



Original research

The multi-dimensional impacts of injury on physically inactive women's participation in sport and physical activity: Insights from concept mapping



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ARTICLE INFO

Article history:

Received 22 February 2024

Received in revised form 23 May 2024

Accepted 17 June 2024

Available online 20 June 2024

Keywords:

Female

Rehabilitation

Injury prevention

Injury management

Barrier

ABSTRACT

Objectives: To explore how injury, as a primary barrier, impacts physically inactive Australian women's engagement in sport and physical activity.

Design: Concept mapping.

Methods: Participants used online concept mapping to brainstorm the meaning of injury, then sorted and rated statements for impact and importance (1 (low)–5 (high) scale). Multi-dimensional scaling, hierarchical cluster analysis and descriptive statistics were applied.

Results: Forty-five Australian women, aged 25–64, brainstormed 94 statements representing the meaning of an injury. Nine clusters emerged from analysis of the sorting data (highest to lowest mean cluster impact order): *Fear and frustration; Physical implications of injury; Activity restrictions; Financial implications; Modification and management; Recovery; Mental and emotional wellbeing; Impact on daily life; and Social impact and engagement.* A high correlation was found between rating scales ($r = 0.92$).

Conclusions: A holistic approach is fundamental to understanding how the multi-dimensional impacts of injury and recovery affect physically inactive women. This approach should extend beyond the medical/physical aspects to other challenges and contextual factors (i.e. environmental and personal) impacting women's functioning. Understanding the diverse needs and experiences of physically inactive women is crucial for tailoring interventions that can effectively support recovery and sustained engagement, through person-centred strategies focused on injury prevention/management. Furthermore, this understanding is essential to fostering collaborative system-wide understanding and change, involving diverse stakeholders (e.g. health practitioners, those in delivery/practice settings, insurance) to improve long-term health and wellness outcomes, and promote greater participation in sport/physical activity.

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Practical implications

- Implement comprehensive care models, going beyond medical/physical treatment, in injury recovery for physically inactive women.
- Integrate psychological support, to overcome fears and frustrations related to injuries, to aid sport/physical activity participation.
- Develop personalised strategies to address unique challenges across physically inactive women's functioning and contextual factors.

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- Increase access to social support and resources to facilitate safer and informed sports/physical activity participation.
- Foster collaborative efforts among stakeholders (e.g. health practitioners, those in delivery/practice settings, insurance) to enhance overall wellness and physical activity engagement.

1. Introduction

1.1. Background

Physical activity (PA) is critical for maintaining health and wellbeing.¹ The World Health Organization (WHO) recommends that adults participate in at least 150 min of moderate-intensity or at least 75 min of vigorous-intensity aerobic PA per week.² Three quarters (77.6%) of Australian adults do not meet these minimum guidelines,³ rendering them physically inactive (PI). Compared to men, women particularly fall short in both frequency (participate in less total PA across the domains of work, household, transport, leisure-time), and intensity of PA.^{1,4} Adults participating in higher amounts of total PA, and at a greater intensity, experience more cardio-respiratory, musculoskeletal and chronic disease prevention benefits.² This underscores the necessity to address the physical activity gender disparity as a significant public health priority.

Despite existing research on the individual and contextual factors inhibiting PA among the PI population,⁵ there remains a significant gap in understanding the unique barriers that specifically impede women's participation in PA. This gap hinders the development of targeted solutions to address the PA gender disparity. Factors such as a lack of social and community support, traditional gender roles, and cultural norms have been suggested as contributors to women's lower PA rates.^{1,4} Notably, injury (as part of a broader health concern) is cited by 29% of Australian women as their primary barrier to engaging in sport/PA,⁶ emphasising the need for more focused research in this area. Whilst various qualitative studies have explored contextual barriers in more detail,^{7,8} rarely do they focus on the impact of individual barriers such as musculoskeletal injury (including fear of). The lack of existing literature examining the impact of injury in the context of women's PA participation highlights a significant gap in knowledge. Investigating the effects of injury on women's PA participation could provide vital insights into the development of more effective support and intervention strategies.

1.2. Injury as a barrier

Recognised as a deterrent to sustained participation, injury is acknowledged as a barrier to participation for PI populations.⁹ Notably, empirical research predominantly explores athlete populations where musculoskeletal injuries are common, and often frames injury as a consequence of sport participation (not a barrier).¹⁰ This overlooks the distinct experiences of the PI population who may face unique challenges, different types of injuries, or barriers to recovery that are not addressed by conventional sport-focused injury prevention strategies. A gendered examination of the literature reveals women are more susceptible to/report a higher risk for certain injuries (such as anterior cruciate ligament (ACL)/knee injury; bone stress injuries, sport related concussions) than men.^{11–13} This gender-specific susceptibility could be partially explained by physiological differences, highlighting the need for different injury prevention/management strategies.¹⁴ The social and environmental factors contributing to increased injury rates among women are documented¹⁵ alongside findings that women often experience poorer patient-reported outcomes and demonstrate lower rates of return to sport post-injury.¹¹ These findings underscore the necessity for more detailed studies focusing on the meaning of injuries in women to understand what influences recovery trajectories. Women's injury experiences and needs (e.g. physiological, social) may be fundamentally different from those of men, indicating a need for women-specific injury

prevention and management strategies. Where the literature focuses on the impact of injury, this is usually psychological in nature and in relation to competitive sport/athletes.¹⁶ This gap limits our ability to understand the psychological impacts on non-athletic populations, and more specifically, on PI women, which could guide more effective psychological support and intervention strategies for this population. PI women may be more susceptible to injury because of their lower PA levels or lack of experience,¹⁷ highlighting a significant oversight in current research which often fails to differentiate between the needs of active and inactive populations. A thorough understanding of women's lived experiences could effectively mitigate or remove barriers—whether actual or perceived—that hinder their participation in sport/PA.

Tailored or bespoke activity approaches may offer a solution to address PI women's unique barriers to engaging in and sustaining PA participation. Whilst community sports provide opportunities to engage in PA, social sport programmes, designed to reduce barriers like performance outcome concerns and emphasise social interaction,¹⁸ may offer more suitable options for PI women. Understanding the nuances and specificities of these barriers, especially when they impact women more significantly,¹⁸ is vital for designing effective public health initiatives aimed at mitigating the gender disparity in PA.

