PFD-SENTINEL: Development of a screening tool for pelvic floor dysfunction in female athletes through an international Delphi consensus

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ABSTRACT

To develop a screening tool for pelvic floor dysfunction (PFD) in female athletes for use by sports medicine clinicians (eg, musculoskeletal/sports physiotherapists, sports and exercise medicine physicians), which guides referral to a PFD specialist (eg, pelvic floor/women's health physiotherapist, gynaecologist, urogynaecologist, urologist).

Between February and April 2022, an international two-round modified Delphi study was conducted to assess expert opinion on which symptoms, risk factors and clinical and sports-related characteristics (items) should be included in a screening tool. We defined consensus a priori as >67% response agreement to pass each round.

41 and 34 experts participated in rounds 1 and 2, respectively. Overall, seven general statements were endorsed as relevant by most participants highlighting the importance of screening for PFD in female athletes. Through consensus, the panel developed the Pelvic Floor Dysfunction-ScrEeNing Tool IN fEmale athLetes (PFD-SENTINEL) and agreed to a cluster of PFD symptoms (n=5) and items (risk factors, clinical and sports-related characteristics; n=28) that should prompt specialist care. A clinical algorithm was also created: a direct referral is recommended when at least one symptom or 14 items are reported. If these thresholds are not reached, continuous monitoring of the athlete's health is indicated.

Despite increasing awareness and clinical relevance, barriers to identify PFD in female athletes are still present. The PFD-SENTINEL is a new resource for sports medicine clinicians who regularly assess female athletes and represents the first step towards early PFD identification and management. Further studies to validate the tool are needed.

INTRODUCTION

Several epidemiological studies have reported a high prevalence of pelvic floor dysfunction (PFD)[1–3] among female athletes.[4] Compared with non-athletic women, athletes have a higher risk of developing urinary incontinence (UI) and also a greater prevalence rate of UI, reaching 80% in trampolinists.[5 6] Evidence is still scant about other PFD such as pelvic organ prolapse (POP) and anal incontinence (AI).[4]

According to various authors, PFD in female athletes may be an under-researched, under-recognised and undertreated problem[4 7 8] for several reasons. Studies showed that the athletes' knowledge of the pelvic floor is low,[9 10] and few discuss their condition with medical staff.[9 11] Moreover, only a minority of professionals are aware of the possible dysfunction that could occur,[12] screening for potential PFD is frequently delayed and risk factors are not often assessed.[12] For example, 30.4% of Australian sports medicine professionals do not screen for PFD, because pelvic floor questions are not currently included in existing screening tools, or because they are not aware of which questions to ask.[12] As a consequence of unrecognised diagnosis, worsening symptoms, negative influence on performance and withdrawal from sports may occur.[5 9 11]

Different screening tools for other conditions have been developed. These include the Sport Concussion Assessment Tool 5, The International Olympic Committee Sport Mental Health Assessment Tool 1 and the Brief Eating Disorder in Athletes Questionnaire.[13–15] However, to our knowledge, there is currently no existing tool or instrument including PFD screening that can be used by sports medicine clinicians. These healthcare professionals, who traditionally see and treat athletes, are usually not specialists in pelvic floor health, but they may play an important role in pelvic floor healthcare in athletes.[16] This study aimed to develop a practical screening tool for PFD in female athletes for use by sports medicine clinicians (eg, musculoskeletal/sports physiotherapists, sports and exercise medicine physicians), which guides referral to a PFD specialist (eg, pelvic floor/women's health physiotherapist, gynaecologist, urogynaecologist, urologist) through a Delphi consensus.

METHODS

An Italian research team worked on the development of the present screening tool using a Delphi modified consensus through a web-based survey (SurveyMonkey, Palo Alto, California, USA). The research team included seven researchers and/or clinicians: SG, SS, TI, PP, GG, MV and AT. The committee's expertise included: epidemiology, primary and secondary research methodology, sports medicine, musculoskeletal/sports physiotherapy, pelvic floor physiotherapy and urogynaecology.

This Delphi study was conducted following the Conducting and Reporting of Delphi Studies (CREDES)[17] recommendations, while the Checklist

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for Reporting Results of Internet E-Surveys (CHERRIES) guidelines[18] was used for the reporting.

Full information, details and data protection policies are reported in the prospectively registered protocol.[19]

Definitions

Target population

The present screening tool is tailored specifically to female athletes of any age, performance level and practising any type of sports. Regarding the term 'athlete', the definition and criteria proposed in 2016 by Araújo and Scharhag[20] was used in the present Delphi consensus.

