

AUTHENTICITY STATEMENT

This is to certify that to the best of my knowledge, the content of this report is my own work. This report has not been submitted for any subject or for other purposes. I certify that the intellectual content of this report is the product of my own work and that all the assistance received in preparing this report and sources have been acknowledged.

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AI USE STATEMENT

I have utilised Generative AI in this report, ChatGPT & Grammarly.ai, to assist in various ways, including grammar and punctuation, research analysis and research summarising.

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EXECUTIVE SUMMARY

Female athletes experience a disproportionately high risk of lower limb injuries, such as ACL tears, which occur two to eight times more frequently than in male athletes and carry a high risk of reinjury. (Supply Physical Therapy, n.d.) Beyond the physical impact, these injuries often result in psychological challenges, including fear of re-injury, reduced confidence, loss of athletic identity, and symptoms of depression or post-traumatic stress. Despite structured rehabilitation protocols, many athletes face barriers to full recovery, with existing assistive products often designed generically or for male users, neglecting female-specific needs.

This research investigates how assistive design can support both physical rehabilitation and psychological well-being for female athletes. Using a multidisciplinary approach combining sports medicine, psychology, surveys of 32 athletes, and interviews with rehabilitation professionals, the study examines current products. It identifies gaps in comfort, usability, female-specific ergonomics, and psychological support. Findings show that user-centred, gender-responsive designs enhance adherence, confidence, and motivation while promoting safe, progressive recovery.

Design implications include developing adaptable, aesthetically considered, and emotionally supportive assistive products. These products should integrate seamlessly into rehabilitation routines, support mobility and strength, and foster resilience and self-identity. Holistic solutions addressing both physical and emotional recovery have the potential to accelerate rehabilitation, improve well-being, and empower female athletes across all levels of sport.



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01

- ABBREVIATIONS
- INTRODUCTION
- BACKGROUND
- BENCHMARKING

ACL

Anterior cruciate ligament

ACLRAnterior cruciate ligament
Reconstruction**RTS**

Return-to-sport

ROM

Range of Motion

PT

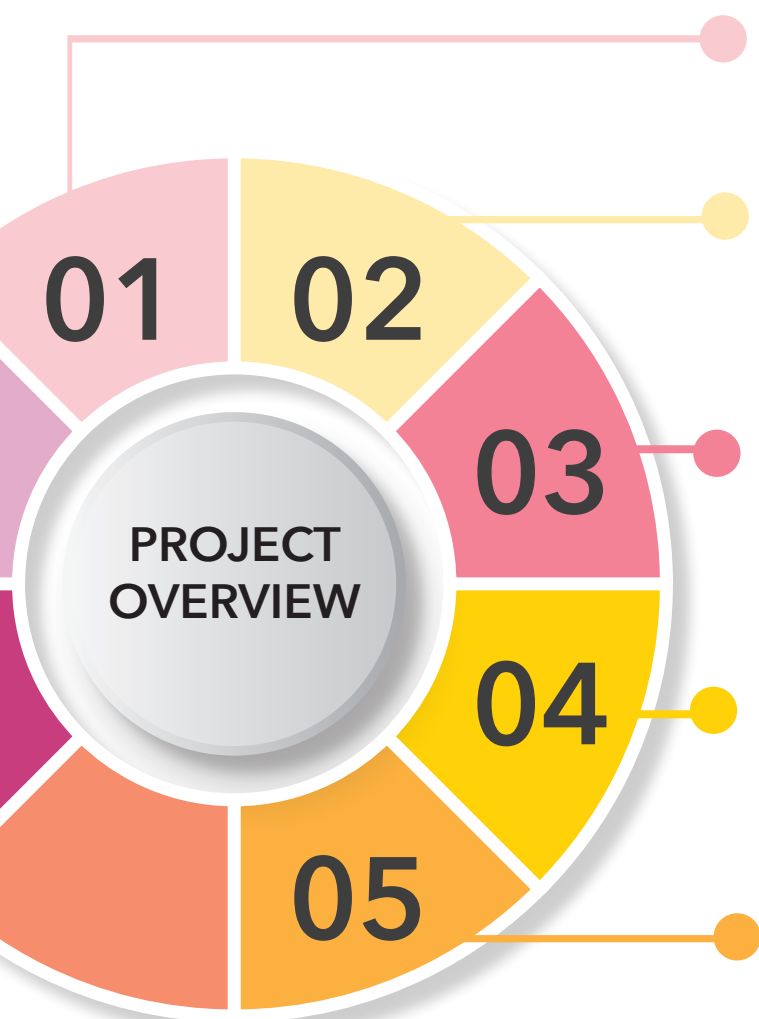
Physiotherapy

PROJECT OVERVIEW

Female athletes face a disproportionately high risk of lower limb injuries, with ACL tears occurring two to eight times more frequently than in male athletes and a six-fold increased risk of reinjury (Forsyth, Donovan, Martin-Smith, & Rowe, 2025); (Niekerk, Matzkin, & Christino, 2023). Injuries of this nature are not only physically limiting but can also have significant psychological consequences. Research indicates that nearly half of injured athletes experience mild depression, while over 75% recovering from ACL injuries report post-traumatic stress symptoms, with female athletes disproportionately affected (Niekerk, Matzkin, & Christino, 2023). Fear of re-injury and Kinesiophobia often reduce activity levels, hinder compliance with rehabilitation programs, and limit the likelihood of returning to competitive sport (Niekerk, Matzkin, & Christino, 2023).