This study aimed to understand PI women's lived experiences of injury in sport/PA. By exploring these experiences, we aim to contribute to reducing the gendered inequality in PA participation and provide support for the substantial number of women who cite injury as a barrier to sport/PA participation. A nuanced comprehension of these lived injury experiences is instrumental for developing empathetic and effective strategies. Engaging directly with these women, our approach unveils bottom-up insights that can enhance injury prevention/management strategies to foster a safer and more accessible environment for women's participation in sport/PA. They can also aid injury recovery, encouraging PI women to re-engage in sport/PA.

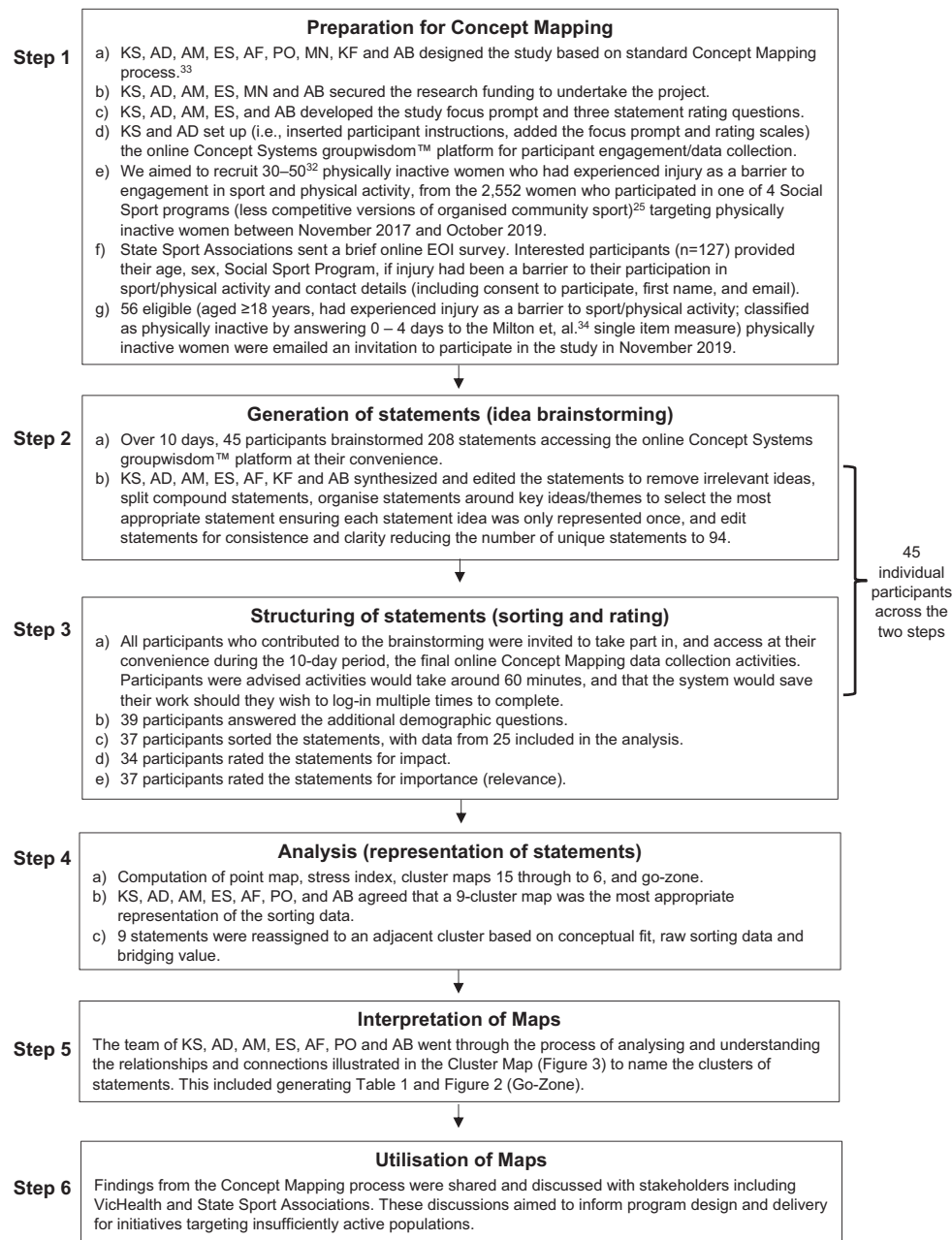
2. Methods

We used concept mapping (CM)¹⁹ to understand the impact injury has on women's PA and sport participation. Employing a mixed-method approach, CM has been employed in sport injury research^{9,20} facilitating the interrogation of previously unexplored concepts with diverse perspectives and crucial experiences.¹⁹ CM is a valid and reliable method for representing complex multivariate data in a two-dimensional space.²¹ We used the online Concept Systems groupwisdom™ platform to collect, analyse and present the data. Participants independently engaged in all activities online at their own convenience. Kane and Trochim²² describe the key steps in CM, detailed in Fig. 1 and summarised below. The study's processes received approval from the La Trobe University human ethics committee (HEC18301).

2.1. Preparation for concept mapping and participants

The initial CM step involves establishing a focus and identifying prospective participants.²⁴ To address the aim of this study, the specific prompt used to elicit ideas from our research participants around the impact of injury was: *"In relation to physical activity and sport, for me, having an injury means..."*.

Prospective participants provided informed consent, identifying as women aged ≥18 years who had experienced injury as a barrier to sport/PA. They were classified as PI if they answered 0–4 days (<150 min per week as per guidelines) to the single item measure: *In the past week, on how many days have you done a total of 30 minutes or more of physical activity, which was enough to raise your breathing rate? This may include sport, exercise, and brisk walking or cycling for recreation or to get to and from places, but should not include housework or physical activity that may be part of your job.*²³ We recruited PI women through expression of interest emails from State Sport Associations that



Note. EOI= Expression of interest

Modified from Kane and Trochim (2007)^{Error! Reference source not found.}

Fig. 1. The concept mapping process.

Note. EOI = expression of interest.

Modified from Kane and Trochim,²²

designed/delivered social sport programmes for PI women in Victoria, Australia. Participants also self-reported: employment; education; parental/carer status; postcode; current injury status; and injury impact on their PA participation. Participants received an AU\$50 gift card for their involvement.

