CLINICAL PAPER

Assessing prevalence of urinary incontinence in Scottish fitness instructors, and experience of teaching pelvic floor muscle exercises: an online survey

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Abstract

Background. The aim of this study was to assess the prevalence of urinary incontinence (UI) in fitness instructors, and evaluate their experience of teaching pelvic floor muscle exercises (PFMEs) and attitudes to incorporating such exercises into classes.

Method. An online survey was undertaken of fitness instructors working in Scotland. This was based on the International Consultation on Incontinence Questionnaire – Urinary Incontinence – Short Form (ICIQ-UI-SF).

Results. The survey was at least partially completed by 106 participants, of whom 73.6% ($n = 53/72$) were female and 52.8% ($n = 38/72$) were in the 35–54-year-old age group. The prevalence of UI was 28.2% ($n = 24/85$), and severity based on ICIQ-UI-SF scores was "slight" in 65.2% ($n = 15/23$) or "moderate" in 26.1% ($n = 6/23$). Leakage of urine was associated with physical activity in 36% ($n = 9/25$) of participants, of whom 31.8% ($n = 7/22$) had not taken actions to reduce the impact, and 86.4% ($n = 19/22$) had not sought professional advice or treatment. There was widespread willingness to incorporate PFMEs into classes, if given appropriate training [86.1% ($n = 62/72$)], and 67.1% ($n = 49/73$) would be happy to recommend a PFME app.

Conclusion. A significant proportion of fitness instructors are in need of PFMEs, and those who perform PFMEs do so at a level below that which is recommended. However, many have had some training in PFMEs, or would be willing to provide this.

Keywords: educational settings, physical activity, population-based and preventative service.

Introduction

Studies of populations of women around the world have found that urinary incontinence (UI) is a common gynaecological problem; however, it is one that is neglected, and characterized by stigma and poor healthcare-seeking behaviour (Perera *et al.* 2014; Wang *et al.* 2015). Although UI is associated with older age (Minassian *et al.* 2003), studies have shown younger women to be affected (Cooper *et al.* 2015), including those who are physically active (Carls 2007; McKenzie *et al.* 2016).

A study by Thompson *et al.* (2015) found that UI was common in women attending fitness classes and gyms, and a Norwegian study that found that UI is prevalent in female fitness instructors concluded that they were also in need of training in pelvic floor muscle (PFM) exercises (PFMEs) (Bø *et al.* 2011). Furthermore, the prevalence of both stress and urge UI has been found to be higher in female elite athletes and women who participate in strenuous exercise (Goldstick & Constantini 2014; Almeida *et al.*

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2015; Sousa *et al.* 2015). Annett *et al.* (2016, p. 58) found that "[s]tress urinary incontinence, once an idea revolving around elderly and parous women, has been shown to be quite the common condition in endurance-trained women". In an overview of published studies on prevalence of UI in elite athletes, Bø (2015, p. 79) found a "high prevalence of symptoms of both stress and urge UI in young nulliparous, as well as parous elite athletes".

High-impact exercise can be considered to cause and have a worsening effect on the symptoms of stress UI, and PFME is recommended (Dias *et al.* 2017). Bø (2015, p. 84) argued that there is "huge potential for improvement in the function and strength of pelvic floor muscles" if athletes undertake PFME training.

Screening of females participating in exercise classes and at gyms, along with the promotion of pelvic-floor-friendly exercise options, have been recommended (McKenzie *et al.* 2016). However, this places significant reliance on fitness instructors. Relatively little is known about the general health of fitness instructors, but recent Norwegian studies have highlighted several health issues in this group including disordered eating behaviour, especially in women (Bratland-Sanda *et al.* 2015). This is important because there is a recognized relationship between UI and eating disorders (Goldstick & Constantini 2014), where contributing factors such as oestrogen deficiency, the high pressure on the PFMs during vomiting, and a general lack of energy and muscle weakness have been identified.