The purpose of this project is to explore how assistive design can support both physical recovery and psychological well-being in female athletes recovering from lower limb injuries. By examining challenges such as discomfort with poorly fitting or male-oriented equipment, social isolation, and disruptions to athletic identity, the study aims to identify opportunities for user-centred, gender-responsive designs that enhance mobility, confidence, and motivation. Ultimately, this research seeks to demonstrate how thoughtfully designed assistive products can contribute to holistic rehabilitation outcomes that address both physical and emotional needs.

Figure 1 displays the project overview for this report.



INTRODUCTION

- Project Overview
- Project Aim
- Background Information

SECONDARY RESEARCH

- Product Benchmarking

PRIMARY RESEARCH

- Qualitative research analysis
- Surveys
- Interviews

ANALYSIS AND FINDINGS

- Analyse Findings
- Discussion
- Design Implications
- Conclusion

DEVELOP AND DELIVER

- Ideation
- Testing Solutions
- Final Solution

Figure 1: Project Overview

Lower limb injuries are a significant concern for female athletes, with anterior cruciate ligament (ACL) tears and ankle sprains occurring at substantially higher rates than in male counterparts (Forsyth, Donovan, Martin-Smith, & Rowe, 2025). These injuries not only impair athletic performance but also heighten the risk of long-term musculoskeletal complications and recurrent injury. Unique risk factors including anatomical differences, hormonal influences, and sport-specific demands make both prevention and recovery more complex for female athletes.

PHYSICAL RECOVERY

Rehabilitation processes are typically structured around progressive stages, beginning with acute injury management, followed by restoration of mobility and strength, advancing to sport-specific conditioning, and culminating in return-to-sport (RTS) readiness (Figure 2). For female athletes, these stages can present additional challenges due to physical and biomechanical factors. While approximately 69% of female athletes return to sport following lower limb injuries, the recovery timeline often 10 to 11 months is influenced by inconsistent rehabilitation protocols and a lack of standardized RTS criteria (Science Direct, 2024). Understanding these stages highlights opportunities for user-focused design solutions that could enhance adherence and reduce dropout during rehabilitation.

PREVALENCE OF INJURIES

ACL ruptures remain one of the most common and severe injuries among female athletes. This increased risk is linked to anatomical factors such as a wider pelvis and greater Q-angle. Q-angle is the angle formed between the hip and knee that affects knee alignment, as well as hormonal effects on ligament laxity (Hewett, Myer, & Ford, 2006). Other frequent injuries include patellofemoral pain syndrome (Boling, et al., 2009), ankle sprains (Gribble, 2016), and stress fractures often associated with bone density issues such as the female athlete triad or relative energy deficiency in sport (Mountjoy, et al., 2018).

5 STAGES OF THE RECOVERY PROCESS

ACUTE / INITIAL

Your injury is very irritable. The goal is to reduce pain, inflammation, and improve motion.

PHASE
01

SUB ACUTE

The injury is no longer as irritable but you should still use caution when making progressions. This phase works on muscle recruitment and activation.

PHASE
02

STRENGTH

Your injury is now more stable. Work through progressions for strength and power.

PHASE
03

SPORTS / ACTIVITY SPECIFIC

This is where we can start to push toward more specific sports activity.

PHASE
04

RETURN TO SPORT

In this phase brings you back into full sports activity and helps guide you in the ramp up back to full participation.

PHASE
05

PSYCHOLOGICAL RECOVERY

Beyond physical healing, lower limb injuries often impose significant psychological burdens. Female athletes frequently experience fear of re-injury, reduced confidence, and a loss of athletic identity, all of which can hinder rehabilitation progress and delay return to sport. Research shows that nearly half of injured athletes experience symptoms of mild depression, while over 75% report post-traumatic stress symptoms during recovery (Niekerk, Matzkin, & Christino, 2023). As shown in Figure 3, the Fear Avoidance Model explains how pain-related fear can lead to avoidance behaviours, reinforcing physical limitations and prolonging recovery if not addressed. Addressing these psychological dimensions is crucial, as emotional well-being strongly correlates with motivation, adherence to rehabilitation programs, and successful RTS.

Integrating mental health support into recovery strategies through counselling, peer support, or emotionally responsive product design can play a vital role in improving both recovery outcomes and overall well-being.

SUMMARY

This research explores a critical opportunity to enhance rehabilitation experiences for female athletes recovering from lower limb injuries. By integrating physical recovery with psychological support, this work has the potential to improve both short-term rehabilitation outcomes and long-term athletic engagement.

