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Confidence and Knowledge of Athletic Trainers in Managing Patellofemoral Pain

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Context: Patellofemoral pain (PFP) is prevalent and challenging to manage. Most patients with PFP are unsatisfied with their knee function at 6 months after treatment and report ongoing pain up to 16 years after diagnosis. The confidence and knowledge of athletic trainers (ATs) in providing evidence-based care to people with PFP is unknown.

Objective: To investigate the confidence and knowledge of ATs in the diagnosis, risk factors, prognosis, and treatment with current evidence for PFP.

Design: Cross-sectional study.

Setting: Online survey.

Patient or Other Participants: A random sample of 3000 ATs were invited to participate; 261 completed the survey (10% participation rate, 88% completion rate).

Main Outcome Measures(s): We surveyed AT demographics, confidence in PFP management, and knowledge related to diagnosis, risk factors, prognosis, and treatment. The confidence and knowledge of ATs in managing PFP was assessed. Their beliefs about evidence were compared with the available evidence (ie, consensus statements, position statements, systematic reviews).

Results: Of the ATs surveyed, 91% were confident that their management of PFP aligned with the current evidence, but only 59% were confident in identifying risk factors for PFP development. In addition, 91% to 92% of ATs agreed that quadriceps and hip muscle weakness were risk factors for PFP, which aligns with the current evidence for the former but not the latter. Moreover, 93% to 97% of ATs' responses related to therapeutic exercise aligned with current evidence. However, 35% to 48% supported the use of passive treatments, such as electrophysical agents and ultrasound, which did not align with the current evidence.

Conclusions: Most ATs were aware of supporting evidence for therapeutic exercise in PFP management and were confident providing it, creating a strong foundation for evidence-based care. However, varying levels of awareness of the evidence related to risk factors and passive treatments for PFP highlight the need for professional development initiatives to better align ATs' knowledge with the current evidence.

Key Words: anterior knee pain, risk factors, rehabilitation

Key Points

- Most athletic trainers (ATs) felt confident (91%) in treating patients with patellofemoral pain (PFP) and thought (93%–97%) that exercise-focused interventions were appropriate, which aligns with the current evidence.
- Of the ATs, 32% to 48% believed that research supported using electrophysical agents, ultrasound, and joint mobilizations to improve PFP outcomes, despite no evidence suggesting these passive treatments provided any benefit beyond exercise therapy alone.
- The majority of ATs (59%) felt confident identifying the risk factors for PFP.

Patellofemoral pain (PFP) is the most common form of knee pain in young adults (18–40 years old).[1] People with PFP frequently present to sports clinics,[1,2] reporting knee pain during weight-bearing tasks that require knee flexion during athletic pursuits (eg, running, jumping) and activities of daily living (eg, squatting, stair negotiation).[3] Persistent knee pain,[4] disability,[5] and impaired joint- and health-related quality of life[6] are commonplace in those with PFP. In addition, reduced physical activity[7] and ability to participate in recreational and social activities are frequent challenges for those with PFP but not for healthy control individuals.[8]

Patellofemoral pain is challenging to diagnose and treat, with almost 90% of patients reporting ongoing pain 16 years after diagnosis.[9] Poor long-term outcomes in most people with PFP[4] raise questions as to whether the current real-world management of PFP aligns with the evidence. Guidance on implementation of evidence-based practice for PFP has been provided by 3 consensus statements from the International Patellofemoral Research Network (IPFRN),[10–12] a position statement of the National Athletic Trainers' Association (NATA),[13] and a clinical practice guideline from the American Physical Therapy Association.[14]

Reflecting known evidence-practice gaps in medicine,[15] only 24% of physiotherapists reported that they provided evidence-based treatments to people with PFP, regardless of their awareness of the current literature,[16,17] which may explain poor long-term outcomes.[4] Athletic trainers (ATs) commonly treat PFP, yet how their management aligns with the current evidence or whether their clinical and personal experience with PFP influences their management is unknown. A better understanding of ATs' knowledge of PFP will provide insight into the potential for the profession to provide evidence-based care and identify professional development priorities for clinical advancement. Therefore, the aim of our study was to evaluate ATs' confidence and knowledge related to PFP (1) diagnosis and treatment and (2) risk factors and prognosis.

METHODS

This cross-sectional, online open survey was prepared according to the Checklist for Reporting Results of Internet E-Surveys guideline recommendations.[18] An online survey link (Qualtrics) was sent to 3000 ATs who were randomly sampled from all 10 districts of the NATA. The random sample of participants was initially contacted by the NATA on March 23, 2020, with reminder emails sent 1, 2, and 3 weeks later to individuals who had not completed the survey. Data collection for this voluntary survey ended 1 month after the initial email correspondence. The online consent process provided participants with the study purpose, study team contact information, estimated time for completion, and storage of identifiers. Whereas cookies and time stamps were not used in the study, multiple entries from a single participant were evaluated by comparing Internet protocol addresses to prevent bias. Processes for the online consent and data collection were approved by the university's institutional review board.

Instrumentation

The survey was created to evaluate the confidence in and knowledge of the diagnosis, risk factors, prognosis, and treatment for PFP. The survey contained Likert-based and open-ended questions and was divided into 4 sections: (1) participant demographics, (2) confidence in the management of PFP, (3) knowledge related to PFP, and (4) current treatment strategies (Appendix A). The survey was adapted with permission from a previous study of physiotherapists.[16]

Participant Demographics. Participants were asked for basic demographic information, including sex, race, ethnicity, highest level of education, years credentialed, and occupational setting. In addition, this section had 2 *yes* or *no* questions: *Have you ever experienced PFP before?* and *Are you currently treating a patient with PFP?* The number of patients with PFP they had treated in the past year was also requested.

Confidence in PFP Management. Respondents were asked to rate their confidence in the management of PFP. Questions were related to confidence in treatments that were unlikely to benefit patients with PFP, the ability to deliver appropriate treatments that followed evidence-based recommendations, and confidence in their skills to manage patients with PFP. These questions were scored on a 5-item Likert scale: *strongly agree, agree, neither agree nor disagree, disagree, strongly disagree*.

Knowledge of PFP. The knowledge of PFP was divided into 4 subcategories: (1) diagnosis, (2) risk factors, (3) prognosis, and (4) treatment. The diagnosis section consisted of 5 Likert-scale questions asking about common diagnostic criteria for PFP and 1 open-ended question asking participants: *How would you define PFP?* The next subsection included 9 Likert-scale questions related to risk factors for the development of PFP, which included anthropometric, neuromuscular, anatomical, and biomechanical risk factors (Appendix A). Participants were then asked an open-ended question about risk factors: *Are there any additional risk factors you believe that would increase an individual's risk for the development of PFP?* Knowledge related to the prognosis of PFP was the next subsection, which included 4 Likert-scale questions. The final subsection included 15 Likert-scale questions related to the treatment of PFP (Appendix A). All Likert-scale questions in these sections had 5 options; *strongly agree, agree, neither agree nor disagree, disagree, strongly disagree*.

