1 (ref)	–
Did PFMEs before pregnancy (irrespective of frequency)	511	288	223				
Yes	156	59	97	1 (ref)	–	1 (ref)	–
No	355	229	126	< 0.0001	0.33 (0.22–0.49)	< 0.0001	0.33 (0.20–0.52)
Attended physiotherapist-led PFME education session at site hospital	509	287	222				
Yes	190	73	117	1 (ref)	–	1 (ref)	–
No	319	214	105	< 0.0001	0.30 (0.21–0.44)	< 0.0001	0.30 (0.19–0.47)
Urinary incontinence during pregnancy	506	287	219				
No	216	125	91	1 (ref)	–	1 (ref)	–
Yes	290	162	128	0.65	0.92 (0.64–1.31)	0.62	0.98 (0.58–1.38)

professionals and women felt midwives were best placed to provide PFME education, they also stated that many health professionals did not view PFME education as a priority antenatally and felt ill prepared to teach PFMEs, and that the correct time to start PFME education was postpartum. In our study, as happens elsewhere [20], many midwives and fewer doctors do not teach PFMEs antenatally. In one Irish study of antenatal educators, considerable proportions felt poorly prepared to teach antenatal classes, a factor that no doubt impacted the way they delivered information [21].

In this study, the three factors significantly associated with not doing PFMEs at optimal frequency were: having no formal educational qualification (which has been noted previously [22, 23]), not doing PFMEs pre-pregnancy and not attending the physiotherapist-led PFME education session. Perceived self-efficacy and developing a ‘routine’ were found to be factors motivating adherence to PFME programmes in studies on UI with non-pregnant populations [24, 25]. Similar to other studies [5, 19] relatively few women practised PFMEs during pregnancy, and less than half did PFMEs daily or weekly. In the physiotherapist-led classes, women are verbally

taught PFMEs and given an opportunity to practice. This class is offered when women are between 24 and 28 weeks pregnant, and it is possible that women did not fully understand the significance of starting PFMEs early or were not reminded to do PFMEs during the rest of pregnancy. Others may not have felt comfortable practising PFME in a class setting. However, 76% ($n = 65$) of primiparous and 74.3% ($n = 78$) of multiparous women who attended these classes knew they were doing the exercises correctly.

Twenty-eight percent of the study sample experienced UI pre-pregnancy, and two of the three factors found to be statistically significantly associated with UI, being aged 35 years and over, or having a BMI of ≥ 30 kg/m², have been reported previously [7, 8]. Women who did PFMEs pre-pregnancy but were unsure they were doing them correctly were more likely to report UI. Half of all women reported UI symptoms during pregnancy especially those aged 30–34 years or having UI pre-pregnancy. Similar to Fine et al.’s findings [6] but contrary to the findings from the recent review [1], our analysis showed no significant association between doing PFMEs during pregnancy and

Table 5 Factors associated with urinary incontinence before pregnancy

	All women				
	n	Urinary incontinence before pregnancy		p value	Unadjusted odds ratio (95% CI)
		No	Yes	P value	OR (95% CI)
Age	541	389	152		
16–24 years	49	34	15	0.21	1.61 (0.75–3.44)
25–29 years	112	88	24	1 (ref)	–
30–34 years	222	162	60	0.26	1.35 (0.79–2.33)
≥ 35 years	158	105	53	0.03	1.85 (1.05–3.23)
BMI category (kg/m ²)	481	350	131		
< 18.5 kg/m ²	21	18	3	0.28	0.50 (0.14–1.76)
18.5–24.99 kg/m ²	311	234	77	1 (ref)	–
25–29.99 kg/m ²	91	64	27	0.34	1.28 (0.76–2.15)
≥ 30 kg/m ²	58	34	24	0.01	2.14 (1.19–3.84)
Educational qualifications	530	377	153		
No formal qualifications	39	23	16	0.43	0.76 (0.38–1.50)
Secondary school/apprenticeship	164	114	50	0.97	1.00 (0.68–1.48)
Diploma level education	46	36	10	0.35	1.35 (0.71–2.56)
College/professional qualification	281	204	77	1 (ref)	–
Did PFMEs before pregnancy	551	394	157		
Daily or several times per week	41	28	13	1 (ref)	–
Never, occasionally or several times per month	410	366	144	0.98	1.00 (0.47–2.14)
Believed I was doing PFMEs correctly	166	133	53		
Strongly agree/agree	89	67	22	1 (ref)	–
Strongly disagree/disagree/neutral	77	46	31	0.03	2.05 (1.05–3.98)

being continent. Helping women understand the link between UI and PFM weakness is important [20] because women who believe that the cause of UI is out of their control (e.g. part of being female, due to pregnancy) may believe that nothing can be done to treat it. In Hill et al.'s study, participants who had not attended antenatal education were significantly more likely to state that it was normal to leak urine during pregnancy [26].