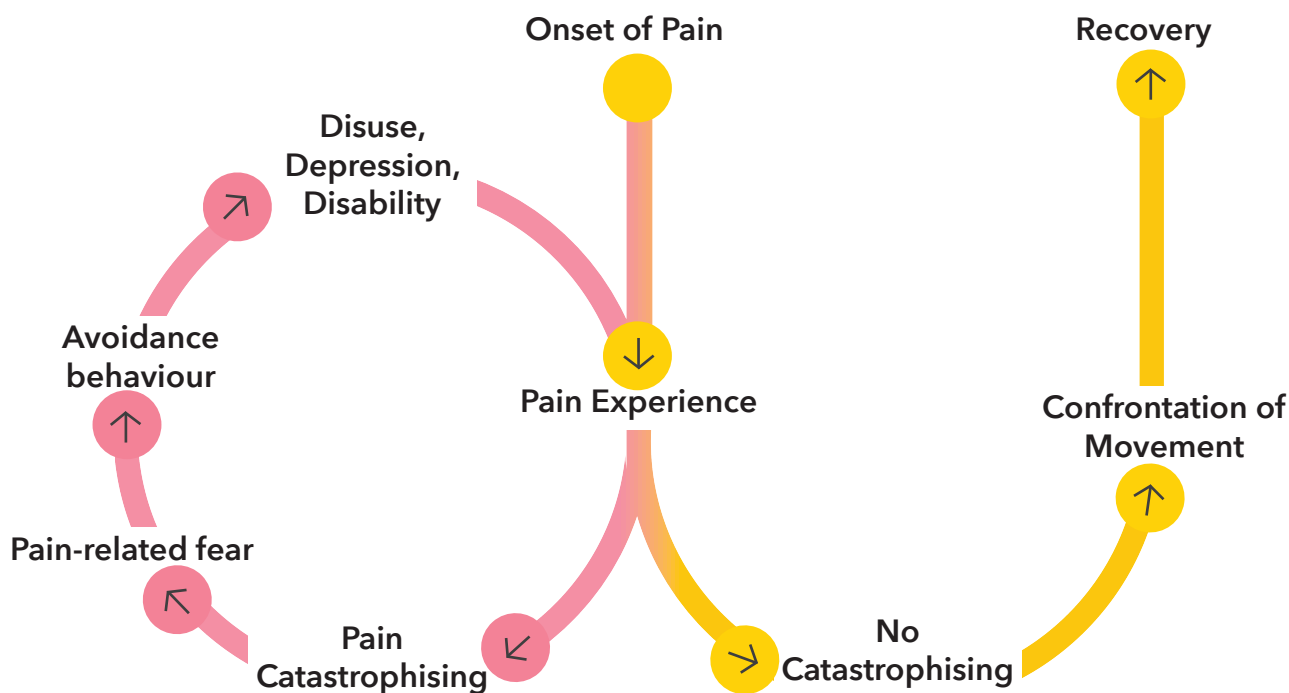


Figure 3: Cognitive-Behavioral Model of Fear of Movement/(Re)Injury

This benchmarking section evaluates the current market of products and programs supporting the prevention, treatment, and rehabilitation of lower-limb injuries in female athletes. The aim is to understand the strengths and limitations of existing solutions, ranging from wearable rehabilitation devices to structured return-to-sport (RTS) programs, in order to identify opportunities for innovation. This process highlights how current tools address physical recovery, while also revealing gaps in areas such as female-specific design, psychological support, and integration of emerging technologies.

MARKET OVERVIEW

The rehabilitation market for lower-limb injuries is broad, spanning wearable supports, physiotherapy-led programs, and digital platforms for progress tracking. These tools often deliver effective physical support, but very few are tailored to the unique biomechanical and hormonal needs of female athletes. This lack of specific consideration creates a gap in the market for targeted, evidence-based tools that not only improve recovery outcomes but also enhance confidence and adherence to rehabilitation protocols.

EXISTING PRODUCTS

Research into the current market highlights products and tools that primarily support three stages of care: injury prevention, active rehabilitation, and return-to-sport (RTS). Table 1 presents a comparative table grading these products on quality, price, comfort, technology, gender-specific design, reputation and psychological benefits.

Many wearable solutions, such as DonJoy and Mueller knee and ankle braces, deliver reliable support and stability throughout recovery. However, their generic, one-size-fits-most designs often lack ergonomic adaptability, limiting comfort and long-term compliance. Similarly, compression garments from brands like McDavid provide basic support and swelling management but do not address the functional or psychological needs of female athletes.

On the technological front, platforms such as KangaTech and Physimax have advanced the field of rehabilitation by integrating data-driven performance tracking and personalised training programs. (KangaTech, 2025) These products, while highly effective in elite sports settings, are often priced beyond the reach of community-level athletes and rarely consider female-specific biomechanics or hormonal cycles.

Basic rehabilitation aids, including balance trainers, resistance bands, and rollers, remain widely used due to their affordability and accessibility. However, these tools provide minimal feedback, little to no adaptability, and limited user guidance leaving athletes without structured support through the recovery process (AliMed, 2024).

As shown in Table , this comparative analysis highlights an evident gap in solutions that combine affordability, comfort, and female-focused design while still providing high levels of support and guidance during rehabilitation. For a further in-depth analysis refer to Appendix 3.

PRODUCT TYPE	Donjoy Unloading Reaction Knee Brace	Mueller The One Premium Ankle Brace	Bio-Logix™ Knee Brace [4200]	Physimax	KangaTech's KT360	McDavid Compression Sleeve	Fusion® Women's Knee Brace by Breg
QUALITY	9	9	9	9	9	6	9
PRICING	2	5	4	7	2	9	4
COMFORT	7	7	7	7	8	7	8
TECHNOLOGY	7	9	9	10	10	1	9
DESIGNED FOR FEMALES	3	5	5	6	7	5	10
REPUTATION	8	9	9	9	8	6	8
PSYCHOLOGICAL RECOVERY	6	5	7	8	7	2	6

Table 1: Existing product scoring benchmarking 10 = Excellent | 1= Poor

KEY COMPETITORS

While analysing existing products highlights the features and limitations of current rehabilitation tools, understanding the companies and organisations behind these solutions provides further insight into market positioning, innovation potential, and competitive strengths. Figure 4 categorises key competitors according to the level of sport they primarily serve; community, semi-professional, and professional/elite, providing a clear overview of market reach and focus.