Low levels of awareness of the prevalence of UI symptoms in younger women have resulted in a lack of access to preventative and treatment resources (McKenzie *et al.* 2016). Indeed, 90% of the younger women in the study by Carls (2007) were unaware of PFME. Low levels of awareness and the higher risk associated with high-impact physical activity, combined with delays in help-seeking behaviour, suggest that there is an immediate need for education and awareness in younger women.

Siegel (2014, p. 6) argued that "despite evidence of efficacy, PFME in males remains under-recognized and underutilized". Pelvic floor muscle exercise can be beneficial to male genitourinary health, and it "should achieve the same recognition, utilization, status and traction as in females" (Siegel 2014, p. 6).

Perera *et al.* (2014) concluded that community-based education is likely to be beneficial, and Brubaker *et al.* (2008) suggested that a non-medical model around pelvic floor fitness may be both more cost-effective and more accessible than current clinical models. Bø & Haakstad (2011) have emphasized the need for more population-based studies of PFME training in fitness classes.

It is clear from the findings of previous research that there is potential benefit for community-based PFME, and that there are opportunities for fitness instructors to both benefit from that training and also incorporate PFME into their classes. There is a need for data about the experience of UI in fitness instructors based in Scotland in order to establish if they would benefit from PFME training. Research is also required into the potential role of fitness instructors in relation to their knowledge of PFME and their willingness to teach it (De Lyon *et al.* 2017).

The aim of the present study was, therefore, to assess the prevalence of UI symptoms in fitness instructors in Scotland, investigate their training in and teaching of PFME, and assess their attitudes towards incorporating PFME into classes that they undertake.

Methods

An online survey of fitness instructors was undertaken across Scotland between September and December 2016. Recruitment of participants was undertaken by searching online for gyms and fitness providers in the public or private sector. Where no e-mail address was available, telephone calls were used to identify an appropriate e-mail address by one of the authors (K.S.). E-mails were sent to gatekeepers for each sports/fitness facility, who ranged from one person to large organizations. A total of 580 fitness facilities across Scotland were contacted.

The eligibility criteria for inclusion in the study were: literacy in English; over 18 years of age; qualified to work as a sports coach, fitness instructor or fitness group leader; and working in Scotland.

A questionnaire was designed using SmartSurvey (Tewkesbury, Gloucestershire, UK), an online survey software and questionnaire tool (www.smartsurvey.co.uk). Respondents were provided with information on the nature of the study and could choose which questions they wished to answer. More-detailed questions around incontinence were automatically skipped if respondents reported no experience of leakage of urine.

The questionnaire included a validated measure, the International Consultation on Incontinence

Questionnaire – Urinary Incontinence – Short Form (ICIQ-UI-SF), which determines the experience of incontinence on a scale of 0–21 (Klovning *et al.* 2009). A small addition was made to this by asking respondents to provide details about the type of exercise they were doing when they experienced leakage. The European Health Risk Monitoring SMK3 indicator (Tolonen *et al.* 2002) was adapted and used to indicate cigarette smoking, which is a risk factor for UI (SIGN 2004). Demographic details were also collected. The questionnaire is available from the present authors, and the data are available on request from the third author (S.M.; e-mail: sandra.macrury@uhi.ac.uk).

The questionnaire did not collect personally identifiable data, such as name, address or date of birth, but it did include an option for respondents to provide an e-mail address to facilitate further research. The CHERRIES checklist was used to inform the reporting of the results (Eysenbach 2004). Ethical approval for the study was obtained from the University of the Highlands and Islands Research Ethics Committee.