Clinical condition

We considered any type of PFD including the most common UI, POP, AI, overactive bladder syndrome and pelvic pain.[1–3]

Target end users

The aim was to create a screening tool for sports medicine clinicians who assess and are in close contact with athletes but are non-specialists in pelvic floor health. In most cases, these professionals are musculoskeletal/sports physiotherapists and sports medicine physicians (including team physicians).

Sports

Considering that the impact of sports practice on the pelvic floor is closely linked to increased intra-abdominal pressure and ground reaction force,[21] we used both these factors to identify high-impact, medium-impact and low-impact sports. High-impact sports include gymnastics, basketball, volleyball, high jump, trampoline and powerlifting. Sports like tennis, running, karate, football were considered medium-impact. Sports that do not involve jumping and abdominal contraction or in which no direct ground contact is involved such as swimming, cycling and walking were considered low-impact.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Equity, diversity and inclusion

The Italian author team included two women and five men, clinician, senior and junior investigators from a variety of specialties. On behalf of 14 nationalities, participants included women and men from different ages, disciplines and levels of expertise. The female athlete is the focus of this article: great attention has been given to medical conditions that strongly impact athletes' life and health.

Identification of risk factors and clinical and sports-related characteristics to include in the screening tool

In addition to the risk factors for PFD in women of the general population,[3 22–24] the research team conducted a comprehensive search in MEDLINE on 13 January 2022. Among the female athlete population, the objective was to identify published primary and secondary studies that reported (a) specific risk factors significantly associated with PFD; (b) clinical conditions investigated by authors potentially but not significantly associated with PFD; (c) sports-related characteristics investigated by authors potentially but not significantly associated with PFD. These data were presented as *items* in the survey. The search strategy is reported in online supplemental file 1, while all extracted data with references are presented in online supplemental file 2.

Delphi study

Approach

An online modified Delphi technique was chosen as it is a commonly used method to establish an agreement on various health-related and research-related issues, especially applied to address research topics that are not yet well developed in the literature.[25] The 'modified Delphi' approach may include any variation of Delphi method,[26 27] and was chosen as we proposed to the experts a set of carefully selected items from the literature as described above.

The ideal number of panellists for a Delphi to reach consensus is not clear[28] and it depends on the investigated subject.[29 30] Since we asked the opinion of experts in a specific knowledge topic, no sample size calculation was performed.

Participant recruitment

Non-random, purposive sampling was used to identify target participants through a literature scan of MEDLINE. In order to preserve the anonymity of participants, the complete search strategy is not reported. Eligible participants were authors of at least two publications of any study design concerning PFD among athletes. We chose this criterion as the most objective method possible to define the degree of panel's expertise. After this phase, a set of unique authors' names and contact information was extracted. To characterise the panel, participants were asked about sociodemographic (eg, nationality, age, sex) and professional characteristics (eg, educational background, their current field of work and role, experience and number of studies on the topic). Participation was voluntary and no incentives were offered.

Procedure and pilot testing

Two Delphi rounds were run. The first round was performed in February 2022 and the second one in April 2022. Before invitation, the content of each round was pilot tested by all the research team members for control purposes, and the survey redesigned based on feedback.

Together with the research team, all eligible authors were then invited by an email from the first author (SG) to participate. The mail included a brief note underlining (a) the aim of the study, (b) contact name and address of the first author, (c) data handling, (d) privacy policy, (e) informed consent, (f) instructions for the completion of the survey and (g) the related link invitation. All participants were invited to participate in both rounds unless they explicitly indicated that they do not wish to participate. During each round, to minimise the non-response bias, one email reminder was sent. To prevent biases, participants' IP address was used to identify potential duplicate entries from the same user and questions were randomised. Participants were able to review and check the completeness of the survey and eventually change responses using a back button, before submitting their answers.