At the community level, brands such as Mueller and McDavid dominate, offering affordable and widely available braces, sleeves, and compression garments. These products provide basic support and protection, but designs are generic and lack female-specific features or advanced ergonomics.

For semi-professional athletes, companies like Moveo and Exo-L deliver more customised and ergonomic solutions, combining comfort and moderate technological support. While effective, these products often remain less accessible due to cost or distribution limitations.

At the professional and elite level, DonJoy, KangaTech, and Physimax lead the market, offering advanced, technology-driven solutions that integrate performance monitoring, biomechanical tracking, and personalised rehabilitation programs. These tools are highly effective for elite athletes but are typically cost-prohibitive and less practical for lower-level or community athletes.

Overall, Figure 4 highlights how competitors are segmented by target athlete level, revealing gaps in solutions that are both female-focused and scalable across all levels of sport. This analysis informs opportunities for products that can combine accessibility, comfort, support, and technology to serve a broader market.



Figure 4: Analysis of product competitors

OPPORTUNITIES & GAPS

Four main gaps were identified in the current market:

- **Female-Specific Design:** Most tools and protocols are built for the “average athlete,” with limited consideration for female biomechanics, hormonal cycles, or injury patterns.
- **Psychological Support:** Rehabilitation tools rarely address the mental health impact of injuries, despite frustration, loss of confidence, and identity disruption being common.
- **Transition to Performance:** Few products adequately support athletes during the critical phase between medical clearance and full performance return, leaving a gap in structured guidance and confidence-building.
- **Integration of Technology:** While wearables and digital platforms are growing, there is room for more intuitive, user-friendly, and affordable tech that provides actionable insights without overcomplicating the process.

Figure 5 presents a matrix graph assessing existing devices across level of support, price, technology, and comfort, revealing a clear trend: products accessible to community-level athletes generally perform well in terms of comfort and support but lack technological features, whereas devices with advanced technology or higher functionality are typically cost-prohibitive and inaccessible to this group. This highlights the challenge of providing solutions that balance affordability, usability, and innovation across all levels of sport.

These gaps point to opportunities for designing rehabilitation tools that are ergonomic, user-friendly, technologically integrated, and psychologically supportive, particularly tailored to female athletes. Such products could improve compliance, confidence, and overall recovery outcomes while remaining accessible to athletes at all levels.



Figure 5: Product Matrix

SUMMARY

This analysis of the current market and competitor products reveals that community-level solutions excel in comfort and support but lack technological innovation, while more advanced, technology-driven products are often cost-prohibitive and inaccessible to lower-level athletes. Despite these strengths, there remains a significant opportunity to develop female-focused, holistic rehabilitation tools that balance ergonomic comfort, functional support, affordability, and technology, while also addressing psychological well-being. Insights from this benchmarking process inform targeted design opportunities that will be further explored in the following sections.

02

- RESEARCH
- ANALYSIS AND FINDINGS

02 | RESEARCH

To conduct primary research, a triangulation approach was applied. Triangulation involves using multiple research methods to gather diverse forms of data, thereby strengthening the credibility and reliability of findings (Wang, 2009). In design research, this approach is particularly valuable as it captures a range of perspectives from different stakeholders, reducing the risk of bias that may arise when relying on a single data source.

METHODOLOGY

A qualitative approach was used to explore the rehabilitation experiences of female athletes with lower limb injuries, capturing both practical and psychological aspects that are often overlooked in quantitative studies (Creswell & Poth, 2023). Data was collected through two complementary methods: semi-structured interviews with professionals and athletes, and an online survey targeting female athletes. This combination enabled triangulation by comparing perspectives from both those delivering and receiving rehabilitation support, enhancing the credibility and depth of the findings.

DATA COLLECTION

An online survey was distributed to 32 female athletes with current or past lower limb injuries, collecting both open and closed ended responses on rehabilitation experiences, product usability, and psychological challenges. The survey was available for two weeks via social media platforms, providing a broad range of athlete perspectives to complement professional insights and support triangulation of findings.

In addition, five semi-structured interviews were conducted: three with professionals (a physiotherapist, a strength and conditioning coach, and a medical device expert who was also a former elite athlete) and two with female athletes at different stages of rehabilitation. Each interview lasted between 20 and 45 minutes, was audio-recorded with consent, and explored rehabilitation challenges, product usability, and both physical and psychological recovery factors.

DATA ANALYSIS

Interview transcripts were thematically analysed to identify recurring patterns and themes as seen in Appendix 4 and 5. Closed-ended survey data were summarised descriptively to contextualise the qualitative findings and enable cross-comparison between professional and athlete perspectives. This analytical process strengthened the validity of conclusions through triangulation by integrating insights from multiple data sources.

ETHICAL CONSIDERATIONS

Participants received an information sheet and provided informed consent. Anonymity was maintained using pseudonyms, and data was securely stored and accessible only to the researcher, ensuring compliance with ethical standards. All survey and interview information sheets and consent forms can be seen in Appendix 2.

The data gathered from interviews and surveys, both qualitative and quantitative, were analysed and cross-checked to identify key patterns and insights.