Contrary to Bø et al.'s [27] findings, we found no significant association between doing PFMEs before pregnancy and any of the possible contributory factors explored. However, none of the women in Bø et al.'s study were underweight or obese.

Our findings come from a relatively large sample of women attending one large maternity hospital. However, they are not necessarily representative of the population as they were a self-selected sample, which can lead to response bias. Nevertheless, they give valuable insights into women's knowledge and practice of PFMEs and PFME education that may have resonance with other sites in Ireland and elsewhere. These findings raise challenges for all maternity care professionals in light of the International Continence Society's (ICS) publications on PFMT adherence and long-term effectiveness [28, 29] and raise particular challenges for maternity care professionals in Ireland because of the planned service reorganisation [30].

Our study has some limitations. The survey was available in English only, which excluded some women from taking part. We asked women retrospectively about learning to do PFMEs before they became pregnant, and this is susceptible to recall bias. We asked women if they believed they were doing PFMEs correctly but a confirmatory vaginal or ultrasound examination was not performed. Finally, our sample did not have sufficient numbers of women in some categories to enable us to conduct complete multivariable analyses, which limits some detail of the findings.

Conclusion

This is the first study that reports on women's knowledge of PFMEs before and during pregnancy in one maternity hospital in Ireland. As half of the women in this study did not recall getting PFME information in their maternity pack, alternative means of sharing written information with women are required. Less than half of all women were informed about PFMEs by midwives and doctors during their antenatal visits, and only a minority received an opportunity to practice PFMEs, indicating that remedial solutions to PFME education provision are needed, as

Table 6 Factors associated with urinary incontinence during pregnancy

	All women			<i>p</i> value	Unadjusted odds ratio (95% CI)	<i>p</i> value	Adjusted odds ratio (95% CI)
	n	Urinary incontinence during pregnancy					
		No	Yes				
Age	544	235	309				
16–24 years	48	24	24	0.69	1.15 (0.58–2.27)	0.53	1.38 (0.50–3.82)
25–29 years	112	60	52	1 (ref)	–	1 (ref)	–
30–34 years	223	91	132	0.02	1.67 (1.05–2.64)	0.05	1.82 (1.00–3.34)
≥35 years	161	60	101	0.08	1.94 (.19–3.17)	0.08	1.77 (0.92–3.40)
BMI category (kg/m ²)	484	204	280				
<18.5 kg/m ²	21	14	7	0.06	0.41 (0.16–1.05)	0.23	0.51(0.17–1.52)
18.5–24.99 kg/m ²	311	141	170	1 (ref)	–	1 (ref)	–
25–29.99 kg/m ²	93	31	62	0.04	1.65 (1.02–2.69)	0.10	1.62 (0.90–2.91)
≥30 kg/m ²	59	18	41	0.03	1.88 (1.03–3.43)	0.39	1.36 (0.66–2.79)
Educational qualifications	533	230	303				
No formal qualifications	38	19	19	0.43	0.76 (0.38–1.50)	0.67	0.78 (0.25–2.44)
Secondary school/apprenticeship	162	70	92	0.97	1.00 (0.68–1.48)	0.64	1.13 (0.66–1.91)
Diploma level education	47	17	30	0.35	1.35 (0.71–2.56)	0.09	1.95 (0.89–4.29)
College/professional qualification	286	124	162	1 (ref)	–	1 (ref)	–
Urinary incontinence before pregnancy	548	236	312				
No	392	221	171	1 (ref)	–	1 (ref)	–
Yes	156	15	141	< 0.0001	12.1 (6.88–21.40)	< 0.0001	11.21 (5.70–22.05)
Attended physiotherapist-led PFME education session at site hospital	549	238	311				
Yes	185	81	105	1 (ref)	–	1 (ref)	–
No	363	157	206	0.94	1.01 (0.70–1.44)	0.82	0.94 (0.59–1.50)
Did PFMEs during pregnancy	506	216	290				
No	287	125	162	0.65	1.08 (0.76–1.54)	0.85	0.95 (0.60–1.51)
Yes (daily or weekly)	219	91	128	1 (ref)	–	1 (ref)	–
Believed I was doing PFMEs correctly during pregnancy	207	86	121				
Strongly agree/agree	159	68	91	1 (ref)	–	–	–
Strongly disagree/disagree, or neutral	48	18	30	0.51	1.24 (0.64–2.41)	N/A	N/A