Participants were ensured that their identities would not be disclosed. Data were downloaded and stored in an encrypted file and all personal data were de-identified to maintain confidentiality and data protection; only the first author had access to information during all stages of the study.[31]

Data collection

The items presented in the Delphi survey were closed questions in which participants could score the endorsement of each item for inclusion in the screening tool on a 5-point Likert scale:

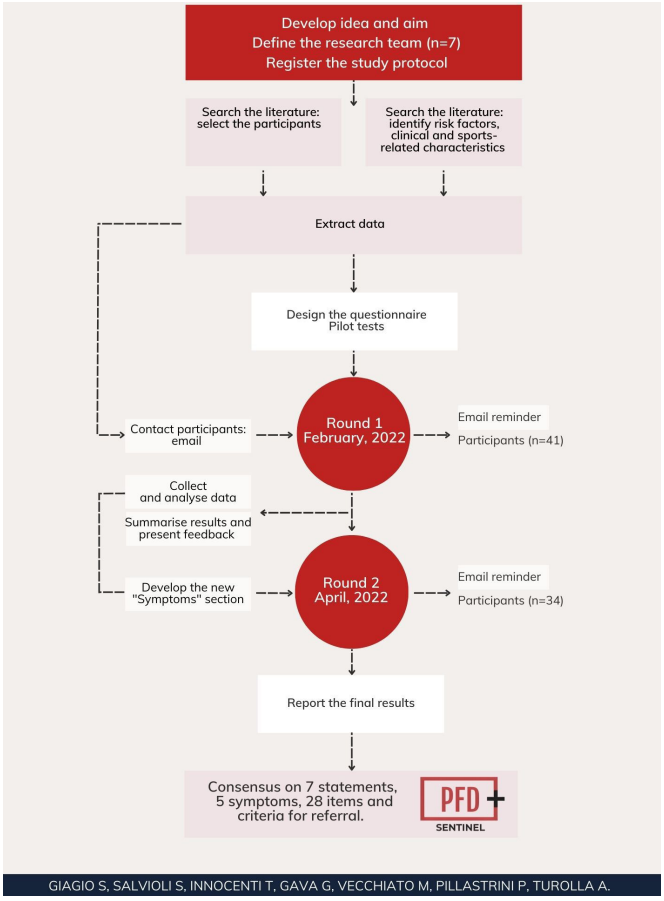

Figure 1 Delphi flow chart: from planning to results. PFD-SENTINEL, Pelvic Floor Dysfunction-ScrEeNing Tool IN fEmale athLetes.

'strongly disagree/absolutely no', 'disagree', 'neutral', 'agree' and 'strongly agree/absolutely yes' (eg, *strongly agree to include the item in the screening tool for referral*). A consensus was set a priori at 67% of the total number of participants (dis)agreeing with a proposal (ie, 'strongly (dis)agree' and '(dis)agree' answers) were pooled together. This criterion is in line with other Delphi studies[32–34] and it was selected considering the nature of the field. We chose to be more conservative as this is a research area that is still in development. Only completed questionnaires were analysed.

Delphi round 1

Preliminary general statements regarding the use and the importance of screening in the field were incorporated into the survey. In addition, clinical and sports-related characteristics along with risk factors extracted from a preliminary literature search were presented as *items*. Subsequently, participants were asked whether they agree or disagree with the endorsement of each item for inclusion in the screening tool. Criteria for referral were identified by the participants in this phase. Finally, two open questions were asked for additional items and general feedback on the Delphi.

Delphi round 2

Items without a consensus were presented again for voting only if they had at least 50% of participants in favour of the endorsement or if any substantial remark favoured their endorsement. In the case of no consensus, all potential items were presented

Table 1 International expert panel: participants characteristics (n=41).

Variable*	N (%)
Age (years)	
20–29	3 (7.3)
30–39	12 (29.3)
40–49	12 (29.3)
50–59	7 (17.1)
60 or more	7 (17.1)
Sex	
Female	26 (63.4)
Male	15 (36.6)
Nationality	
Italian	11 (26.8)
Brazilian	5 (12.2)
Australian	4 (9.7)
Norwegian	3 (7.3)
Spanish	3 (7.3)
US-American	3 (7.3)
Austrian	2 (4.9)
New Zealand	2 (4.9)
Portuguese	2 (4.9)
Slovak	2 (4.9)
Others	4 (9.7)
Educational background	
Physiotherapy	19 (46.3)
Urogynaecology/Gynaecology	8 (19.5)
Sports medicine	6 (14.6)
Physical medicine and rehabilitation	5 (12.2)
Urology/Female pelvic medicine and reconstructive surgery	2 (4.9)
Physical education professional	1 (2.4)
Current field of work	
Physiotherapy	16 (39.0)
Sports medicine	7 (17.1)
Urogynaecology/Gynaecology	7 (17.1)
Physical medicine and rehabilitation	5 (12.2)
Not a specific field (academic)	3 (7.3)
Urology/Female pelvic medicine and reconstructive surgery	2 (4.9)
Women's health, exercise and sports	1 (2.4)
Current role	
Clinician and researcher	22 (53.6)
Researcher	10 (24.4)
Clinician	4 (9.7)
Academic and researcher	2 (4.9)
Academic	2 (4.9)
Academic, researcher, clinician	1 (2.4)
Workplace	
University hospital	14 (34.1)
Multiple settings (eg, university/private clinic/hospital)	13 (31.7)
Private clinic	7 (17.1)
University	6 (14.6)
Hospital	1 (2.4)
Experience in the pelvic floor dysfunction field (years)	
None	6 (14.6)
<5	9 (21.9)
5–10	8 (19.5)
>10	18 (43.9)