2.2. Generation of statements (idea brainstorming)

Participants followed standard CM procedures,²² contributing single-idea statements in response to the focus prompt over a period of 10 days. Participants could access the platform multiple times, submit

numerous statements, view de-identified contributions from others, and search to prevent repetition. The research team then synthesised/edited the brainstormed ideas to produce a manageable number of clear, unique, and relevant statements, whilst preserving the original voice of participants where possible.²⁴ The process included refining statements, ensuring clarity and consistency of terminology, and removing irrelevant ideas.²² The research team cross-checked the final list of statements against participants' original contributions to ensure all relevant ideas were represented. This process was conducted by multiple members of the research team across several meetings. Consensus was reached among the research team members about any statements

removed or revised. No statements were rejected from the final list for being too disparate from those on the original list.

2.3. Structuring of statements (sorting and rating)

Over a second period of 10 days, participants viewed the refined randomised statements, and grouped them by perceived meaning using the software's drag-and-drop function. Participants named each group reflecting the perceived meaning that linked statements together. They were advised against grouping unrelated statements together (e.g., 'irrelevant' or 'other' groups) or creating value-based groups (e.g., importance/relevance), and advised that group numbers typically ranged from 5 to 20.²¹ Finally, participants were instructed to rate each statement: 1) using the full scale (1–5) and 2) relative to the other statements in the list, using two questions:

- Importance: "On a scale from 1 (not at all important) to 5 (extremely important), when you are injured how important is each of the following statements to you?" (participants were asked to gauge each statement's relevance and their level of agreement when rating its importance), and
- Impact: "On a scale from 1 (extremely unlikely) to 5 (extremely likely), when you are injured how likely is it that each of the following statements will impact you?"

2.4. Analysis and interpretation

After checking each participant's data to ensure it had been contributed following the sorting and rating instructions,²⁴ a two-dimensional 'point map' was created using multi-dimensional scaling (each sorted statement represents a separate point). This produced a stress value (between 0 and 1) to evaluate the fit (closer to 0 is better) between the point map and the original sorting data.²¹ Hierarchical cluster analysis then segmented the map into distinct clusters of related statements in two-dimensional space. The research team reviewed cluster maps (15-to-6-cluster solutions) to determine the best configuration that retained distinction between clusters whilst merging those that belonged together.²² Once the most appropriate cluster map was identified, the appropriateness of each statement within its cluster was assessed. If warranted by the raw statement sorting data and bridging value (an indicator of how frequently a statement was sorted with other statements in its immediate vicinity on the map; closer to 0 = more frequently, closer to 1 = less frequently), cluster boundaries were adjusted for better conceptual fit.²² Clusters were named based on the encompassing concept and group names used by participants when sorting the statements.

The mean importance and impact rating statistics were calculated and used to generate a bivariate Go-Zone graph,²² divided into four quadrants using the grand mean importance and impact ratings. We used the Pearson correlation coefficient to evaluate the linear association between the scale variables.²¹

To provide a framework to inform cluster and individual statement interpretation, we used the World Health Organization's (WHO) International Classification of Functioning (ICF), Disability and Health to explore the impact of injury on PI women engaging in sport/PA. The ICF, with its standardised terminology for consistent analysis,²⁵ provides a comprehensive framework to structure the interplay between the multi-dimensional impacts of injury, the diverse functionality levels of PI women affected by injury, and their contextual (environmental and personal) factors.²⁶ This biopsychosocial model provides a holistic perspective to ground our analysis, beyond just the cause(s) of injury,²⁶ within the context of PI women engaging in sport/PA.

We applied the ICF framework in accordance with WHO guidelines.²⁵ Recognising that each context of PI women is different, we interpreted the 'health condition' as the injury impacting their

functioning; we understood their 'body structures and body functions' to be physiological and psychological restrictions; we interpreted the 'activity' as the execution of activities needed for or activity restrictions on sport/PA (e.g. squatting, lifting etc.); 'participation' was classified as life involvement limitations; with 'environmental factors' considered to be physical, social and attitudinal; and 'personal factors' classified as individual determinants such as age, gender, fitness, and habits.

3. Results

3.1. Participant demographics and engagement with concept mapping

Forty-five women social sport participants aged 35–54 years (Table 1) contributed to the various CM activities. Thirty-nine participants answered the demographic questions during the CM activities: 92 % were parents/carers, 87 % were employed/self-employed, 87 % had a university education, 46 % had a current injury, and 71 % reported being less physically active because of injury.

Forty-five participants brainstormed 208 statements in response to the focus prompt. Post-synthesis, 94 statements were presented back to participants for sorting and rating (Table 2). Then, 37 participants engaged in data sorting. Post-reviewing, data from 25 participants were analysed (mean = 9.3 groups; mode = 6; range = 4–15). Thirty-four participants rated the statements for likely impact and 37 participants rated for importance.

3.2. Go-Zone graph

Fig. 2 is a Go-Zone graph plotting statements against the impact of injury (grand mean = 3.47) and importance (relevance) (grand mean = 3.50). There is a strong positive correlation between impact and importance ($r = 0.92$). Fifty-five statements exceeded the grand mean impact rating; 49 also surpassed the grand mean importance rating, placing them in the 'Go-Zone' (top right priority quadrant, Q1) and six below the grand mean importance rating (Q2). One statement was rated above the grand mean for importance but below for impact (Q3). The remaining 38 statements are in quadrant Q4, with below grand mean ratings for both impact and importance. To aid interpretation of the Go-Zone, refer to Table 2 for mean impact and importance ratings for each statement.

3.3. Clusters

On the cluster map (Fig. 3), the proximity between points indicates the frequency of statements sorted together, representing their similarity. The stress index of 0.2969 indicates the cluster map accurately represents participants' sorted data.²¹ We agreed that the 9-cluster map retained the most useful/logical representation of the sorted data and renamed each cluster to reflect the contained statements (Fig. 3).

Clusters, in order of the highest to lowest mean impact rating were:

- 1 *Fear and frustration* (10 statements, mean impact 3.87, mean importance 3.79, and contained the statements of highest impact (#70) and importance (#57))
- 2 *Physical implication of injury* (15 statements, 3.71, 3.69)
- 3 *Activity restrictions* (8 statements, 3.66, 3.76)
- 4 *Financial implications* (4 statements, 3.63, 3.55)
- 5 *Modification and management* (14 statements, 3.39, 3.39)
- 6 *Recovery* (3 statements, 3.34, 3.47)
- 7 *Mental and emotional wellbeing* (14 statements, 3.20, 3.28; contained 2 of the top 3 importance statements (#89, #25))
- 8 *Impact on daily life* (6 statements, 3.03, 3.09), and
- 9 *Social impact and engagement* (10 statements, 2.83, 3.08).