Frequency of Treatment Strategies. This section consisted of 11 Likert-scale questions on the frequency of various treatment strategies, including patient education, activity modification, drivers of pain, written instructions for or videos of exercises, and patient-reported outcome measures. The answer options were *all of the time, most of the time, sometimes, occasionally,* and *never*.

Statistical Analysis

Data from all participants who started the survey were electronically converted from Qualtrics to Excel (Microsoft Corp) for data analysis. Any participants who started the survey but did not complete it were removed from the final analysis. We evaluated ATs' knowledge related to diagnosis, risk factors, prognosis, and treatment of PFP and their confidence in treating patients with PFP by calculating means, SDs, frequencies, or percentages of the data. The respondent data were also compared with the NATA position statement and IPFRN consensus statements (Appendix B), which supply open-access evidence. Frequencies were calculated for the accuracy of the PFP definition open-ended question as directly compared with the IPFRN definition. Frequencies were also recorded for additional risk factors ATs described as increasing the likelihood of developing PFP.

Furthermore, we performed separate Pearson χ^2 models to determine whether the observed response differed based on (1) years credentialed (<5, 6–10, 11–15, >16), (2) clinicians who were currently treating patients with PFP, and (3) clinicians who had previously experienced PFP. The ATs were much less confident in identifying risk factors than in addressing other aspects of PFP. We expected that those with greater confidence would display more knowledge of the risk factors, but an additional Pearson χ^2 test indicated that was not the case; those with high or low levels of confidence did not differ in their actual knowledge of the risk factors. Due to the large number of analyses, a more conservative α was set a priori: $P < .01$.

RESULTS

A total of 297 individuals participated (10% response rate) and provided 261 complete responses (88% completion rate). No duplicate Internet protocol addresses were

found, so multiple entry was not identified in our cohort. Demographics of the participants who completed the study are reported in the Table.

Confidence in and Knowledge of Diagnosis and Treatment of PFP

The ATs' confidence in PFP management is presented in Figure 1. Most ATs *strongly agreed* or *agreed* that they felt confident in the management of PFP following the current evidence (91%), had the skills to manage PFP following the current evidence (95%), were confident in delivering appropriate treatment for PFP (90%), and were confident identifying treatments that would be unlikely to benefit patients with PFP (81%). Only 59% of ATs were confident identifying PFP risk factors.

Years credentialed as an AT did not influence any measure of confidence ($P > .01$; Appendix A). Current experience treating patients with PFP as an AT did improve confidence in their skills to manage the condition ($\chi^2 = 19.00$, $P < .001$). A history of PFP in the ATs themselves enhanced their confidence regarding the types of treatments that were unlikely to benefit patients ($\chi^2 = 17.44$, $P = .002$).

The ATs' knowledge of diagnosis of PFP is described in Figure 2. Years certified, currently treating patients with PFP, or personal experience with PFP did not influence their knowledge related to PFP diagnosis ($P > .01$). Of all respondents, only 5% supplied a complete definition of PFP that aligns with the consensus definition, whereas 66% offered a general definition of anterior knee pain. The remaining 29% provided general statements that focused on patellar tendinopathy, cartilage damage, muscle imbalance, and patellar maltracking.

The ATs' knowledge of evidence-based treatment for PFP is illustrated in Figure 3. Most ATs (93%–97%) *strongly agreed* or *agreed* that exercise therapy can improve pain and function and that combined hip and knee exercises are preferable to knee exercise alone (95%). No difference was evident in treatment-related answers when we evaluated the ATs based on their years certified, current treatment of patients with PFP, or having experienced PFP ($P > .01$).

The majority of ATs reported that they discussed activity modification (98%) and physical drivers of pain (82%), educated patients about the length of their recovery (82%), provided written exercises (68%), and discussed knee crepitus (66%) *all of the time* or *most of the time* with their patients.

Knowledge of Risk Factors and Prognosis of PFP

The ATs' knowledge of the risk factors of PFP is addressed in Figure 3 and Appendix C. Participants *strongly agreed* or *agreed* with most of the items related to PFP risk factors (>75%), except for decreased hamstrings and gastrocnemius flexibility and age as risk factors (Figure 4). Knowledge of PFP risk factors did not differ by years certified, ATs currently treating patients with PFP, or having experienced PFP themselves ($P > .01$). In addition, 128 respondents completed the open-ended question inquiring about other risk factors. The most common answers were increased activity or training load (32/128 = 25%), previous knee injury (18/128 = 14%), and playing surface or shoe wear (6/128 = 5%).

Table. Demographics of Study Volunteers (N = 261)

Characteristic	Value, No. (%)[a]
Age, y, mean ± SD	33.74 ± 10.17
Sex	
Male	97 (37.2)
Female	162 (62.0)
Prefer not to answer	2 (0.8)
Ethnicity	
Hispanic	15 (5.8)
Non-Hispanic	243 (93.1)
Prefer not to answer	3 (1.1)
Race	
White	235 (90.1)
Black	9 (3.4)
Asian	9 (3.4)
American Indian or Alaska Native	6 (2.3)
Prefer not to answer	2 (0.8)
Highest level of education	
Bachelor's	60 (23.0)
Master's	176 (67.4)
Clinical doctorate (doctor of athletic training, doctor of physical therapy)	18 (6.9)
Doctoral degree (doctor of philosophy, doctor of education)	3 (1.1)
Professional degree (doctor of medicine, doctor of jurisprudence)	4 (1.6)
Credentials held in addition to certified athletic trainer	
Certified strength and conditioning specialist	25 (9.6)
Doctor of physical therapy	13 (5.0)
Physical therapy assistant	6 (2.3)
Certified orthopaedic technologist	6 (2.3)
National Academy of Sports Medicine Corrective Exercise or Performance Enhancement Specialist	10 (3.8)
Employment setting	
College	92 (35.2)
Secondary school	60 (23.0)
Clinic	30 (11.5)
Professional	10 (3.8)
Industry, occupational, or corporate	9 (3.4)
Academic	3 (1.1)
Combination of settings	46 (17.7)
Other	11 (4.3)
Years credentialed as a certified athletic trainer	
<5	70 (26.8)
6–10	101 (38.7)
11–15	52 (20.0)
<16	38 (14.5)
Have you ever experienced PFP before?	
Yes	184 (70.5)
No	77 (29.5)
Are you currently treating a patient with PFP?	
Yes	176 (67.4)
No	85 (32.6)
Patients with PFP treated/y	
<10	149 (57.1)
11–30	89 (34.1)
>30	23 (8.8)

Abbreviation: PFP, patellofemoral pain.

[a] Except where otherwise indicated.

The ATs' knowledge of the prognosis of PFP is reported in Figure 5. Knowledge of a PFP prognosis did not differ by years certified or ATs who were currently treating patients with PFP or had experienced PFP themselves ($P > .01$).