Continued

Table 1 Continued

Variable*	N (%)
Average number of patients with pelvic floor dysfunction visited in the last year	
None	11 (26.8)
<20 per month	21 (51.2)
20–50 per month	4 (9.7)
>50 per month	5 (12.2)
Number of publications regarding pelvic floor dysfunction	
None	2 (4.9)
<5	17 (41.5)
5–10	12 (29.3)
>10	10 (24.4)

*Others, Canadian (n=1; 2.4), Greek (n=1; 2.4), Israeli (n=1; 2.4) and Swiss (n=1; 2.4).
Academic, expert who works primarily in the university setting. Researcher, expert who carries out scientific research in any other setting.

again for rating. Additional items, based on first-round participant suggestions, were added in this round.

Results from the Delphi survey

Item scores were summarised as appropriate (eg, frequency and proportions) accompanied by a narrative summary of findings, comments and suggestions. For the analysis, 'strongly (dis) agree' and '(dis)agree' answers were pooled together. In the final phase, the research team participated in a meeting group revising a dummy version of the tool for control purposes. Once approval was obtained from all the members, the screening tool was considered ready for reporting.

RESULTS

The complete Delphi process is presented in the flow diagram (figure 1). Eighty-three experts' names and contact information were extracted from the initial MEDLINE search and 70 valid email addresses were found. Together with the research team (n=7), a total of 77 participants were invited to participate. Forty-one respondents took part in round 1 and 34 in round 2, representing 53.2% (41/77) and 44.2% (34/77) of participants. The average time of completion during round 1 was 11 min, while for round 2 participants took about 6 min. Completion rate was 100% for both rounds.

Characteristics of participants

Females, Italians and physiotherapists were the most prevalent sex, nationality and educational background, respectively. Most participants were currently working as clinicians and researchers (n=22; 53.6%) and reported considerable experience, with 43.9% having worked for >10 years in this field. Table 1 illustrates the main characteristics of the participants.

Consensus

The responses provided by participants are divided into four sections: (1) general statements; (2) items; (3) agreement for referral; (4) cluster of PFD symptoms.

Six statements gained immediate consensus by round 1, while one additional statement was suggested by participants. Figure 2 graphically illustrates the final consensus (figure 2).

Table 2 details specific items included (n=28) under each section and the level of agreement for both rounds (table 2).

Participants agreed to identify the benchmark of total item score for suggesting referral to a PFD specialist. The only option that reached the minimum consensus was 'total item score ≥50% of all items included in the screening tool' (n=28; 68.3%).

Figure 2 Results of two rounds Delphi showing level of agreement with 'general statements'. PFD, pelvic floor dysfunction.

Table 2 Results of two rounds of Delphi showing levels of agreement with items for PFD in female athletes to include in the screening tool for referral.