Results

The survey website was accessed by 125 individuals, and partially or fully completed by 106. The geographical areas in which the respondents worked are listed in Table 1. There was a slightly higher proportion from the north of Scotland, where the present authors had stronger contacts with the fitness industry. Gender was predominantly female, i.e. 73.6% [$n = 53/72$; 95% confidence interval (CI) = 62.4–82.4] with males at 26.4% ($n = 19/72$; 95% CI = 17.6–37.6). The majority of respondents indicated that they worked for the public sector or arm's-length public sector organizations: 18 worked for private companies, 25 were self-employed and seven worked on a voluntary basis. Just over half of the respondents were 35–54 years of age, and had typically been qualified as fitness instructors for between 1 and 10 years [40.2% ($n = 39/97$; 95% CI = 31.0–50.2)] (see Table 1).

The prevalence of UI symptoms in fitness instructors in Scotland was 28.2% ($n = 24/85$; 95% CI = 19.8–38.6), although the frequency of incontinence was generally "once a week or less often". Only one participant who reported incontinence was male (23 were females), and the aetiology of incontinence in this participant was atypical because incontinence had only occurred "when excessively drunk". Comments were recorded in a comments box, as illustrated by respondent 2: "I only leak a little urine if I'm bursting for a pee, have left it a bit late and then sneeze. This happens maybe once every 3 months."

Table 1. Characteristics of participants

	Response	
Variable	Total (n)	Percentage (%)
Location		
Central Scotland and Fife	21	21
Dumfries and Galloway	8	8
Grampian	7	7
Highland	21	21
Lothian and Borders	13	13
Northern Isles	7	7
Strathclyde	15	15
Western Isles	7	7
All	72	100
Age group (years)		
18–24	10	14
25–34	14	19
35–54	38	53
≥ 55	10	14
All	72	100
Experience as a fitness instructor (years)		
< 1	9	9
1–10	39	40
10–20	33	34
> 20	16	16
All	97	100

The categorized ICIQ-UI-SF scores for respondents reporting incontinence were: slight (1–5), 65.2% ($n = 15/23$); moderate (6–12), 26.1% ($n = 6/23$); severe (13–18), 8.7% ($n = 2/23$); and very severe ($n = 19$–21), 0%. Leakage of urine was associated with physical activity/exercising in 36.0% ($n = 9/25$; 95% CI = 20.2–55.5) of respondents who answered this question. The types of exercise where respondents experienced leakage of urine were: jumping, and specifically, jumping with legs apart, as in star jumps or jumping jacks; aerobic exercise; running; and hopping. The duration of physical activity was also mentioned as a factor. A significant proportion of those reporting incontinence, 31.8% ($n = 7/22$; 95% CI = 16.4–52.7), did not appear to have taken any of a range of common actions to reduce the impact, and 86.4% ($n = 19/22$; 95% CI = 66.7–95.3) had not sought advice or treatment for their problem (Table 2). Of the instructors who experienced symptoms of UI, three had undergone previous abdominal or gynaecological surgery, and three were occasional smokers.

Most instructors had received some training in relation to PFME, i.e. 72.2% ($n = 52/72$; 95% CI = 60.1–81.2), and 34.7% ($n = 25/72$; 95%

Table 2. Prevalence of urinary incontinence

Category	Response	
	Total (*n*)	Percentage (%)
How often does urine leak?		
Never	61	71.8
About once a week or less often	16	18.8
Two or three times a week	3	3.5
About once a day	3	3.5
Several times a day	2	2.4
All the time	0	0.0
All	85	100.0
When does urine leak?		
Leaks before you can get to the toilet	7	28.0
Leaks when you cough or sneeze	10	40.0
Leaks when you are asleep	0	0.0
Leaks when you have finished urinating and are dressed	5	20.0
Leaks all the time	0	0.0
Leaks for no obvious reason	2	8.0
Leaks when you are physically active/exercising	9	36.0
Other	2	8.0
All	25	100.0
Which of these actions would you take to avoid or contain urine leakage at a class?		
Empty bladder prior to a class	15	68.2
Reduce intake of liquids prior to a class	0	0.0
Reduce intake of caffeine prior to a class	1	4.5
Wear additional layers of clothing	0	0.0
Use sanitary protection or an incontinence pad	3	13.6
Contract pelvic floor muscles prior to exertion or jumping	4	18.2
Contract pelvic floor muscles prior to coughing, sneezing or laughing	4	18.2
I have stopped teaching/leading a class because of urine leakage	0	0.0
I have not taken any of these actions	7	31.8
Other (please specify)	1	4.5
All	22	100.0
Have you sought advice or treatment about urine leakage from any of the following?		
General practitioner or practice nurse	0	0.0
Family or friends	0	0.0
The Internet	0	0.0
Gynaecologist/urologist	0	0.0
Continence nurse	0	0.0
Continence physiotherapist	1	4.5
Midwife/health visitor	1	4.5
I have never sought advice or treatment	19	86.4
Other (please specify)	2	9.1
All	22	100.0