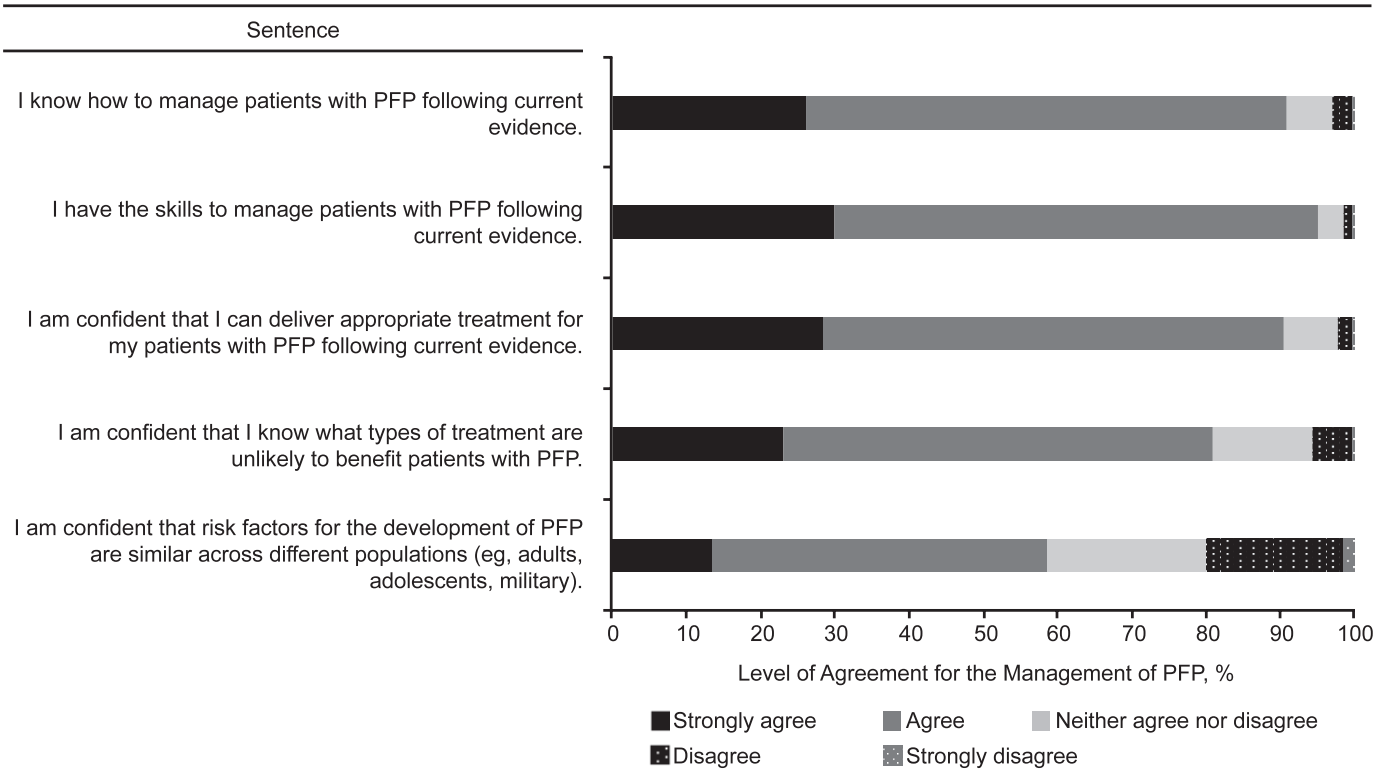

Figure 1. Athletic trainers' confidence in managing patients with patellofemoral pain (PFP).

DISCUSSION

We evaluated ATs' confidence in and knowledge of PFP diagnosis, treatment, risk factors, and prognosis. Most ATs were confident in their treatment of PFP. The majority accurately identified the criteria for PFP diagnosis, recognized quadriceps weakness as a risk factor, and provided exercise-focused treatment strategies, consistent with evidence-based recommendations.[10,11,13,14] However, only 59% of ATs were confident in identifying PFP risk factors, and most did not accurately identify PFP risk factors. Moreover, 32% to 48% of ATs believed that the

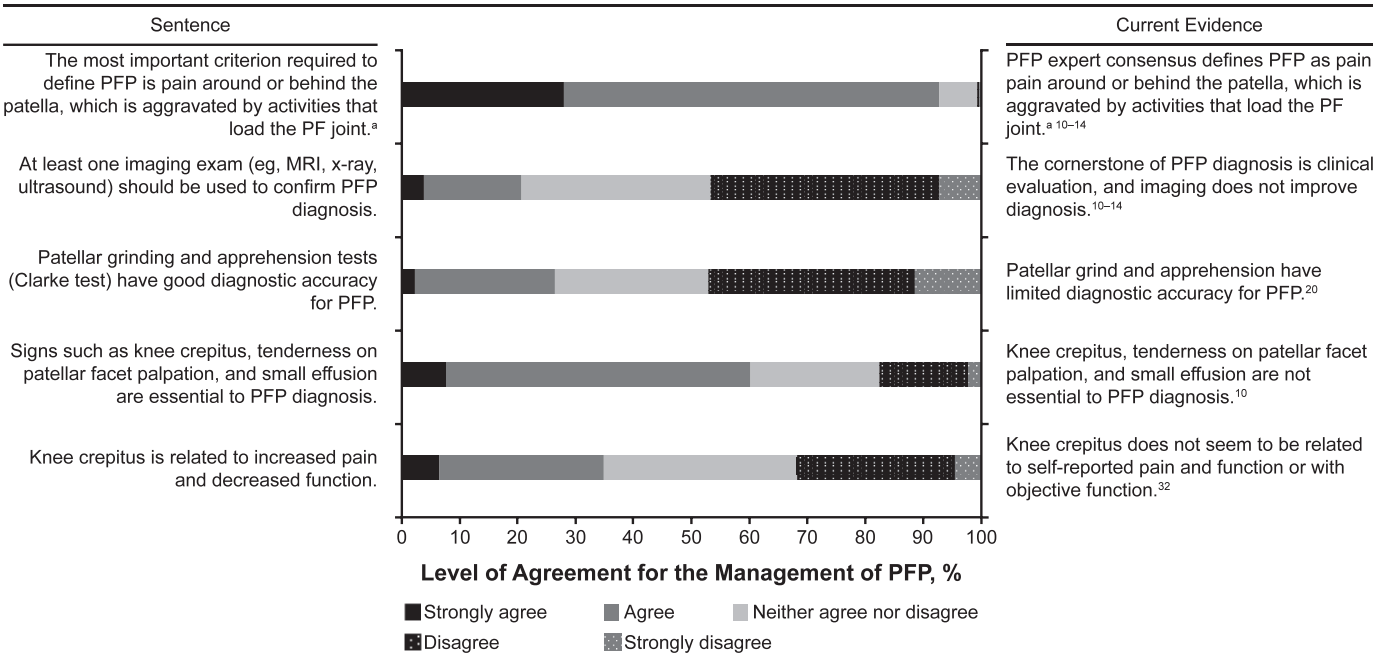

Figure 2. Athletic trainers' knowledge of the diagnosis of patients with patellofemoral pain (PFP). Abbreviations: MRI, magnetic resonance imaging; PF, patellofemoral. [a] Activities that load the PF joint include squatting, stair ambulation, jogging or running, and hopping or jumping.