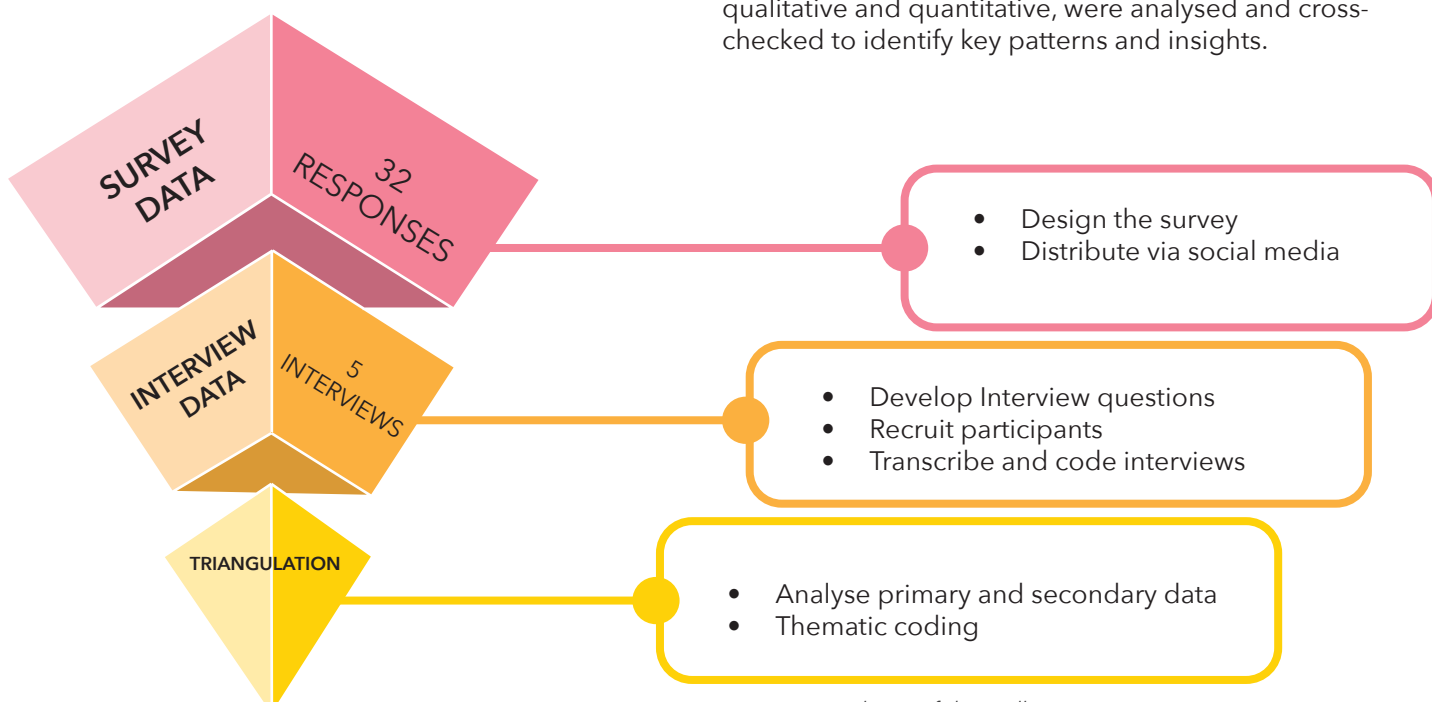


Figure 6: Triangulation of data collection

SURVEY FINDINGS

Thirty-two survey responses were collected over a two week period before data was extracted and analysed in three phases. Qualtrics was used to distribute and collect the data. The survey targeted female athletes with a current or past history of lower limb injuries, and questions were designed to capture not only practical experiences with rehabilitation and assistive products but also emotional and psychological dimensions of recovery. The full survey can be found in Appendix 1.

The analysis involved collating quantitative data using Qualtrics' built-in statistical and graphing features. Multiple-choice and Likert scale questions were used to gauge participants' perspectives on issues such as comfort and usability of equipment, perceived support during recovery, and self-reported confidence in RTS. These responses provided an overview of participant attitudes and helped identify patterns worth exploring further.

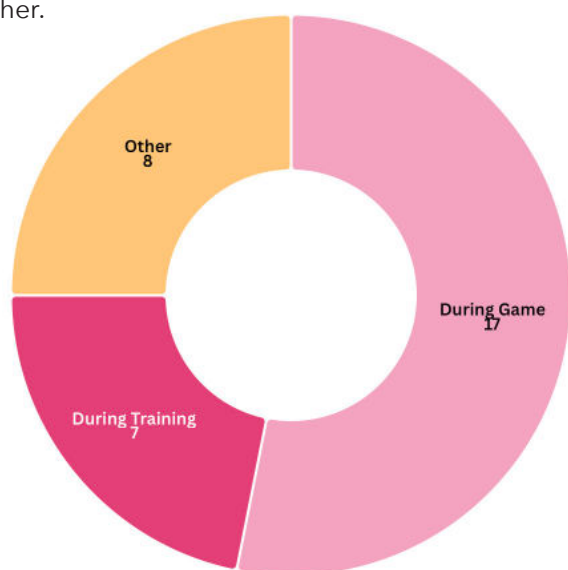


Figure 7: Occurrence of Lower Limb Injuries Among Participants

According to figure 7, 75% of participants reported sustaining their injuries either during a game (17 responses) or during training (7 responses), while 8 participants indicated other circumstances. This highlights that the majority of lower limb injuries are associated with structured athletic activities, underscoring the importance of targeted injury prevention strategies in both competitive and training environments.