CI = 24.7–46.2) of respondents currently taught PFMEs (Table 3). The survey included a question about current practice of PFME by the trainers themselves. The pattern of PFMEs used by respondents is shown in Table 4. Although 83.9% ($n = 52/62$) of respondents to this question undertook some PFME, only 11.5% ($n = 6/52$) of those who undertook PFME followed the National Institute for Health and Care Excellence (NICE) guidelines to undertake three sets of PFMEs daily (NICE 2013).

Several questions were asked regarding the promotion of PFME. Of those who responded to these questions, 86.1% ($n = 62/72$; 95% CI = 76.3–92.3) agreed or strongly agreed with the proposal that they could incorporate PFME in their classes if given appropriate training, and 67.1% ($n = 49/73$; 95% CI = 55.7–76.8) agreed or strongly agreed that they would be happy to recommend a mobile phone app on PFME. A slightly lower percentage, i.e. 60.3% ($n = 44/73$; 95% CI = 48.8–70.7), agreed or strongly agreed that they would be comfortable talking about incontinence and recommending PFME (Table 3).

Discussion

Main finding of this study

The results from the present study confirm that a significant proportion of fitness instructors need to undertake PFME themselves. The study has found various patterns of exercise behaviour

Table 3. Proportion of fitness instructors who had received training on pelvic floor muscle exercises (PFMEs), and level of agreement with statements related to promoting PFMEs

Category	Response	
	Total (*n*)	Percentage (%)
What is your experience of being taught PFMEs?		
I have never been taught	20	23.5
I was taught in pregnancy	19	22.4
I have been taught in a clinical setting (e.g. continence physiotherapist)	5	5.9
I have been taught in a non-clinical setting (e.g. yoga, Pilates, fitness class)	38	44.7
I used a DVD/app/website (please specify)	3	3.5
All	85	100.0
What is your experience of teaching PFMEs?		
I have never taught PFMEs	28	38.9
I currently incorporate PFMEs in a class I teach	25	34.7
I do not currently teach PFMEs, but I have done so in the past	13	18.1
Other (please specify)	6	8.3
All	72	100.0
"I am confident that I could incorporate PFMEs in my classes if I was given appropriate training"		
Strongly agree	33	45.8
Agree	29	40.3
Neither agree nor disagree	5	6.9
Disagree	2	2.8
Strongly disagree	3	4.2
All	72	100.0
"I would be happy to recommend an app for PFMEs to people who take my classes"		
Strongly agree	18	24.7
Agree	31	42.5
Neither agree nor disagree	20	27.4
Disagree	3	4.1
Strongly disagree	1	1.4
All	73	100.0
"I would be comfortable talking about incontinence and recommending PFMEs in my classes"		
Strongly agree	17	23.3
Agree	27	37.0
Neither agree nor disagree	18	24.7
Disagree	7	9.6
Strongly disagree	4	5.5
All	73	100.0

amongst those who currently perform PFME, most of whom do so at a level below that which is recommended. However, many fitness instructors have had some training on PFME, and are willing promote it.