	Items	Round 1 Agreement* (%)	Round 2 Agreement* (%)
1	Age <18 years	43.9	–
2	Age ≥28 years	53.7	32.3
3	BMI >30 (kg/m^2)	80.5	–
4	BMI <18.5 (kg/m^2)	87.8	–
5	Childbirth	82.9	–
6	Type of delivery: caesarean section	–	55.9
7	Type of delivery: vaginal birth	–	94.1
8	Menopause	82.9	–
9	Medications (eg, psychotropic medications, ACE inhibitors, diuretics)	58.5	70.6
10	Smoking	63.4	55.9
11	Higher age of menarche	46.3	–
12	Irregular menstrual cycle	70.7	–
13	Hormonal therapy, oestrogen deficiency states	70.7	–
14	History of urinary tract infections (LUTS)	82.9	–
15	Family history of urinary incontinence	68.3	–
16	Family history of pelvic organ prolapse	–	76.5
17	Constipation	78.0	–
18	Nerve, muscle damage, tissue disruption (pelvic floor)	90.2	–
19	Pelvic surgery, radiation	92.7	–
20	Lung disease	63.4	50
21	Diabetes mellitus	58.5	70.6
22	Connective tissue disease	87.8	–
23	Hypermobility syndrome	90.2	–
24	Relative energy deficiency in sport (RED-s; Mountjoy, 2014)	90.2	–
25	Eating disorders	80.5	–
26	Other musculoskeletal disorders (eg, low back pain, hip pain)	78.0	–
27	Daily drinking carbonated beverages	29.3	–
28	Excessive caffeine consumption	34.1	–
29	High-impact sports (eg, volleyball, gymnastics, powerlifting)	95.1	–
30	Medium-impact sports (karate, triathlon)	92.7	–
31	Low-impact sports (eg, swimming, cycling)	58.5	32.3
32	Age at start of training <14 years	58.5	70.6
33	Years of training/sports practice ≥9	70.7	–
34	Training hours/day ≥2	78.0	–
35	Training hours/week ≥8	82.9	–
36	Training frequency/week ≥4	80.5	–
37	High-level sports/Athlete's national ranking	82.9	–

*Green indicates >67% of agreement to include the item in the tool.
Red indicates ≤67% of agreement to include the item in the tool.
In case of 50%–67% of agreement during round 1, items were presented again in round 2 for rating.
BMI, body mass index; LUTS, lower urinary tract symptoms; PFD, pelvic floor dysfunction.

During round 1, experts suggested introducing symptoms into the tool. For this reason, we developed a new section 'symptoms', and in round 2 participants were asked whether they agree or disagree with the endorsement for the inclusion. Symptoms presented in this phase were selected and adapted from validated questionnaires. Online supplemental file 3 displays the rationale behind this selection with references. Thirty-one participants (91.2%) agreed to incorporate the new section and then, five out of six symptoms reached the minimum agreement (table 3).

Table 3 Results of round 2: specific questions regarding PFD symptoms to include in the screening tool for referral.

Main symptoms	Question*	Round 2 Agreement** (%)
Urinary incontinence (any type)	Do you usually experience urine leakage?	100
Anal incontinence	Do you usually lose stool or gas beyond your control?	100
Overactive bladder syndrome	Do you usually experience urinary urgency (that is a strong sensation of needing to go to the bathroom) usually accompanied by frequent urination and nocturia?	97.1
Pelvic organ prolapse	Do you usually have a bulge or something falling out that you can see or feel in your vaginal area?	100
	Have you ever had to push in the perineal area with your fingers to start or complete a bowel movement or to start or complete urination?	61.8
Pelvic pain	Do you usually experience pain or discomfort in the lower abdomen or genital region?	82.4

*Question: "Do you agree to include the following symptoms?"
**Green indicates >67% of agreement to include the symptom in the tool.
PFD, pelvic floor dysfunction.

In round 2, the majority of experts chose the Pelvic Floor Dysfunction-ScrEeNing Tool IN fEmale athLetes (PFD-SENTINEL) as the official name for the tool (n=16; 47.1%).

All sections of relevant information for the application of PFD-SENTINEL are available in A4-printable version (online supplemental file 4).

To provide a transparent analysis, the complete data, agreement, feedback and comments for each section and round are reported in online supplemental file 5A–M.

DISCUSSION

This two-round Delphi study involving 41 experts worldwide reached a multidisciplinary consensus on the proposal of the first screening tool for PFD in female athletes. Despite an increasing interest in pelvic floor research among female athletes,[4] relevant barriers for identifying the real prevalence and burden of these conditions are still present.[7 8 12] In an expanding but still grey area, we asked for the experts' opinion with the main purpose to reduce this gap. The result was the development of the PFD-SENTINEL: a simple, practical and friendly-to-use screening tool for sports medicine clinicians who regularly assess female athletes and are not usually specialists or trained in pelvic floor health.

The choice to consider any type of PFD was made for two main reasons: (1) the heterogeneity of epidemiological studies among female athletes[4] and (2) the aim of the tool. The PFD-SENTINEL is not a diagnostic or prognostic tool but describes the cluster of symptoms (n=5) and risk factors, clinical and sports-related characteristics (n=28) that should prompt a referral to specialist care.

Most of the proposed symptoms and items were included in the final tool. This is possibly because they were derived from a preliminary literature search and validated questionnaires.