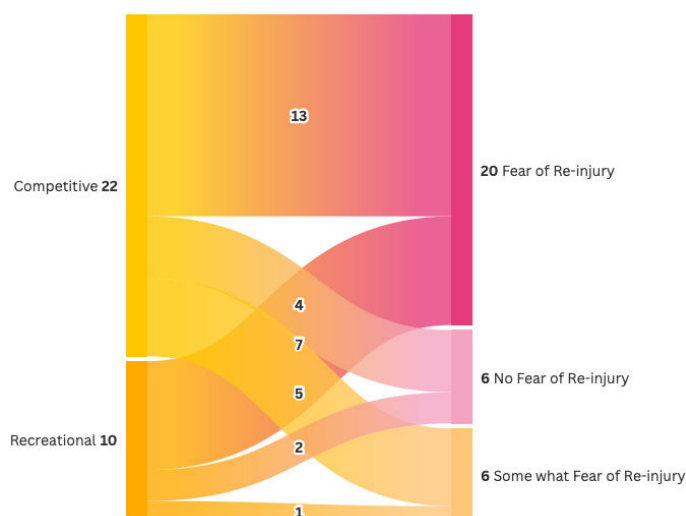


Figure 8: Alluvial Map shows a correlation Between Level of Sport and Fear of Re-injury When Returning to Sport

Figure 8 illustrates a clear correlation between the level of sport and the psychological response to returning after injury. Among competitive athletes (22 participants), the majority reported experiencing fear of re-injury (13 participants), while a smaller proportion expressed either no fear or only moderate concern. Recreational athletes showed a similar but less pronounced trend. These findings suggest that fear of re-injury is prevalent across both levels of sport but is more significant among competitive athletes, likely due to heightened performance pressures and expectations. Addressing these psychological barriers through targeted rehabilitation strategies and mental health support could play a critical role in improving RTS outcomes.

The second phase of analysis focused on the qualitative short-answer responses provided within the multiple-choice sections. These responses were documented and analyzed for recurring ideas, which were then grouped into related themes. Common themes included frustration with generic or male oriented equipment, the importance of social support in rehabilitation, and feelings of diminished athletic identity. This thematic grouping provided a foundation for deeper comparative analysis.

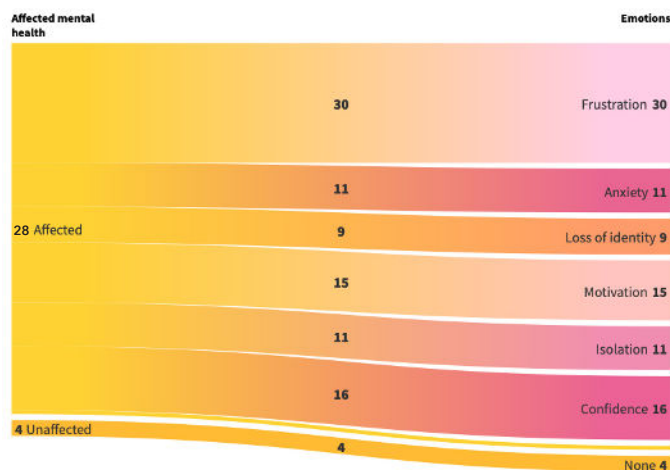


Figure 9: Emotional Responses Experienced During Rehabilitation

The survey results highlight the complex emotions athletes navigate during recovery. Frustration emerged as the most common response, while feelings of confidence, motivation, anxiety, isolation, and loss of identity were also frequently reported. These findings reflect the significant psychological impact of injury recovery, with frustration and fluctuating confidence being particularly dominant themes. Of the 32 participants, 28 (81%) reported that their injury affected their mental health in some way, reinforcing that rehabilitation is not solely a physical process but also a deeply psychological one. When considered alongside the fear-of-re-injury data, it becomes clear that holistic support strategies addressing both mental and physical demands are essential, particularly for competitive athletes who may experience greater identity loss or performance pressure.

SUPPORT SYSTEMS

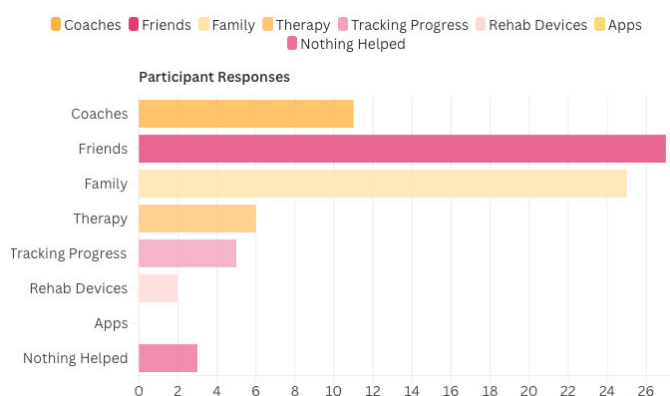


Figure 10: Sources of Motivation and Support During Rehabilitation

Figure 10 demonstrates the critical role of social support in the recovery process. Friends (27 participants) and family (25 participants) were by far the most significant sources of motivation and support, with coaches providing additional support for some athletes. Professional interventions, such as therapy (6 participants) and progress tracking (5 participants), played smaller but meaningful roles, while very few participants identified rehabilitation devices or apps as helpful. Notably, three participants indicated that nothing helped during their recovery, underscoring gaps in available support systems.