The conversations that were had with organizations involved asking them to disseminate the e-mail to their staff. Some organizations said that they would check the survey first before sending it to their staff. It is possible that the gap between the 125 individuals who opened the survey and those who completed it may, in part, be a result of management staff who were not fitness instructors opening and reading the survey to check it out before forwarding it to staff.

What is already known on this topic

Despite the findings of Perera *et al.* (2014) and Brubaker *et al.* (2008), who concluded that a non-medical, community-based approach to PFME education might be beneficial, there is some controversy about who should teach it and in what setting (MacLean & Cardozo 2002). The importance of the correct identification of PFMs has been highlighted in ensuring the efficacy of PFME training (Hay-Smith *et al.* 2015). Thompson & O'Sullivan (2003, p. 87) found that incorrect exercise could "contribute to the pathology of urinary stress incontinence and genital organ prolapse". More specifically, evidence from Goldstick & Constantini (2014, p. 298) suggests that "common exercises taught in gymnastics, Pilates and yoga classes do not necessarily elevate the bladder neck, and they might even result in bladder neck descent" with resulting pelvic floor weakness. There is clearly a need for PFME to be taught correctly in order to avoid harm from incorrect exercise.

Kisner & Colby (2012, p. 983) suggested that "although all physical therapists can fairly easily

Table 4. Pattern of pelvic floor muscle exercises undertaken by respondents

Variable	Number of contractions undertaken					Response total
	1–5	6–10	11–20	20–30	> 30	
Duration of contractions (s)						
Three sets daily	2	1	2	0	1	6
One set daily	6	3	3	2	1	15
Three sets weekly	4	2	2	1	2	11
One set weekly	5	2	2	0	2	11
Three sets monthly	1	0	0	1	0	2
One set monthly	4	1	1	0	1	7
None						10
Number of repetitions in set						
Three sets daily	2	4	0	0	0	6
One set daily	6	6	2	1	0	15
Three sets weekly	4	3	2	0	2	11
One set weekly	5	3	3	0	1	12
Three sets monthly	1	1	0	0	0	2
One set monthly	3	1	0	0	1	5
None						7

incorporate activation of the pelvic floor muscles [. . .] true expertise can only come with further training and mentoring". In Brubaker *et al.*'s (2008, p. 1299) study, all community-based fitness instructors "completed the same, standardized training and were trained before the initiation of the research classes". This would suggest that, if community-based PFME training is to be made more widespread, non-clinical instructors require high-quality training in order to ensure that they teach correctly.

Difficulties in sustaining motivation and lack of ongoing adherence to PFME have been identified as barriers to the efficacy of the exercises in treating symptoms of incontinence. Therefore, the use of appropriate behaviour-change techniques is important to ensure maximum adherence and subsequent efficacy (Hay-Smith *et al.* 2015). Training for non-clinical instructors should incorporate a behaviour-change component, as well as a good understanding of the relevant physiology.

Of the fitness instructors who reported that they currently incorporate PFME into their classes or sports instruction, or had done so in the past, the majority were taught the exercises in a non-clinical setting. In addition, despite being taught in a clinical setting, previous studies have found that women can still lack confidence in identifying their PFMs, or be unsure as to whether they are doing the exercises correctly. This may mean that some instructors have not been taught correctly, or may have forgotten how to exercise correctly, and may not be teaching exercises to a high standard.

Relatively few of the fitness instructors who experience UI symptoms, undertook the recommended three sets of PFMEs per day (NICE 2013). This would suggest that there is a lack of awareness of the required level of exercise to achieve benefits from PFME, or that fitness instructors would benefit from behaviour change techniques to improve their own levels of adherence.

The integration of mobile phone apps might also improve adherence (Stephen *et al.* 2014). There is evidence that multimodal approaches to behaviour change may be more effective, and may complement each other.