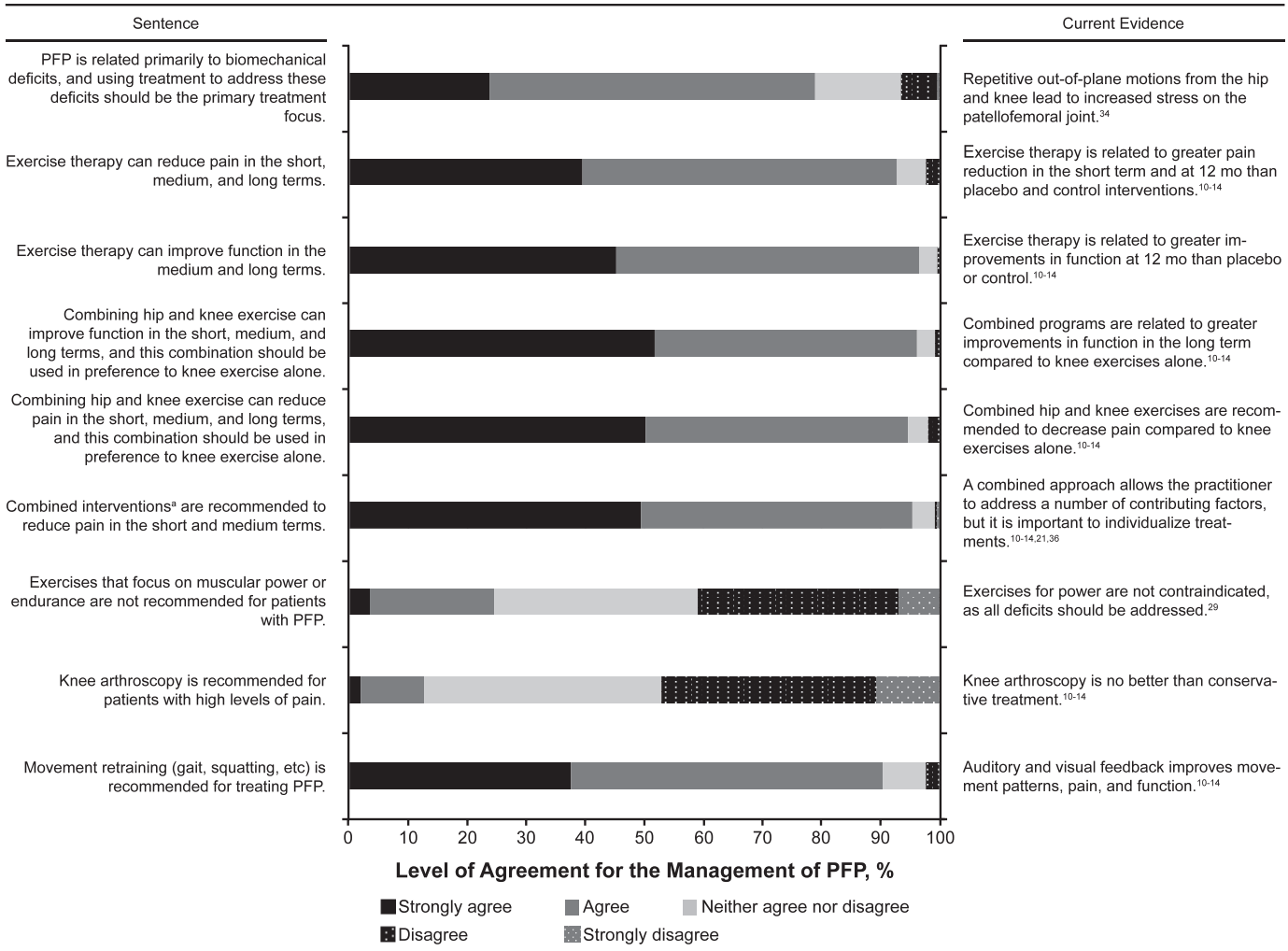

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Figure 3. Athletic trainers' knowledge of the treatment of patients with patellofemoral pain (PFP). [a] Combined interventions as a management program incorporate exercise therapy as well as 1 of the following: foot orthoses, patellar taping, or manual therapy. Continued on next page.

evidence supported the use of passive treatments for PFP (electrical stimulation, ultrasound, and joint mobilizations), which does not agree with evidence-based recommendations.[18–21] This suggests that continuing education for ATs should focus on risk factors, prognosis, and non–exercise treatment strategies to improve clinician knowledge for the management of patients with PFP.

Confidence in and Knowledge of Diagnosis and Treatment of PFP

The majority of ATs knew the most important criteria for PFP diagnosis (93%). Yet, when responding to open-ended questions, fewer (66%) provided a general definition related to anterior knee pain, and only 5% gave a definition for PFP that aligned with consensus and position statements.[10,13,14] Misleading PFP definitions are frequently identified in common search engines,[19] which could influence the ATs' ability to provide an accurate definition. This diagnosis is challenging for clinicians because it requires a clinical evaluation and is often diagnosed by exclusion of other knee conditions.[20] Professional education and development are needed to improve the diagnostic skills of ATs because patients often want to know the cause of their pain.[8] Future researchers should evaluate the level of education at which ATs learn about PFP, given that accurate and reliable resources are required to ensure proper education for those who diagnose and treat PFP.

According to our findings, ATs understood that therapeutic exercises were appropriate interventions for treating PFP to improve both pain and function, aligning with current evidence.[11,13,21] They realized that combining exercise therapy with passive interventions such as knee taping and foot orthotics could reduce pain in the short term,[10] which is supported by evidence.[11,22] Passive treatments, such as electrophysical agents (modalities), ultrasound, and joint mobilizations demonstrated the largest discrepancy between AT knowledge and current evidence. Some ATs supported the use of electrophysical agents (48%), ultrasound (32%), and joint mobilizations (47%) to improve PFP outcomes, yet no evidence indicates that these passive treatments provide benefit beyond that of exercise therapy alone.[21,23] These results are consistent with physiotherapists' knowledge of exercise interventions and passive treatments for PFP.[24] Additional insights into the current practice approach of health care professionals are