A full list of the statements within each cluster, including the nine statements reassigned to an adjacent cluster is provided in Table 2.

Table 1
Participant demographic information.

Characteristic collected at EOI	N = 45	%
Gender		
Women	45	100 %
Age		
25–34 years	9	20 %
35–44 years	21	47 %
45–54 years	13	29 %
55–64 years	2	4 %
Characteristic collected during final concept mapping activities ^a	N = 39	%
Employment status		
Self employed	3	8 %
Employed for wages, salary or payment in kind	31	79 %
Engaged in home duties	3	8 %
Student/retired/unemployed/unable to work/prefer not to say	0	–
Other	2	5 %
Highest level of education		
Primary school	0	–
Completed some high school (i.e. Year 7 to Year 11, Form 1 to Form 5)	1	3 %
Completed high school (i.e. Year 12, Form 6, HSC, VCE)	2	5 %
TAFE or trade certificate or diploma	2	5 %
University, or some other tertiary degree, including post graduate study (i.e. postgraduate diploma, masters or PhD)	34	87 %
Prefer not to say/other	0	–
Parent or carer (this includes children under and over 18 years, people with a disability or the elderly)		
Yes	36	92 %
No	3	8 %
Currently impacted by injury		
Yes, and the injury is related to participating in sport or physical activity/exercise	10	26 %
Yes, but the injury IS NOT related to participating in sport or physical activity/exercise	8	21 %
No, but I have previously had an injury related to participating in sport or physical activity/exercise	18	46 %
No, but I have previously had an injury but NOT related to participating in sport or physical activity/exercise	3	8 %
Injury impact on physical activity		
A lot less physically active	15	38 %
A bit less physically active	13	33 %
About the same	6	15 %
A bit more physically active	4	10 %
A lot more physically active	1	3 %

Note. EOI = expression of interest.
^a Participant questions were posed in the final concept mapping step to avoid influencing the brainstormed statements regarding the impact of injury on participants' possible physical activity engagement.

3.4. International classification of functioning

To aid in interpreting the findings of this study, we mapped the nine clusters of impacts of injury, as identified by PI women, to the components of the ICF framework (Fig. 4). Some clusters mapped to multiple components of the ICF framework (e.g. Cluster 2 (Physical implications of injury) maps to both 'Body structures and body functions' and 'The execution of activities needed for sport/PA'; and Cluster 8 (Impact on daily life) maps to 'The execution of activities needed for sport/PA', 'Participation' and 'Environmental factors'), whilst some are unique to one domain (e.g. Cluster 4 (Financial implications) maps to 'Environmental factors' only).

4. Discussion

This study presents an initial exploration into how injury impacts the ability of women, particularly those who are PI, to engage in sport/PA. This is important because injury is the primary barrier to sport/PA participation for almost three in 10 Australian women.⁶ Notably, whilst less than half (46 %) of the women in our study reported a current injury, 71 % of those with an injury acknowledged a concomitant reduction in their PA levels. This aligns with health status being both a correlate and determinant of PA participation.⁵ Moreover, this decline in PA emphasises the breadth of the nine-cluster solution: *Fear and frustration*; *Physical implications of injury*; *Activity restrictions*; *Financial implications*; *Modification and management*; *Recovery*; *Mental and emotional wellbeing*; *Impact on daily life*; and *Social impact and engagement*, which delves into women's 'real' multi-dimensional lived experiences,

reflecting the true burden of injury for our participants. Understanding the complex role of injury in hindering sports/PA participation for PI women can guide the development of holistic, person-centred rehabilitation strategies and injury management and enhance system-level service planning.²⁶

4.1. Fear and frustration

The emergence of *Fear and frustration* (Cluster 1) as predominant factors impacting the functioning of PI women (Table 1; Fig. 4) highlights the need to address the psychological burden of injury. Therefore, psychological support could be an integral component of injury rehabilitation and management. Participants expressed significant apprehension regarding the physical repercussions of injuries, such as diminished fitness, altered body condition (i.e. muscle, movement and flexibility), and having to rebuild physical conditioning and strength. This is evident through statements reflecting concerns about body changes and recovery progress (e.g. #24, #70, #36). A noticeable fear of re-injury (e.g. #5, #40) and psychological readiness (performance-related e.g. #38, #33) were evident in women's responses, indicating a discrepancy between physical recovery and psychological recovery. This observation aligns with the existing athlete literature, suggesting a nuanced interplay between physical recovery and psychological recovery post-injury.²⁷ These statements suggest a potential gap in the accessibility and adequacy of rehabilitation resources available to PI women, resulting in persistent fears and frustrations related to injury (e.g. #32, #30). Like Der Ananian et al.,⁷ this research contributes to the existing literature by extending the discussion beyond the standard

Table 2

The meaning of injury, according to participants, in relation to physical activity and sport (by cluster and in order of mean impact rating).