What this study adds

The results from the present study confirm that a significant proportion of Scottish fitness instructors experience UI symptoms. The study found that those who currently perform PFME do so at a level below that which is recommended.

Relatively little is known about the capacity of fitness instructors to deliver PFME teaching, but the present paper provides some evidence that they may be an untapped resource. Fitness instructors appear to have some training in teaching PFMEs, and to be interested in pursuing this further.

Training and supporting fitness instructors in how to teach PFMEs correctly could be explored further as a method for: reducing demand on health services, and providing easier access to support for a common problem. Furthermore, there would be value in a follow-up to assess changes over time.

Limitations of this study

The present study has a number of weaknesses. There is a potential for significant bias in the

results because of the self-selecting nature of the respondents, and the variable level of completion across different questions. Information provided to gatekeepers in organizations and to potential participants mentioned UI, and this may have dissuaded individuals who had no interest in the subject or found it off-putting. However, it is unclear how one could develop more-reliable methods for obtaining such information. Participants may be increasingly reluctant to click on hyperlinks in e-mails because these can sometimes result in the installation of malware, even when appearing to come from a safe university e-mail address.

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References

Almeida M. B. A., Barra A. A., Saltiel F., *et al.* (2015) Urinary incontinence and other pelvic floor dysfunctions in female athletes in Brazil: a cross-sectional study. *Scandinavian Journal of Medicine and Science in Sports* **26** (9), 1109–1116.

Annett S., Cassas K. & Bryan S. (2016) Gender differences: considerations for the female endurance athlete. In: *Endurance Sports Medicine: A Clinical Guide* (ed. T. L. Miller), pp. 55–70. Springer, Cham.

Bø K. (2015) Exercise and pelvic floor dysfunction in female elite athletes. In: *Handbook of Sports Medicine and Science: The Female Athlete* (ed. M. L. Mountjoy), pp. 76–85. John Wiley & Sons, Hoboken, NJ.

Bø K., Bratland-Sanda S. & Sundgot-Borgen J. (2011) Urinary incontinence among group fitness instructors including yoga and Pilates teachers. *Neurourology and Urodynamics* **30** (3), 370–373.

Bø K. & Haakstad L. A. H. (2011) Is pelvic floor muscle training effective when taught in a general fitness class in pregnancy? A randomised controlled trial. *Physiotherapy* **97** (3), 190–195.

Bratland-Sanda S., Nilsson M. P. & Sundgot-Borgen J. (2015) Disordered eating behavior among group fitness instructors: a health-threatening secret? *Journal of Eating Disorders* **3:** 22. DOI: 10.1186/s40337-015-0059-x.

Brubaker L., Shott S., Tomezsko J. & Goldberg R. P. (2008) Pelvic floor fitness using lay instructors. *Obstetrics and Gynecology* **111** (6), 1298–1304.

Carls C. (2007) The prevalence of stress urinary incontinence in high school and college-age female athletes in the Midwest: implications for education and prevention. *Urologic Nursing* **27** (1), 21–24, 39.

Cooper J., Annappa M., Quigley A. & Dracocardos D. (2015) Prevalence of female urinary incontinence and its impact on quality of life in a cluster population in the United Kingdom (UK): a community survey. *Primary Health Care Research and Development* **16** (4), 377–382.

De Lyon A. T. C., Neville R. D. & Armour K. M. (2017) The role of fitness professionals in public health: a review of the literature. *Quest* **69** (3), 313–330.

Dias N., Peng Y., Khavari R., *et al.* (2017) Pelvic floor dynamics during high-impact athletic activities: a computational modeling study. *Clinical Biomechanics* **41** (January), 20–27.

Eysenbach G. (2004) Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES). *Journal of Medical Internet Research* **6** (3): e34. DOI: 10.2196/jmir.6.3.e34.

Goldstick O. & Constantini N. (2014) Urinary incontinence in physically active women and female athletes. *British Journal of Sports Medicine* **48** (4), 296–298.