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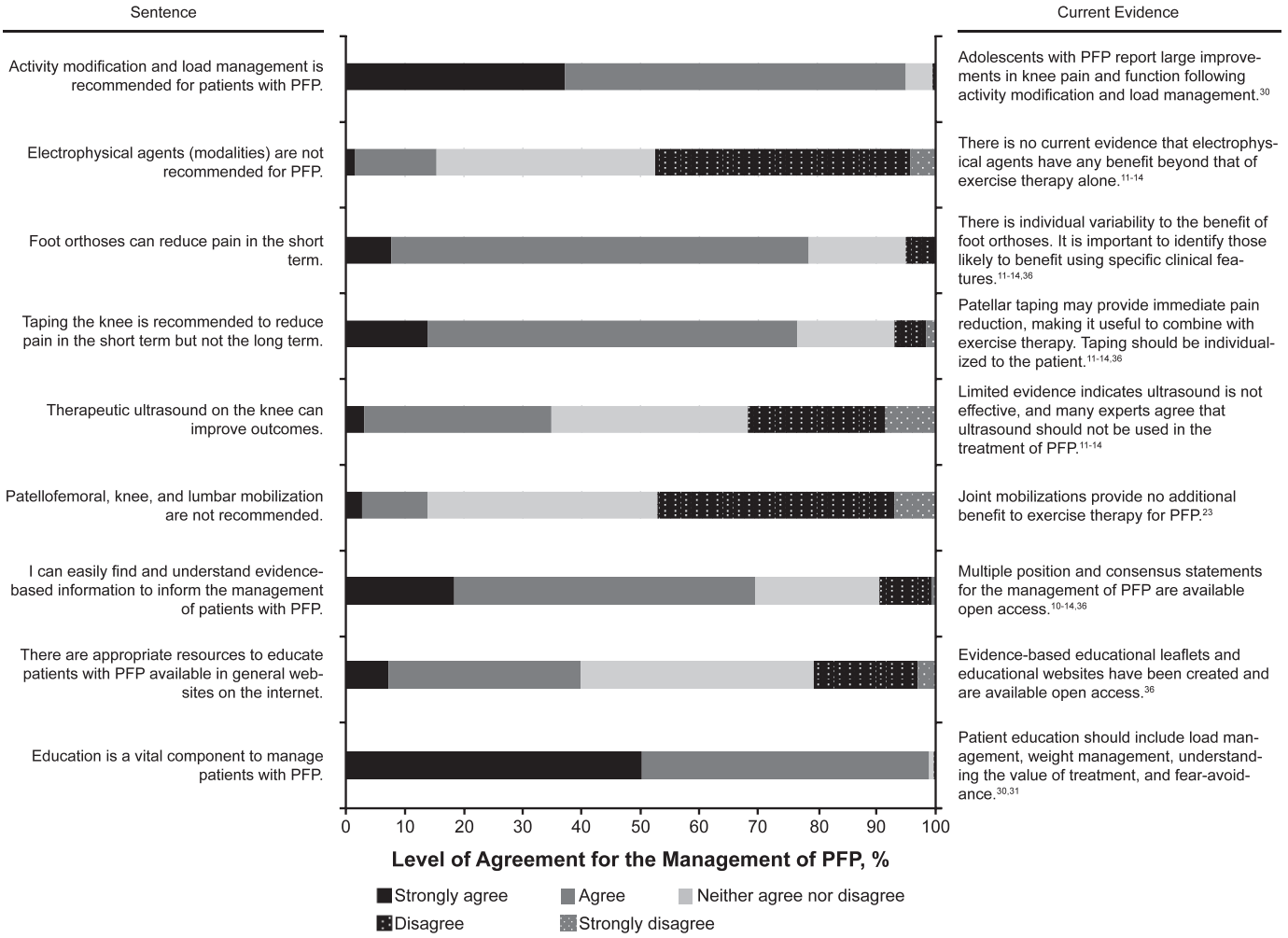

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needed to determine whether these passive treatments are used in isolation or as adjuncts to evidence-based interventions.

Knowledge of Risk Factors and Prognosis of PFP

Apart from accurately identifying quadriceps weakness as a risk factor for PFP, these data show that ATs struggled to identify the risk factors of PFP in accordance with the current evidence. Hip weakness was cited as a risk factor for PFP development by 90%, despite the fact that prospective findings did not support this notion.[24] In fact *increased* hip-abduction strength has been reported to be a risk factor for PFP development in adolescents.[24] The disconnect between AT knowledge and the current best evidence may be due to the differences between factors associated *with* PFP and prospective risk factors *of* PFP. Hip muscle weakness is a common impairment[25] that clinicians target with conservative treatment, yet it is not a risk factor for PFP.[25] Hip muscle weakness has been suggested as a consequence of injury rather than a cause, which may account for the ATs' beliefs in hip strength as a risk factor.

Most ATs (85%–91%) thought that dynamic knee valgus, increased Q-angle, and foot pronation were risk factors for PFP development, though this is not supported by the current evidence.[24] Our survey did not specify the tasks used to assess dynamic knee valgus, Q-angle, or foot pronation, and that may have influenced the ATs' responses. The discord between risk factors and evidence could reflect the type of evidence accessed by ATs. Researchers who conducted cross-sectional studies reported that individuals with PFP had greater dynamic knee valgus[26] than did asymptomatic populations. However, the results of prospective studies[24] did not support dynamic knee valgus as a risk factor for PFP development, which may have confused clinicians. This discord between evidence types could also explain why ATs supported female sex, greater body mass index, and decreased hamstrings and gastrocnemius flexibility as risk factors. Based on cross-sectional studies, females had a greater prevalence of PFP and people with PFP had an increased body mass index[27] and decreased flexibility.[28] Nonetheless,

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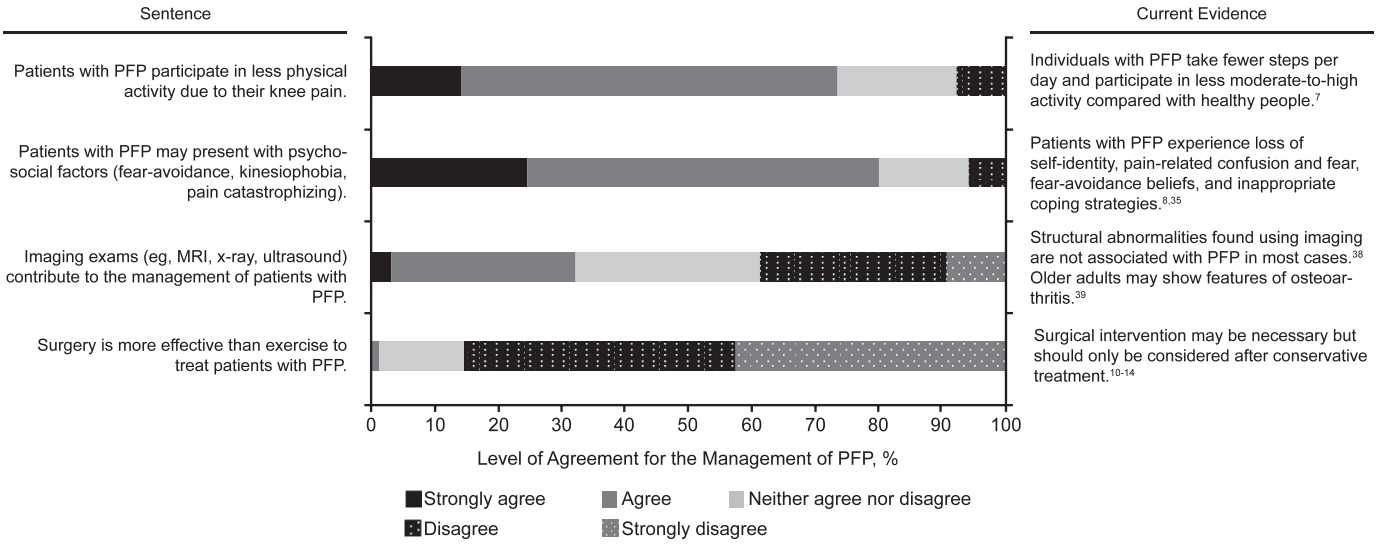