Cluster and statements		Bridging score ^a	Mean rating ^b (± SD)		All statement Go-Zone
			Impact (n = 34)	Importance (relevance) (n = 37)	
Cluster 1	Fear and frustration	0.36	3.87 (0.32)	3.79 (0.37)	–
70	It is frustrating to lose strength, muscle tone, agility, fitness.	0.49	4.44	4.24	Q1
47	Feeling like I am getting old and my body doesn't do what it use to.	0.59	4.41	4.35	Q1
24	Worrying about whether my body will ever be the same (e.g. loss of muscle, movement, flexibility etc.)	0.48	4.24	4.05	Q1
53	It's harder to find motivation to exercise and be active.	0.32	4.12	4.08	Q1
57	Not being able to participate in physical activity that I enjoy.	0.42	4.12	4.46	Q1
4 ^c	I don't have time for this! Injury is time consuming and frustrating.	0.43	4.03	3.76	Q1
36	Being frustrated with my lack of progress.	0.31	4.00	3.86	Q1
38 ^c	Frustration as limits ability to participate.	0.24	3.97	3.86	Q1
21	It affects everything in my life (when I'm exercising and feeling fit and well, I also want to eat well, go to bed early and have other good habits), when I'm injured it all goes backwards.	0.37	3.94	3.95	Q1
26	I worry about how it will affect my ability to participate in the longer term (I may not get back into it again).	0.31	3.82	3.76	Q1
90 ^c	Feeling like I'm back at the beginning/start again.	0.18	3.79	3.57	Q1
5	It makes me nervous to do more challenging activities again.	0.24	3.79	3.86	Q1
32	Fear of pain with movement.	0.54	3.79	3.41	Q2
84	Being disappointed when my mind thinks I can do something, but my body doesn't perform (disappointment in my capacity to exercise).	0.44	3.79	3.97	Q1
33	That I don't want to try other exercise because it might hurt?	0.21	3.76	3.32	Q2
30	That you live in fear of making the injury worse.	0.31	3.74	4.11	Q1
56 ^c	Becoming less likely to try new things.	0.41	3.59	3.32	Q2
40 ^c	Being frustrated at having to be timid when in similar injury prone situations... less brave.	0.19	3.56	3.51	Q1
80	Having an excuse to avoid it (physical activity).	0.22	3.35	3.03	Q4
58 ^c	Less independence.	0.47	3.09F	3.27	Q4
Cluster 2	Physical implications of injury	0.42	3.71 (0.32)	3.69 (0.29)	–
34	That I can't do the things I used to e.g. Not being able to complete activities to the level I want/having to adapt to what I can do.	0.32	4.18	3.97	Q1
65	It is harder to re-establish fitness level upon recovery.	0.35	4.12	3.78	Q1
17	Having to cease the activity/exercise/sport.	0.36	4.09	4.11	Q1
31	Gaining weight.	0.54	4.06	4.03	Q1
76	Participating in my usual physical activity/exercise is painful.	0.39	4.06	3.86	Q1
74	Another barrier to exercise.	0.29	3.88	4.11	Q1
11	That I haven't built up enough strength and fitness to participate.	0.51	3.65	3.59	Q1
22	I feel like it's a cycle because the less I work out the more likely I am to get another injury.	0.36	3.65	3.32	Q2
91	I feel exhausted all the time (tired and sore).	0.53	3.65	3.41	Q2
28	Reduced mobility.	0.37	3.56	3.84	Q1
75	I do other things that are not good for my health.. like staying in and having a glass of wine instead of being outdoors.	0.55	3.47	3.65	Q1
94	Living with pain.	0.42	3.47	3.78	Q1
69	I move slower, everything takes more time.	0.40	3.38	3.30	Q4
1	I can't act spontaneously anymore (loss of freedom).	0.45	3.32	3.43	Q4
92	Limited weightbearing.	0.43	3.15	3.22	Q4
Cluster 3	Activity restrictions	0.34	3.66 (0.38)	3.76 (0.36)	–
82	I don't participate as much/how I want to (in sport or physical activity).	0.32	4.26	4.19	Q1
54	Not being able to be as active as I'd like in my daily life (running after a tram, going for a walk, playing with my son, weekend activities).	0.37	4.12	4.24	Q1
35	Not having the freedom to push boundaries as I would like to (being cautious).	0.29	3.76	3.59	Q1
66	A disruption in a physical activity routine, making it difficult to establish a habit.	0.34	3.74	4.05	Q1
62	Less time out of doors.	0.33	3.68	3.81	Q1
12	Knowing that if I push harder or longer then I will have to take a long break from activity.	0.35	3.35	3.62	Q3
15	I should reconsider whether organised sport is a good option.	0.42	3.21	3.19	Q4
68	A reality check that the risks are real.	0.34	3.18	3.35	Q4
Cluster 4	Financial implications	0.74	3.63 (0.35)	3.55 (0.30)	–
37	Costly having to rehabilitate (e.g. physio, doctor, speciality, medical imaging, expensive equipment etc.).	0.91	4.06	3.95	Q1
52	Engaging in sport and exercise is more expensive for example if I have to go back to the physio to get cleared or do specialised classes (e.g. clinical Pilates).	0.64	3.85	3.76	Q1
78	I often have to pay for low/no impact sports like swimming as opposed to free activities like walking, jogging and running.	0.63	3.41	3.24	Q4
42	Wasted money if I can't play out the season/term or use all the equipment in the gym.	0.80	3.18	3.27	Q1
Cluster 5	Modification and management	0.44	3.39 (0.41)	3.39 (0.39)	–
7	I need to take it easier/adjust the way I do things (not push myself above what my body will allow)	0.23	3.88	3.97	Q1
44	Having to adjust my expectations of what I can achieve and by when.	0.21	3.85	3.76	Q1
67	Allowing time for rest/recovery, so the injury doesn't persist.	0.34	3.85	3.81	Q1
73	Trying to find alternative exercise that I can do whilst I am injured.	0.35	3.79	3.70	Q1
83	Not knowing how to ease back into sport, not over do it too soon.	0.46	3.65	3.59	Q1
13	Listening to my body and taking a break.	0.31	3.59	3.73	Q1
49	Having to re-think how to achieve the goals I've set.	0.41	3.47	3.73	Q1
18	If the injury is minor just being careful.	0.27	3.38	3.03	Q4
77	Not pushing myself, so it doesn't affect my ability to work etc.	0.53	3.38	3.24	Q4
14	I'm not doing the activity/exercise or move correctly.	0.67	3.35	3.27	Q4

(continued on next page)

Table 2 (continued)