Although some items suggested by participants do not currently have strong evidence, from our perspective the inclusion of these data was appropriate, as our aim to maximise the inclusion of clinically relevant information in the tool. The overall agreement for these items was high, suggesting their clinical relevance and the importance for inclusion in further investigations. Participants provided positive feedback, highlighting the importance of screening as part of comprehensive model of care based on early identification and intervention. However, further prospective research is warranted to validate the tool.

How to use and apply the PFD-SENTINEL

The tool consists of two consecutive sections. The first part aims to screen for symptoms, while the second part investigates the presence of general clinical and sports-related risk factors potentially associated with PFD. For each section, the clinician is required to score one point for each referred symptom or satisfying item. In implementing the tool, we have proposed the following algorithm:

1. *Score A:* direct referral to a PFD specialist should be encouraged if at least one symptom is reported. Only in the case that no symptom is referred, the clinician may proceed to the next section, named 'total item score'.
2. *Score B:* referral to a PFD specialist should be suggested if the total item score is ≥14 (50% of all items included).
3. *Score C*: referral to a PFD specialist should not be suggested if the total item score is <14, which represents the 50% of all items included. Instead, continuous monitoring of the athlete's health within a multidisciplinary team is indicated.

According to experts' opinion, the PFD-SENTINEL should ideally be administered on a regular basis to check any changes in health and athletic activity. In particular, the tool should be embedded within the preseason period to test the athlete's health before the upcoming training and competitions. We also suggest using the tool whether the athlete experienced an enforced stop that has significantly affected her performance or if she has suffered an injury potentially connected to the pelvic floor. During mid-season, a new administration of the tool could be considered for athletes who are forced to take long-term breaks from competitive activities (ie, winter breaks for team sports championships in countries with low temperatures). It may also be reasonable to retest the tool in case the athlete joins a new team during the current season. It is also important to underline that, in case of return to sport after pregnancy and among para-athletes, experts agreed that additional screening is required.

Clinical implications

The PFD-SENTINEL aims to be a key resource where the implementation of the tool may facilitate the referral pathway to a PFD specialist (eg, pelvic floor/women's health physiotherapist, gynaecologist, urogynaecologist, urologist) and may represent the first step towards early diagnosis and accessing appropriate PFD management. This is important as the sixth International Consultation on Incontinence[35] suggested lifestyle interventions and pelvic floor muscle training as the first-line treatment with level 1A evidence/recommendation for some PFD presentations such as UI.

Facilitators and barriers to application

Our aim was to create a tool that includes general medical and pelvic floor questions that considers all relevant information without the need for a pelvic floor assessment. The tool is designed to be used quickly and easily by sports medicine clinicians. Including the specific questions for screening symptoms and the clinical checklist, the PFD-SENTINEL provides clear step-by-step support for easy implementation. However, as for other medical conditions,[36] education of a clinician not specialised in pelvic floor health, using the tool in a confidential setting where such information can be shared may support the application.

Strengths and limitations

Overall, the main strengths of the current study are related to the novelty of the topic and the transparency of the Delphi process. To our knowledge, this is the only existing study to develop a screening tool for pelvic floor health, in female athletes. An extensive preliminary search was conducted to identify risk factors along the available clinical and sports-related characteristics, and the current guidelines (CHERRIES, CREDES) were used. Moreover, we reported any information and data, as supplementary files.

While our findings are of interest, we note some study limitations. First, although we attempted to be comprehensive in inviting participants worldwide and in minimising non-response bias, the geographical representativity of experts' community could not be fully representative. Second, the expert coefficient competence 'K' for determining the specific level of expertise in the field has not been calculated; this may also represent a potential limitation of this study. Concerning the participation of the authorship panel, five out of seven authors matched the criterion of eligibility as 'experts' and two authors are developing a research background in the field. The participation of authors on the Delphi process may represent a consensus bias. Lastly, athletes were not involved in any phase of this study.

Further validation studies are necessary to test the screening tool accuracy, thus confirming or modifying the proposed referral options in consideration of the multifactorial aetiology of PFD.

CONCLUSIONS

According to existing literature, PFD is an under-recognised and undertreated condition among female athletes. The proposed PFD-SENTINEL tool consisting of 5 symptoms and 28 items represents a novel resource to reduce this gap. The tool was developed to aid sports medicine clinicians (eg, musculoskeletal/sports physiotherapists, sports medicine physicians) in referring female athletes to a PFD specialist such a urogynaecologist and pelvic floor/women's health physiotherapist. This step could be a starting point towards early PFD specialist management. Additional prospective studies are needed to validate the tool and assess its accuracy and performance.

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