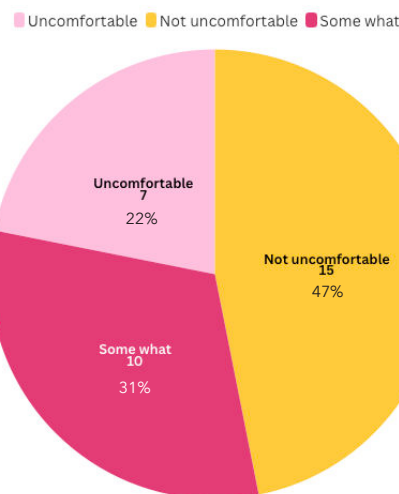


Figure 11: Comfort Levels with Current Rehabilitation Tools

In figure 11, 47% of participants found current rehabilitation tools comfortable, while 31% reported some discomfort and 22% experienced significant discomfort. These results suggest that, although nearly half of users are satisfied, there is a clear need to improve the comfort and usability of rehabilitation devices. Enhancing these aspects could increase adherence to rehabilitation programs and support better recovery outcomes.

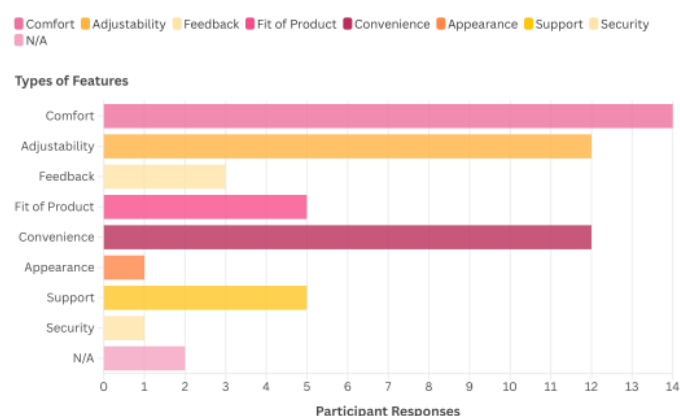


Figure 12: Most Valued Features of Rehabilitation Tools

According to figure 12, the results suggest that athletes prioritize practical and ergonomic features that directly support their rehabilitation experience. This aligns with the findings in figure 11, that found over half of the participants experienced some level of discomfort with current rehabilitation tools. Designing devices with enhanced comfort, adaptability, and ease of use could improve compliance, engagement, and overall recovery outcomes.

SUMMARY OF FINDINGS

From this analysis, three dominant themes emerged, notably the need for better tailored, female-specific assistive products and the importance of addressing the psychological as well as physical aspects of recovery. These insights provided critical context to complement the expert perspectives gained through interviews.

INTERVIEW FINDINGS

Following the survey phase, semi-structured interviews were conducted with two athletes at different competitive levels, two rehabilitation professionals, a strength and conditioning coach, a physiotherapist, and one participant who is both a former professional athlete and now a specialist in the medical devices and technology sector. Analysis of these discussions revealed four key themes as seen in figure 13 and figure 14: The critical role of strength and conditioning in physical recovery programs; the significant psychological impact of injury on confidence, motivation, and athletic identity; the importance of strong support systems throughout the recovery process; and the need to account for anatomical and physiological differences, particularly between male and female athletes when designing rehabilitation protocols and equipment.

Insights from professionals emphasized the importance of holistic and individualized rehabilitation approaches, integrating technology not only to monitor physical progress but also to support psychological readiness.

The perspective of the former professional athlete further enriched these findings, offering personal reflections on injury and recovery alongside informed commentary on advancements in medical devices and emerging technologies shaping current rehabilitation practices. Collectively, these interviews provided a nuanced understanding of the survey results, offering a comprehensive view of the physical, psychological, and systemic factors influencing athletes’ RTS experiences.

Overall, the discussions reinforced and expanded on the survey findings, showing that successful rehabilitation and RTS are shaped by a complex interplay of physical preparation, psychological resilience, supportive networks, and individualized strategies. These insights form a strong foundation for developing more targeted and holistic approaches to enhance recovery outcomes for athletes across all levels of sport.