Cluster and statements		Bridging score ^a	Mean rating ^b (±SD)		All statement Go-Zone
			Impact (n = 34)	Importance (relevance) (n = 37)	
2	I need to be educated about how to avoid injury.	0.63	3.00	3.11	Q4
19	Taking anti-inflammatory medication.	0.83	2.85	2.78	Q4
46	An opportunity to get curious and learn about my body and the way I use it or a better way to use it.	0.53	2.82	2.95	Q4
10	That I haven't found the right activity for my body yet.	0.41	2.56	2.81	Q4
Cluster 6	Recovery	0.60	3.34 (0.28)	3.47 (0.22)	–
63	Extra stress to follow rehabilitation exercise at home (without support of group setting and fitting this in with family commitments).	0.67	3.56	3.73	Q1
9 ^c	That I have a long road to recovery.	0.4	3.53	3.49	Q2
8 ^c	I'm concerned about needing future surgery.	0.73	2.94	3.19	Q4
Cluster 7	Mental and emotional wellbeing	0.20	3.20 (0.66)	3.28 (0.74)	–
89	Less of an outlet for stress which is not good for my mental health.	0.24	4.09	4.41	Q1
25	My mental health will suffer along with my physical wellbeing.	0.10	3.97	4.38	Q1
43	Disappointed at missing out.	0.23	3.79	3.57	Q1
64	A drop in self-esteem.	0.04	3.65	3.86	Q1
23	Losing confidence.	0.00	3.63	3.86	Q1
79	Missing out on me time.	0.33	3.57	3.62	Q1
71	Seeing the people around you get fitter, feeling left behind.	0.21	3.41	3.43	Q4
29	You feel broken.	0.14	3.35	3.49	Q4
50	Feeling like a failure because I can't do what I want to do physically, and haven't really been able to regularly complete exercises or classes recommended by physios.	0.12	3.31	3.24	Q4
81	Being self-conscious about how I look when I cannot participate correctly (i.e. My injury isn't obvious so people look at me and expect I can do the exercise).	0.24	2.88	2.65	Q4
20	Feeling like a 'victim'	0.06	2.65	2.49	Q4
59	Increased social anxiety.	0.28	2.47	2.78	Q4
86	Not wanting to mention I have an injury when the instructor/coach asks at the session (in front of the group).	0.45	2.29	2.16	Q4
87	The instructor/coach embarrasses me, by telling me in front of the group, how an activity can be made easier for my condition.	0.43	1.79	1.97	Q4
Cluster 8	Impact on daily life	0.78	3.03 (0.34)	3.09 (0.40)	–
3	Not being able to perform simple everyday activities (e.g. getting a toddler in and out of the car, standing, cooking etc.).	0.58	3.50	3.86	Q1
39	Having to find someone to help with recovery. I don't always know who to go to so this takes time and investment to resolve.	0.92	3.43	3.27	Q4
72	Taking dependents with me to medical/physio appointments (caring responsibilities and treatment commitments don't really mix)	0.81	3.09	2.97	Q4
60	Not being able to travel as easily.	0.70	2.76	3.03	Q4
61	More reliance on car for transport.	0.87	2.76	2.81	Q4
6	It's going to impact badly on my work.	0.80	2.62	2.59	Q4
Cluster 9	Social impact and engagement	0.60	2.83 (0.42)	3.08 (0.36)	–
88	Not being able to do things with my family/friends which are enjoyable.	0.56	3.85	4.00	Q1
55	Not being able to meet people through sports or physical activity (i.e. a disconnection of community).	0.56	3.15	3.38	Q4
27	Feeling like my social outlets are suffering, in addition to having to recover from the physical injury.	0.56	2.94	3.14	Q4
93	Being a burden on my family or others.	0.57	2.86	3.19	Q4
48	Not seeing some of my friends.	0.69	2.76	2.89	Q4
45	Letting others down, having to pull out of team sports while I work on my recovery.	0.51	2.74	2.89	Q4
41	Holding others back because I can't do what they are doing or I can't keep up.	0.51	2.62	2.89	Q4
16	Being isolated.	0.53	2.5	2.81	Q4
51	Worrying about the example I'm setting for others	0.46	2.50	2.65	Q4
85 ^c	The instructor/coach having no idea how to engage me with an injury.	1.00	2.26	3.00	Q4
All statements		–	3.47	3.50	–

All statement Go-Zone: Q1 = above all-statement mean on impact and importance/relevance; Q2 = above all-statement mean on impact, below all-statement mean on importance/relevance; Q3 = below all-statement mean on impact, above all-statement mean on importance/relevance; Q4 = below all challenge mean on impact and importance/relevance.

^a Values range between 0.00 and 1.00. Values closer to 0 indicate anchoring statements closely related to others in the cluster. Values closer to 1 indicate bridging statements more connected to statements in other clusters in the map.

^b 1 = low; 5 = high.

^c Reassigned from an adjacent cluster.

representation of injury (or fear of) as merely a barrier to PA participation. This highlights the need for a comprehensive review of the multifaceted barriers to PA among PI women, focusing particularly on how injury and related fears impact their participation.

This study reveals that PI women, like athletes in existing research, often experience psychological consequences after injury. These responses predominantly appear as fears related to re-injury and performance.²⁷ For example, women, particularly those recovering from hip and/or knee injuries, experience high levels of re-injury (psychological) fears. This is also notably present among athletes recovering from ACL injury, where the concern associated with re-injury hinders their return to sports.²⁸ However, the applicability of these findings deserves careful consideration, given their predominant focus on

sports-related injuries (almost a third of PI women did not have injuries resulting from sport – Table 1) or specific injury types.²⁸ Moreover, these studies also explore the psychological impact (emotions, cognitions and behaviours) following an athletic injury.²⁷ Additionally, the existing literature overlooks the various constraints imposed on the choice of PA options among these women, a concern prominently featured in the responses of our participants (#57).

4.2. Physical implications

The physical impact of injury profoundly influences PI women's functioning and participation in PA, as evidenced by the prominence of the physical implication in the cluster analysis (2 of the top 3 clusters,

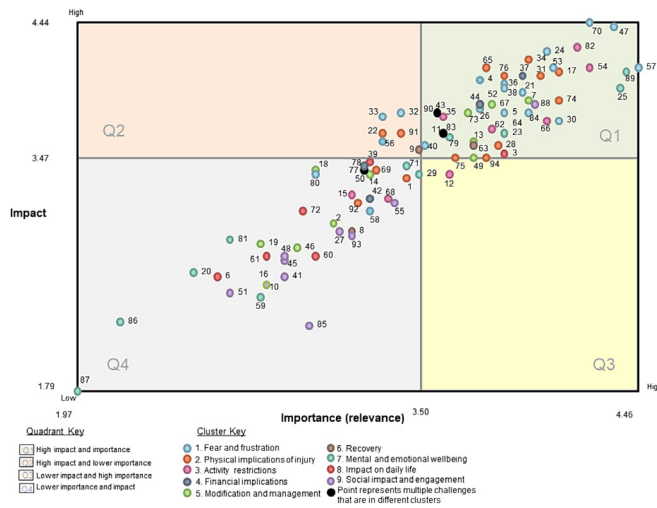


Fig. 2. Go-Zone graph plotting the mean rating of each statement for impact and importance (relevance).