are clear guidelines that define the responsibilities of all maternity care professionals. The fact that some women did not remember to practise PFMEs following the physiotherapist-led PFME session is a concern, and the remaining challenge is to ensure that all women attending these sessions understand the education offered and the importance of ongoing habitual practice. This is the first time we have benchmarked the totality of PFME education and service provision in the site hospital. It was a beneficial exercise, and we recommend that others conduct similar research to share findings from practices elsewhere and enable learning from those who are delivering optimal PFME education and/or have addressed service deficits and constraints. Research of this type would

identify the services offered to *all* pregnant women, move the focus beyond findings from intervention studies and demonstrate the real-world reality. In an ideal service, all pregnant women should have at least one physiotherapist appointment during early pregnancy. At a minimum, all maternity care professionals should offer all pregnant women PFME information and education in early pregnancy and ensure that they understand that UI is not normal. They should also explore women's self-efficacy in performing PFMEs, offer reminders to perform PFMEs regularly throughout pregnancy and have recourse to physiotherapist referral, when necessary. Such a service requires that midwives and doctors are competent to provide PFME education and regard it as an integral part of

their role. Our current focus is to find ways of offering all women, particularly those who are less likely to or cannot attend antenatal classes, evidenced-based information on PFMEs and UI in easily accessible and understandable ways to improve compliance within existing service capacity constraints.

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Compliance with ethical standards

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References

- Woodley SJ, Boyle R, Cody JD, Mørkved S, Hay-Smith EJC. Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women. *Cochrane Database Syst Rev*. 2017;(12). doi:<https://doi.org/10.1002/14651858.CD007471.pub3>.
- NICE. Antenatal care for uncomplicated pregnancies. Clinical guideline [CG 62] London, UK; 2017. Available at: <https://www.nice.org.uk/guidance/cg62>
- Gerrard J, ten Hove R. RCM/CSP joint statement on pelvic floor muscle exercise. Improving health outcomes for women following pregnancy and birth. London: CSP, RCM; 2013. Available at: <http://www.csp.org.uk/publications/improving-health-outcomes-women-following-pregnancy-birth>
- Mason L. Evidence-based midwifery in action. Guidelines on the teaching of pelvic floor exercises. *Br J Midwifery*. 2001;9(10):608–11. <https://doi.org/10.12968/bjom.2001.9.10.12691>.
- Chiarelli P, Murphy B, Cockburn J. Women's knowledge, practises, and intentions regarding correct pelvic floor exercises. *Neurourol Urodyn*. 2003;22(3):246–9. <https://doi.org/10.1002/nau.10119>.
- Fine P, Burgio K, Borello-France D, Richter H, Whitehead W, Weber A, et al. Teaching and practice of pelvic floor muscle exercises in primiparous women during pregnancy and the postpartum period. *Am J Obstet Gynecol*. 2007;197(1):107–9. <https://doi.org/10.1016/j.ajog.2007.02.052>.
- Brown SJ, Donath S, MacArthur C, McDonald EA, Krastev AH. Urinary incontinence in nulliparous women before and during pregnancy: prevalence, incidence, and associated risk factors. *Int Urogynecol J*. 2010;21(2):193–202. <https://doi.org/10.1007/s00192-009-1011-x>.
- Daly D, Clarke M, Begley C. Urinary incontinence in nulliparous women before and during pregnancy: prevalence, incidence, type, and risk factors. *Int Urogynecol J*. 2018;29(3):353–62. <https://doi.org/10.1007/s00192-018-3554-1>.
- Viktrup L, Lose G. Lower urinary tract symptoms 5 years after the first delivery. *Int Urogynecol J Pelvic Floor Dysfunct*. 2000;11(6):336–40. <https://doi.org/10.1007/s001920070002>.
- Triviño-Juárez J-M, Romero-Ayuso D, Nieto-Pereda B, Forjaz M-J, Criado-Álvarez J-J, Arruti-Sevilla B, et al. Health related quality of life of women at the sixth week and sixth month postpartum by mode of birth. *Women Birth*. 2017;30(1):29–39. <https://doi.org/10.1016/j.wombi.2016.06.005>.
- Coulter-Smith S. The Rotunda Hospital Dublin Clinical Report 2012. Rotunda Hospital, Dublin; 2013. Available at: <https://rotunda.ie/rotunda-pdfs/Clinical%20Reports/Annual%20Clinical%20Report%202012.pdf>
- Marques A, Stothers L, Macnab A. The status of pelvic floor muscle training for women. *Can Urolog Assoc J*. 2010;4(6):419–24 Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2997838/pdf/cuaj-6-419.pdf>.
- World Medical Association. World medical association declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA*. 2013;310(20):2191–4. <https://doi.org/10.1001/jama.2013.281053>.
- Haylen B, de Ridder D, Freeman R, Swift S, Berghmans B, Lee J, et al. An international urogynecological association (IUGA)/international continence society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Int Urogynecol J*. 2010;21(1):5–26. <https://doi.org/10.1007/s00192-009-0976-9>.
- Peat J, Barton B. Medical statistics a guide to data analysis and critical appraisal. Oxford: Blackwell Publishing Ltd.; 2005.
- Bardino M, Di Martino M, Ricci E, Parazzini F. Frequency and determinants of urinary incontinence in adolescent and young nulliparous women. *J Pediatr Adolesc Gynecol*. 2015;28(6):462–70. <https://doi.org/10.1016/j.jpog.2015.01.003>.
- Neels H, Wyndaele JJ, Tjalma WA, De Wachter S, Wyndaele M, Vermandel A. Knowledge of the pelvic floor in nulliparous women. *J Phys Ther Sci*. 2016;28(5):1524–33. <https://doi.org/10.1589/jpts.28.1524>.
- Bump RC, Hurt WG, Fantl JA, Wyman JF. Assessment of Kegel pelvic muscle exercise performance after brief verbal instruction. *Am J Obstet Gynecol*. 1991;165(2):322–9.
- Guerrero K, Owen L, Hirst G, Emery S. Antenatal pelvic floor exercises: a survey of both patients' and health professionals' beliefs and practice. *J Obstet Gynaecol*. 2007;27(7):684–7. <https://doi.org/10.1080/01443610701612284>.
- Bo K, Haakstad LA, Voldner N. Do pregnant women exercise their pelvic floor muscles? *Int Urogynecol J Pelvic Floor Dysfunct*. 2007;18:733–6. <https://doi.org/10.1007/s00192-006-0235-2>.
- O'Sullivan C, O'Connell R, Devane D. A descriptive survey of the educational preparation and practices of antenatal educators in Ireland. *J Perinat Educ*. 2014;23(1):33–40. <https://doi.org/10.1891/1058-1243.23.1.33>.
- Fabian HM, Rådestad IM, Waldenström U. Characteristics of Swedish women who do not attend childbirth and parenthood education classes during pregnancy. *Midwifery*. 2004;20(3):226–35. <https://doi.org/10.1016/j.midw.2004.01.003>.
- Stoll KH, Hall W. Childbirth education and obstetric interventions among low-risk Canadian women: is there a connection? *J Perinat Educ*. 2012;21(4):229–37. <https://doi.org/10.1891/1058-1243.21.4.229>.
- Hines SH, Seng JS, Messer KL, Raghunathan TE, Diokno AC, Sampelle CM. Adherence to a behavioral program to prevent incontinence. *West J Nurs Res*. 2007;29(1):36–56. <https://doi.org/10.1177/0193945906293793>.
- Messer KL, Hines SH, Raghunathan TE, Seng JS, Diokno AC, Sampelle CM. Self-efficacy as a predictor of PFMT adherence in a prevention of urinary incontinence clinical trial. *Health Educ Behav*. 2007;34(6):942–52. <https://doi.org/10.1177/1090198106295399>.
- Hill AM, McPhail SM, Wilson JM, Berlach RG. Pregnant women's awareness, knowledge and beliefs about pelvic floor muscles: a