Hay-Smith J., Dean S., Burgio K., *et al.* (2015) Pelvic-floor-muscle-training adherence "modifiers": a review of primary qualitative studies – 2011 ICS State-of-the-Science Seminar research paper III of IV. *Neurourology and Urodynamics* **34** (7), 622–631.

Kisner C. & Colby L. A. (2012) *Therapeutic Exercise: Foundations and Techniques*, 6th edn. F. A Davis, Philadelphia, PA.

Klovning A., Avery K., Sandvik H. & Hunskaar S. (2009) Comparison of two questionnaires for assessing the severity of urinary incontinence: the ICIQ-UI SF versus the incontinence severity index. *Neurourology and Urodynamics* **28** (5), 411–415.

McKenzie S., Watson T., Thompson J. & Briffa K. (2016) Stress urinary incontinence is highly prevalent in recreationally active women attending gyms or exercise classes. *International Urogynecology Journal* **27** (8), 1175–1184.

MacLean A. B. & Cardozo L. (eds) (2002) *Incontinence in Women.* RCOG Press, London.

Minassian V. A., Drutz H. P. & Al-Badr A. (2003) Urinary incontinence as a worldwide problem. *International Journal of Gynecology and Obstetrics* **82** (3), 327–338.

National Institute for Health and Care Excellence (NICE) (2013) *Urinary Incontinence in Women: Management.* NICE Clinical Guideline 171. National Institute for Health and Care Excellence, London.

Perera J., Kirthinanda D. S., Wijeratne S. & Wickramarachchi T. K. (2014) Descriptive cross sectional study on prevalence, perceptions, predisposing factors and health seeking behaviour of women with stress urinary incontinence. *BMC Women's Health* **14:** 78. DOI: 10.1186/1472-6874-14-78.

Scottish Intercollegiate Guidelines Network (SIGN) (2004) *Management of Urinary Incontinence in Primary Care: A National Clinical Guideline.* Scottish Intercollegiate Guidelines Network. Edinburgh.

Siegel A. L. (2014) Pelvic floor muscle training in males: practical applications. *Urology* **84** (1), 1–7.

Sousa M., Viana R., Viana S., *et al.* (2015) Effects of a pelvic floor muscle training in nulliparous athletes with urinary incontinence: biomechanical models protocol. In: *Computational and Experimental Biomedical Sciences: Methods and Applications. ICCEBS 2013 – International Conference on Computational and Experimental Biomedical Sciences* (eds J. Manuel, R. S. Tavares & R. M. Natal Jorge), pp. 83–90. Springer, Cham.

Stephen K, Munoz S.-A. & Cumming G. (2014) The use of apps to support pelvic floor muscle exercise. *International Journal of Integrated Care* **14:** 8. DOI: http://doi.org/10.5334/ijic.1833.

Thompson J., Mckenzie S., Watson T. & Briffa N. K. (2015) Women who attend group exercise classes or gymnasiums have high prevalence of stress urinary incontinence. *Physiotherapy* **101** (Suppl. 1): e171. DOI: https://doi.org/10.1016/j.physio.2015.03.325.

Thompson J. A. & O'Sullivan P. B. (2003) Levator plate movement during voluntary pelvic floor muscle contraction in subjects with incontinence and prolapse: a cross-sectional study and review. *International Urogynecology Journal* **14** (2), 84–88.

Tolonen H., Kuulasmaa K., Laatikainen T., *et al.* (2002) *Recommendation for Indicators, International Collaboration, Protocol and Manual of Operations for Chronic Disease Risk Factor Surveys.* [WWW document.] URL https://thl.fi/publications/ehrm/product2/product2.pdf

Wang C., Li J., Wan X., *et al.* (2015) Effects of stigma on Chinese women's attitudes towards seeking treatment for urinary incontinence. *Journal of Clinical Nursing* **24** (7–8), 1112–1121.

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