2. Physical implications of injury; 3. Activity restrictions). These impacts manifest not only as physical constraints but also result in activity restrictions and life involvement limitations (Fig. 4). Specific concerns articulated by PI women include (Cluster 2) weight gain (#31), reduced mobility/strength/fitness/slower movement (#28, #11, #69), which collectively contribute to (Cluster 3) restrictions on activity (#82) and participation limitations (#54).

A recurrent theme, from PI women (emerging from Cluster 2), is the perceived entrapment in a cycle of injury and reduced PA (#22). This observation emphasises the need for comprehensive guidance and education to facilitate safe and effective participation in sport/PA. A potential lack of awareness and knowledge regarding safe participation strategies, recovery processes (including how and when to return from injury), and alternative, less strenuous, and enjoyable sport/PA emerges as a significant barrier.⁷ These findings highlight the important role of health professionals, sport organisations, sport/PA providers/deliverers, and insurance providers. These stakeholders are instrumental in creating environments conducive to safe and progressive re-engagement in sport/PA. This involves the development and communication of effective recovery strategies, injury prevention guidelines, skilled programme deliverers (e.g. sport coach or instructor) and

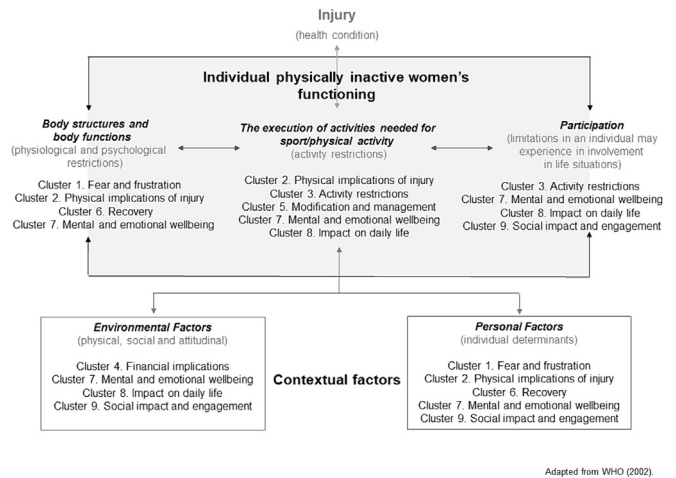


Fig. 4. ICF biopsychosocial model for physically inactive women facing injury as a barrier to sport/PA.

creating adaptable PA programmes that resonate with the preferences and needs of PI women.

4.3. Financial implications

Our study identified significant financial barriers impacting the participation of PI women in sport/PA (Cluster 4). This aligns with the WHO's classification of financial constraints as environmental barriers.²⁵ The financial implications were particularly noticeable in areas such as intensive rehabilitation, medical clearances, and participation in specialised classes or low impact sports, as evidenced by participant responses (#37, #52, #78). This adds much needed nuance to the existing literature, which frequently emphasises only generic cost as a barrier to women's participation.¹⁸ Interestingly, financial considerations appeared less prohibitive concerning community programme participation. This suggests a potential willingness among PI women to engage in community-based programmes that facilitate continued PA. Such programmes, due to their cost-effectiveness compared to intensive rehabilitation options, may present a viable pathway to increasing PA levels among PI women. However, considering the potential fear of injury or reinjury, these programmes must include targeted strategies to engage these women effectively and safely.

4.4. Psychological wellbeing and social support

Participation in sport has been considered the social glue that holds the community together,²⁹ a conduit for positive mental health outcomes³⁰ and a means through which women can socially undertake mental health and trauma recovery.³⁰ However, our findings reveal nuanced injury impacts faced by PI women, particularly in relation to psychological wellbeing and social support. Fear and frustration predominantly characterised the psychological responses in Cluster 1. Notably, *Mental and emotional wellbeing* (Cluster 7) unveiled additional layers of psychological impact, such as loss of stress outlets (#89), reduced confidence (#64, #23, #81), and increased social anxiety (#59, #86), despite being rated as less impactful. Research has consistently shown sports and physical activities are linked to enhanced mental health and stress reduction.³⁰ However, there is a noticeable gap in understanding how these activities affect women's mental wellbeing, especially when injuries pose a barrier to their PA participation. Existing studies, often athlete-focused, tend to perceive injury as a temporary setback,¹⁶ limiting a comprehensive understanding of the multifaceted challenges encountered by PI women. Our findings suggest that PI women may lack sufficient social support, an essential environmental factor, in resuming sport/PA. Such support appears secondary,

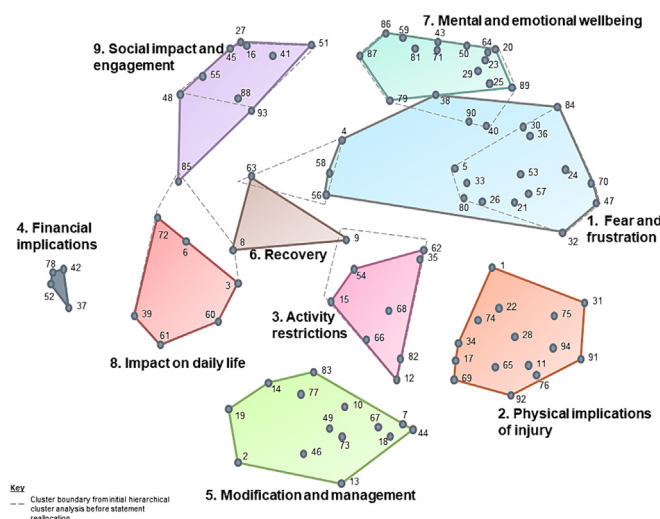


Fig. 3. Cluster map displaying the 9 key meanings of injury, according to participants.

overshadowed by the immediate demands of managing injuries in conjunction with societal roles, such as caregiving, a role identified by 92 % of participants. This underscores the necessity for robust social support structures, offering access to evidence-based advice, psychological backing, logistical assistance, and tailored communication strategies from sport/PA programme deliverers. Such nuanced support is instrumental in navigating the complexities of rehabilitation and re-engagement in sport/PA, facilitating a more informed and empathetic approach to overcoming injury-related barriers.