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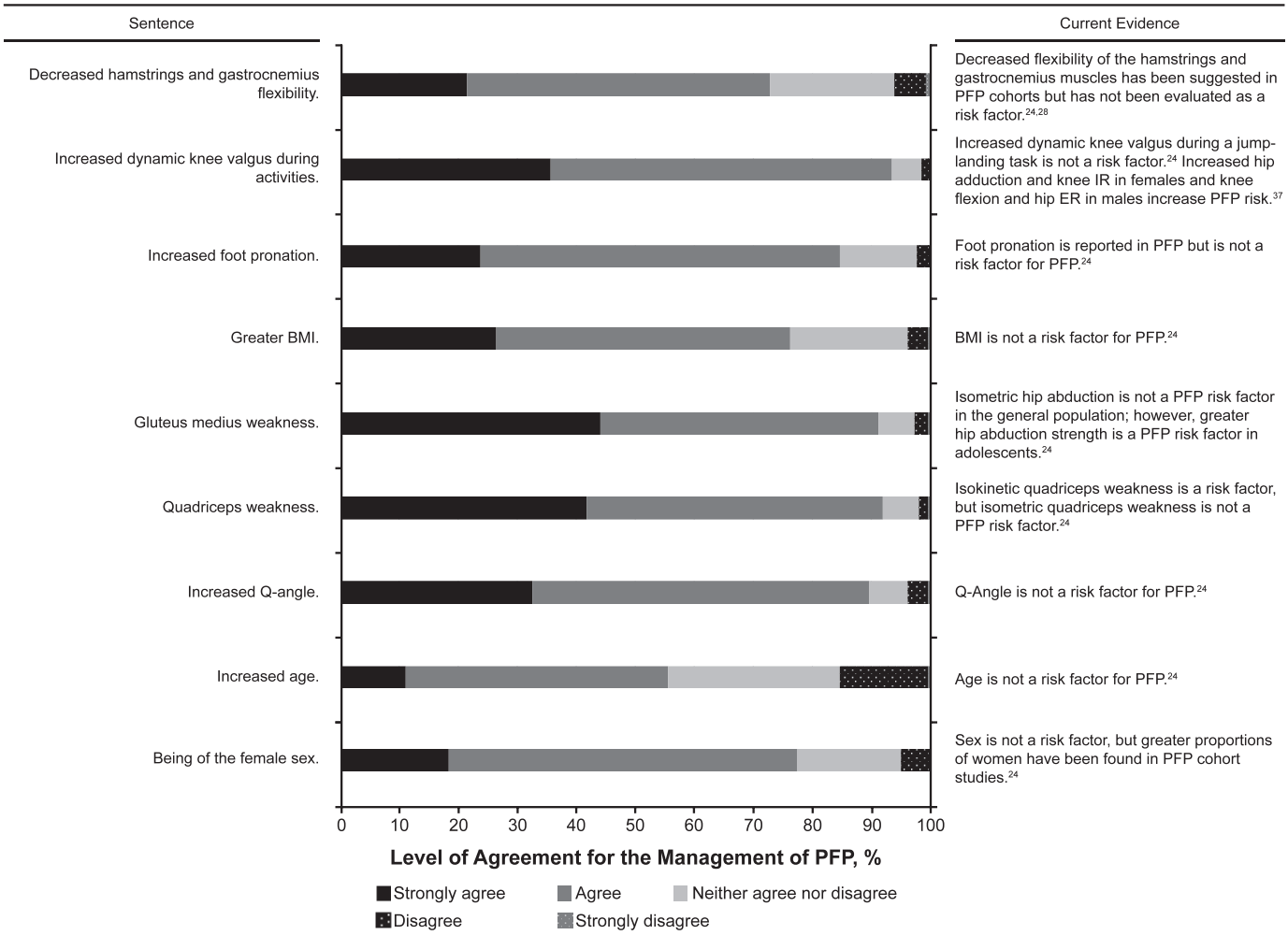

Figure 4. Athletic trainers' knowledge of the risk factors for patellofemoral pain (PFP). Abbreviations: BMI, body mass index; IR, internal rotation; ER, external rotation.

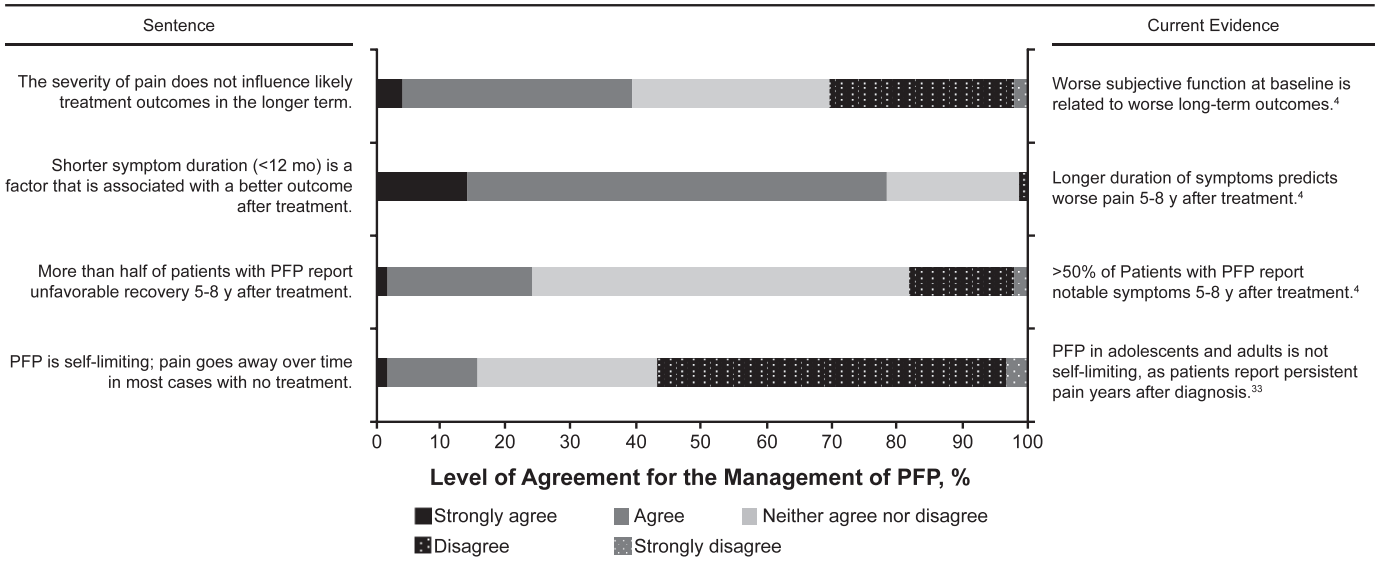

Figure 5. Athletic trainers' knowledge of the prognosis of patellofemoral pain (PFP).