- cross-sectional survey. *Int Urogyn J.* 2017;28(10):1557–65. <https://doi.org/10.1007/s00192-017-3309-4>.
27. Bø K, Owe KM, Nystad W. Which women do pelvic floor muscle exercises six months' postpartum? *Am J Obstet Gynecol.* 2007;197(1):49–51. <https://doi.org/10.1016/j.ajog.2007.02.014>.
 28. Frawley HC, McClurg D, Mahfooza A, Hay-Smith J, Dumoulin C. Health professionals' and patients' perspectives on pelvic floor muscle training adherence-2011 ICS state-of-the-science seminar research paper IV of IV. *Neurourol Urodyn.* 2015;34(7):632–9. <https://doi.org/10.1002/nau.22774>.
 29. Dumoulin C, Hay-Smith J, Frawley H, McClurg D, Alewijnse D, Bø K, et al. 2014 consensus statement on improving pelvic floor muscle training adherence: international continence society 2011 state-of-the-science seminar. *Neurourol Urodyn.* 2015;34(7):600–5. <https://doi.org/10.1002/nau.22796>.
 30. Department of Health. CREATING A BETTER FUTURE TOGETHER National Maternity Strategy 2016–2026. Department of Health, Dublin, Ireland; 2016. Available at: <https://health.gov.ie/wp-content/uploads/2016/01/Final-version-27.01.16.pdf>