4.5. Broader impacts of injury on daily life and social engagement

It is important to recognise that the injury experience of PI women is not only related to sport/PA. Less explored are other injury impacts that align to the ICF,²⁶ namely *Impact on daily life* (Cluster 8) and *Social impact and engagement* (Cluster 9). Though these clusters were not rated as highly as other clusters/statements by our participants, both contain a statement in Q1 (#3, #88), highlighting the necessity of a comprehensive approach to understanding the injury experiences of PI women, aligning with the ICF framework, to effectively mitigate the broader impact of injury on their lives.

4.6. Limitations and future research

This study, utilising the CM methodology, is limited by its cross-sectional design, capturing data at a single point in time, and does not explore PI women's longitudinal injury experience. Additionally, the recruitment of women from social sport programmes may limit the generalisability of our findings to women more broadly. Recruitment through these programmes, however, provides valuable insights specific to the targeted inactive subgroup, which is often underrepresented in physical activity injury research. Future research should consider a broader and longitudinal examination of injury trajectories and causal patterns and include comparisons with sufficiently active adults. A more inclusive engagement with various stakeholders, including public health officials and sport administrators, is essential to understanding the planning and implementation processes pertinent to injury prevention/management strategies. This could potentially unveil crucial factors such as decision-making support, leadership influences, and the utility of data systems such as injury surveillance. There is also a pressing need for research to identify and evaluate effective approaches and interventions tailored to address the specific challenges identified, focusing on mitigating injury risks. Whilst the CM methodology showed a good data fit with a low stress index, it shares common limitations with other qualitative approaches, such as restricted generalisability due to smaller sample sizes.²¹ Additionally, the varying number of participants across different stages of the study—some participants involved in brainstorming and others in statement sorting and rating—may further impact the generalisability of the data collected.

4.7. Comprehensive care and multi-dimensional impacts of injury

This study emphasises the multi-dimensional impacts of injury on PI women engaging in sport/PA, advocating for holistic consideration beyond physical or medical management. Implementing comprehensive care models that go beyond medical or physical treatment may enhance injury recovery and physical activity re-engagement for PI women. Using the ICF model, the complexities of injury impacts are understood in terms of functioning, activity engagement, and participation, within personal and contextual factors. Key findings reveal that fear and frustration predominantly impact the psychological responses of PI women to injuries, creating a significant barrier to sport/PA participation. To address this, integrating psychological support may help PI women overcome fears and frustrations related to injuries, thus aiding ongoing and future sport and physical activity participation. Moreover, PI women want to be more physically active, but their psychological

and physical recovery may not necessarily coincide. Physical implications, such as weight gain, reduced mobility/slower movement and pain, further limit activity restrictions and require modifications to participation strategies. Developing personalised strategies to address the unique challenges across PI women's functioning and contextual factors is crucial. A noticeable lack of social support and tailored resources (e.g. how and when to return from injury, how to participate in sport/PA safely) also emerged as significant barriers, emphasising the need for evidence-based injury prevention/management support structures that address psychological, physical, and logistical issues.

On the front line, sport/PA deliverers, through their direct contact with PI women, are particularly well positioned to make impactful changes, including providing information that will potentially reduce the impact of injury as a barrier, expedite women's return to sport/PA, and increase their levels of PA. This may be possible by integrating evidence-informed injury prevention/management strategies into programme design and delivery, modifying activities to meet individual needs, and using tailored communication and engagement strategies for PI women.⁹ This can create environments conducive to safe and sustained PA participation. However, whilst these practitioners play a crucial role, their efforts alone are insufficient for broad-scale impact. A concerted response from diverse stakeholders — including health professionals, public health planners, sport and recreation governing bodies, insurance providers, and friends and family — is required to deliver system-wide understanding and change. Each group of stakeholders contributes differently; for example, health professionals can provide medical and recovery support; public health planners may assist with appropriate funding initiatives and/or the availability of accessible facilities; and friends and family can offer ongoing encouragement and emotional support. Together, these efforts may significantly enhance overall wellness and physical activity engagement, creating a supportive system that fosters long-term health benefits.

5. Conclusion

This study provides insights into the complex impact of injury on PI women engaging in sport/PA. It highlights the need for a collaborative, system-wide approach that involves diverse stakeholders. A collaborative approach is necessary to foster environments that support recovery and sustained participation, whilst emphasising a holistic, person-centred strategy focused on preventing/managing injuries. Based on the findings of this study, the goal should be to address the multifaceted needs of PI women and support their journey towards improved long-term health and wellness outcomes, with the overarching aim of enhanced overall wellbeing and PA levels that reach international recommendations. As we look to the future, one must ask: How can we better integrate the voices and needs of PI women into the public health agenda to ensure that sport/PA programmes and initiatives effectively reduce injury as a barrier to their participation?

Funding information

This work was supported by a La Trobe University Women in Sport Special Initiative Seed Grant.

Confirmation of ethical compliance

The study's processes received approval from the La Trobe University human ethics committee (HEC18301).

CRediT authorship contribution statement

Kiera Staley: Conceptualization, Funding acquisition, Project administration, Methodology, Software, Investigation, Formal analysis, Writing – original draft, Writing – review & editing, Visualization. **Alex Donaldson:** Conceptualization, Funding acquisition, Methodology,

Software, Investigation, Formal analysis, Supervision, Writing – review & editing, Visualization. **Andrea B. Mosler:** Conceptualization, Funding acquisition, Methodology, Formal analysis, Writing – review & editing. **Emma Seal:** Conceptualization, Funding acquisition, Methodology, Formal analysis, Writing – review & editing. **Adrienne Forsyth:** Conceptualization, Formal analysis, Writing – review & editing. **Paul O'Halloran:** Conceptualization, Formal analysis, Supervision, Writing – review & editing. **Matthew Nicholson:** Conceptualization, Funding acquisition, Project administration, Supervision, Writing – review & editing. **Kirsty Forsdike:** Conceptualization, Formal analysis, Writing – review & editing. **Andrea M. Bruder:** Conceptualization, Funding acquisition, Methodology, Formal analysis, Supervision, Writing – review & editing, Visualization.

Declaration of interest statement

We declare that we have no known conflicts of interest associated with this publication nor any competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

Acknowledgements

The authors thank the four State Sport Associations, who received funding from the Victorian Health Promotion Foundation (VicHealth) to develop programmes targeting insufficiently physically active women, for supporting this study.

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