these features have not emerged as risk factors in prospective studies.[24] We did not inquire about the ATs' specific evidence (such as systematic reviews, cross-sectional studies, or prospective studies) regarding risk factors.

Limited knowledge of risk factors among the ATs surveyed was consistent, with only 59% feeling confident in identifying PFP risk factors. These findings suggest that increased attention needs to be placed on risk factor identification in athletic training programs and continuing education courses. Injury prevention is a key domain for ATs and is a focus of numerous musculoskeletal conditions, so increased efforts to improve ATs' knowledge of PFP-specific risk factors are warranted.

Almost 50% of ATs did not agree that PFP results in unfavorable long-term outcomes. Numerous intervention programs have been developed for treating PFP,[4,29,30] with significant variations in exercises that strictly adhere to evidence-based recommendations. The lack of consistency across studies may influence ATs' beliefs about PFP outcomes, depending on ATs' familiarity with the literature. Athletic trainers should be aware of the PFP prognosis because it is not self-limiting[4] and knee pain and functional limitations may be present for years after diagnosis.[4] They must also be able to educate patients with PFP that their condition may not completely resolve after formal treatment, so that patients have appropriate expectations. Acknowledging these persistent concerns is vital in educating patients appropriately regarding the potential need to continue exercise therapy on their own beyond formal treatment.[31]

Our study has some limitations that must be considered. Although the survey was sent to 3000 ATs, only 10% completed it, a lower rate than for previous knowledge-based surveys. Respondents may have had a clinical interest in PFP and been more familiar with the current evidence, thereby introducing the possibility of selection bias. Both the NATA position statement[13] and American Physical Therapy Association clinical practice guidelines[14] were published in the last few years, suggesting it may take time to integrate evidence into clinical practice.[15]

CONCLUSIONS

Most ATs were confident in their knowledge of and skills for managing patients with PFP and demonstrated evidence-based knowledge of exercise-focused treatment for PFP. However, their knowledge and confidence related to diagnosis, certain passive treatments, risk factors, and prognosis varied. This indicates a need for further education to better align ATs' knowledge with the current evidence related to PFP.

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Appendix A. Survey Items with Secondary Analyses (*P* Values) for Years Credentialed, Previous Experience of PFP, and Previous Experience Treating PFP

Confidence Items	Years Credentialed	Previous Experience of PFP	Previous Experience Treating PFP
I know how to manage patients with PFP following current evidence	.486	.264	.077
I have the skills to manage patients with PFP following current evidence	.629	.060	.092
I am confident that I can deliver appropriate treatment for my patients with PFP following current evidence	.871	**.001**[b]	.052
I am confident that I know what types of treatment are unlikely to benefit patients with PFP	.568	.208	**.002**[c]
I am confident that risk factors for the development of PFP are similar across different populations (eg, adults, adolescents, military)	.468	.874	.432
Diagnostic Items			
The most important criterion required to define PFP is pain around or behind the patella, which is aggravated by activities that load the PFP joint (eg squatting, stair ambulation, jogging/running, hopping/jumping)	.450	.473	.443
At least one imaging exam (eg MRI, x-rays, ultrasound) should be used to confirm the PFP diagnosis	.123	.136	.704
Patellar grinding and apprehension tests (Clarke test) have good diagnostic accuracy for PFP	.450	.106	.345
Signs such as knee crepitus, tenderness on patellar facet palpation, & small effusion are essential to PFP diagnosis	.041	.671	.683
Knee crepitus is related to increased pain and decreased function	.308	.360	.751
Risk Factor Items			
Being of the female sex	**<.001**[a]	.228	.984
Increased age	.196	.108	.123
Increased Q-angle	.813	.940	.476
Quadriceps weakness	.900	.755	.119
Gluteus medius weakness	.380	.969	.011
Greater body mass index	.092	.030	.054
Increased foot pronation	.259	.858	.048
Increased dynamic knee valgus during activities	.187	.051	.288
Decreased flexibility of the hamstrings and gastrocnemius	.091	.079	.804

Prognostic Items	Years Credentialed	Previous Experience of PFP	Previous Experience Treating PFP
Patellofemoral pain is self-limiting; pain goes away over time in most cases with no treatment	.022	.376	.833
More than half of patients with PFP report unfavorable recovery 5–8 years after treatment	.707	.914	.244
Shorter symptom duration (<12 mo) is associated with a better outcome after treatment	.165	.544	.501
The severity of pain does not influence likely treatment outcomes in the longer term	.105	.795	.691
Treatment Items			
Patellofemoral pain is related primarily to biomechanical deficits and, therefore, using treatment to address these deficits should be the primary focus on treatment	.307	.273	.622
Exercise therapy can reduce pain in the short, medium, and long term	.228	.295	.275
Exercise therapy can improve function in the medium and long term	.668	.121	.165
Combining hip and knee exercise can reduce pain in the short, medium, and long term, and this combination should be used in preference to knee exercise alone	.990	.569	.865
Combining hip and knee exercise can improve function in the short, medium, and long term, and this combination should be used in preference to knee exercise alone	.539	.816	.205
Exercises that focus on muscular power or endurance are not recommended for patients with PFP	.072	.797	.462
Knee arthroscopy is recommended for patients with high levels of knee pain	.200	.451	.363
Movement retraining (gait, squatting, etc) is recommended for treating PFP	.606	.117	.298
Patellofemoral, knee, and lumbar mobilization are not recommended	.650	.326	.029

Treatment Questions (Continued)	Years Credentialed	Previous Experience of PFP	Previous Experience Treating PFP
Therapeutic ultrasound to the knee can improve outcomes	.294	.991	.396
Taping the knee is recommended to reduce pain in the short term but not in the long term	.930	.260	.488
Foot orthoses can reduce pain in the short term	.271	.353	.681
Electrophysical agents (modalities) are not recommended for PFP	.440	.108	.152
Activity modification and load management is recommended for PFP patients	.488	.386	.159
Combined interventions are recommended to reduce pain in the short and medium term (combined interventions incorporate exercise therapy as well as one of the following: foot orthoses, patellar taping, or manual therapy	.329	.569	.060
Surgery is more effective than exercise to treat patients with PFP	.685	.152	.494
Imaging exams (eg MRI, radiographs, ultrasound) contribute to the management of patients with PFP	.561	.305	.590
Patients with PFP may present with psychosocial factors (fear avoidance, kinesiophobia, anxiety, pain catastrophizing)	.231	.301	.474
Patients with PFP participate in less physical activity due to their knee pain	.940	.910	.024
Education is a vital component to manage patients with PFP	.556	.382	.067
There are appropriate resources to education patients with PFP available in general websites on the internet (eg, nonscientific search on YouTube, Google, etc)	.744	.962	.074
I can easily find and understand evidence-based information to inform the management of patients with PFP	.799	.420	.249

Abbreviation: PFP, patellofemoral pain.

[a] A longer duration with the athletic trainer credential displayed stronger agreement that being female was a risk factor for PFP.

[b] Athletic trainers who hadexperienced PFP themselves had more confidence delivering appropriate treatment for patients with PFP.

[c] Athletic trainers with previous experience treating patients with PFP were more confident about the types of treatments that were not beneficial.

Appendix B. Current Patellofemoral Pain Evidence

	Item	Current Evidence
Diagnosis	The most important criterion required to define PFP is pain around or behind the patella, which is aggravated by activities that load the PF joint[a]	IPFRN Consensus statement[10]
	At least one imaging exam (eg MRI, x-ray, ultrasound) should be used to confirm PFP diagnosis	IPFRN Consensus statement[10]
	Patellar grinding and apprehension tests (Clarke test) have good diagnostic accuracy for PFP	Systematic review[20]
	Signs such as knee crepitus, tenderness on patellar facet palpation, and small effusion are essential to PFP diagnosis	IPFRN Consensus statement,[10] NATA position statement[13]
	Knee crepitus is related to increased pain and decreased function	Cross-sectional study[32]
Risk Factors	Decreased hamstrings and gastrocnemius flexibility	Systematic review[24]
	Increased dynamic knee valgus during activities	NATA Position statement,[13] systematic review[24]
	Increased foot pronation	Systematic review[24]
	Greater body mass index	Systematic review[24]
	Gluteus medius weakness	IPFRN Consensus statement,[10-12] NATA position statement,[13] systematic review[24]
	Quadriceps weakness	IPFRN Consensus statement,[10-122] NATA position statement,[13] systematic review[24]
	Increased Q-angle	IPFRN Consensus statement,[12] NATA position statement[13]
	Increased age	Systematic review[24]
	Being of the female sex	Systematic review[24]
Prognosis	The severity of pain does not influence likely treatment outcomes in the longer term	Systematic review (long-term follow-up from 2 RCTs),[4] NATA position statement[13]
	Shorter symptom duration (<12 mo) is a factor that is associated with a better outcome after treatment	Systematic review (long-term follow-up from 2 RCTs),[4] NATA position statement[13]
	More than half of patients with PFP report unfavorable recovery 5–8 years after treatment	Systematic review (long-term follow-up from 2 RCTs),[4] NATA position statement[13]
	PFP is self-limiting, pain goes away over time in most cases with no treatment	IPFRN Consensus statement,[10] NATA position statement[13]
Treatment	PFP is related primarily to biomechanical deficits and using treatment to address these deficits should be primary treatment focus	IPFRN Consensus statement,[12, 34] NATA position statement[13]
	Exercise therapy can reduce pain in the short, medium, and long-term	IPFRN Consensus statement,[12] NATA position statement[13]
	Exercise therapy can improve function in the medium and long term	IPFRN Consensus statement,[12] NATA position statement[13]
	Combining hip and knee exercise can improve function in the short, medium, and long-term, and this combination should be used in preference to knee exercise alone	IPFRN Consensus statement,[12] NATA position statement[13]
	Combining hip and knee exercise can reduce pain in the short, medium, and long-term, and this combination should be used in preference to knee exercise alone	IPFRN Consensus statement,[12] NATA position statement[13]
	To reduce pain in the short and medium term, combined interventions that incorporate exercise therapy as well as one of	IPFRN Consensus statement,[12] NATA position statement[13]

	the following are recommended: foot orthoses, patellar taping or manual therapy	
	Exercises that focus on muscular power or endurance are not recommended for patients with PFP	Cross-sectional and feasibility study[29]
	Movement retraining (gait, squatting, etc) is recommended for treating PFP	IPFRN Consensus statement,[12] NATA position statement[13]
	Activity modification and load management is recommended for PFP patients	NATA Position statement,[13] systematic review[30]
	Electrophysical agents (modalities) are not recommended for PFP	IPFRN Consensus statement,[12] NATA position statement[13]
	Foot orthoses can reduce pain in the short term	IPFRN Consensus statement,[12] NATA position statement[13]
	Taping the knee is recommended to reduce pain in the short term, but not long-term	IPFRN Consensus statement,[12] NATA position statement[13]
	Therapeutic ultrasound on the knee can improve outcomes	IPFRN Consensus statement,[12] NATA position statement[13]
	Patellofemoral, knee, and lumbar mobilization are not recommended	IPFRN Consensus statement,[12] NATA position statement[13]
	Education is a vital component to manage patients with PFP	NATA Position statement[13]
	Patients with PFP participate in less physical activity due to their knee pain	Case-control study[7]
	Patients with PFP may present with psychosocial factors (fear-avoidance, kinesiophobia, pain catastrophizing)	Systematic review[8,35]
	Imaging exams (eg MRI, x-rays, ultrasound) contribute to the management of patients with PFP	IPFRN Consensus statement[12]
	Knee arthroscopy is recommended for patients with high levels of pain	IPFRN Consensus statement,[12] NATA position statement[13]
	Surgery is more effective than exercise to treat patients with PFP	Systematic reviews,[10–12,14] NATA position statement[13]

Abbreviations: IPFRN, International Patellofemoral Research Network; NATA, National Athletic Trainers' Association; RCT, randomized controlled trial.

[a] Activities that load the PF joint include squatting, stair ambulation, jogging or running, and hopping or jumping.

Appendix C. Post Hoc Pearson χ^2 Analysis of ATs' Confidence Regarding Risk Factors in the Development of PFP

Risk Factor Questions	*P* Value
Being of the female sex	$<.001$[a]
Increased age	.248
Increased Q-Angle	.091
Quadriceps weakness	.052
Gluteus medius weakness	.023
Greater BMI	.218
Increased foot pronation	.052
Increased dynamic knee valgus during activities	.308
Decreased flexibility of the hamstrings and gastrocnemius	.718

Abbreviations: ATs, Athletic Trainers; PFP, patellofemoral pain.

[a] ATs with greater confidence levels had stronger agreement that "Being of the female sex" was a risk factor for the development of PFP.