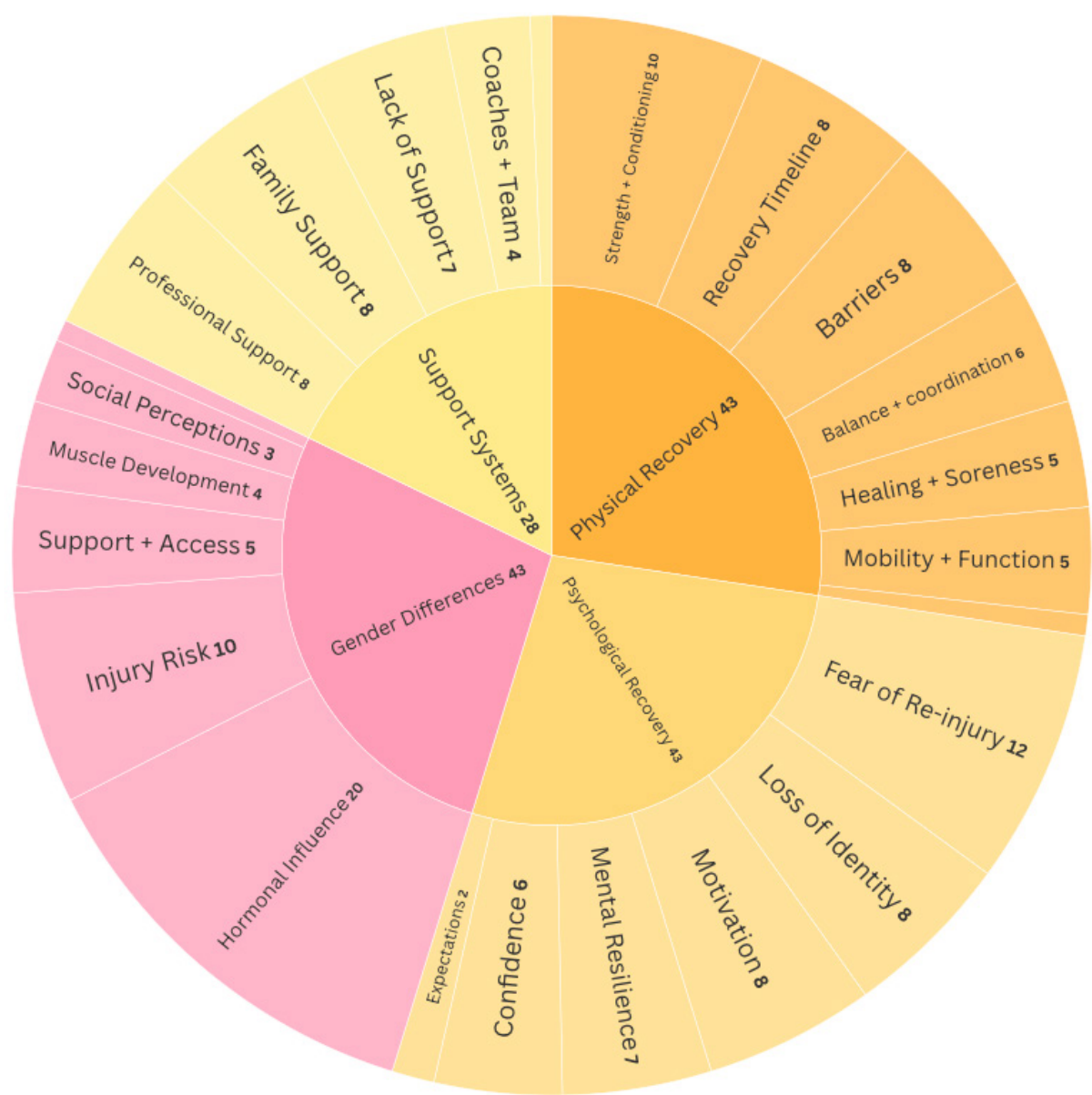


Figure 13: Frequency of code appearance

Theme	Sub-theme	Transcript Example
Physical Recovery	Strength and Conditioning	“Strength training is such a good tool, especially for lower limb injuries.” “Women have to work so much harder to build strength... it's not like we're just going to get jacked.”
	Balance and Coordination	“Regaining balance and coordination takes more time than just building strength.” “Even after they're cleared, there's often underlying instability that needs work.”
	Mobility + Functions	“I had to get that range of motion back before I could have the surgery.” “My body fatigues a lot faster now... I have to be more mindful.”
	Recovery Timeline	“I got shin splints, and I got a stress fracture... that led to being in a moon boot and on crutches on and off for about eight years. It was a long journey.”
	Residual Effects	“Every now and then I get a bit of phantom pain... but now I'm working through that and knowing my body can take more.”
	Healing and Soreness	“I think I'd get really good and then, you know, a couple weeks later, the pain would come again.” “It was hard to articulate what I was feeling – like, is it sharp or dull pain? I didn't even know how to answer that.”
Psychological Recovery	Loss of Identity	“Lonely, sad. It's almost like grieving what I had.” “A lot of female athletes struggle mentally when returning—they constantly compare themselves to their old self.”
	Motivation / Engagement	“The thing I'm most excited about again is that social connection... being physically challenged, being active.” “In the initial weeks post-op... I just had no motivation to do anything.”
	Confidence	“Confidence takes a big hit after surgery; you see hesitation in every movement.” “Mentally, it was a big factor of having the confidence that it's not going to happen again... the fear of it happening again changes the way you play.”
	Pressure and Expectations	“Doubt creeps in—some don't believe they'll ever get back to their old level.”
	Fear of Re-injury	“Fear of re-injury can really slow progress.” “There's always that constant fear of re-injury... I just don't want to go backwards.”
	Mental Resilience	“If they believe they can get back, they recover faster.” “Celebrating small wins keeps them coming back to sessions.”
Support Systems	Support Gaps	“We need better access for grassroots players...because 99% of clubs can't afford physios or sports trainers.”
	Professional Support	“Emotionally, I think I probably should have accessed a psychologist... maybe more knowledge and access to sports injury psychologists.”
	Family Support	“Family and Hayden have helped out a lot... but at the same time, I feel like I'm being a burden.”
	Coaches + Team	“When teammates share their own recovery stories, it gives them hope.” “Coaches-wise, not very supportive... my teammates kept moving forward while I felt stuck.”
	Lack of Support	“As someone who isn't an elite athlete, there's not a whole team rushing to get you fixed... you're kind of on your own.” “I didn't feel much support outside my family... it was very isolating.”
Gender Differences	Hormonal influence	“Hormones play a role. During certain times of the menstrual cycle, injury risk goes up.” “Pregnancy, menopause, these stages really affect recovery and rehab needs.”
	Muscle Development	“Physiologically, men are generally stronger, quicker, and faster due to muscle and bone density.” “Every ACL that's been done surgically for the past 30 years has been based off success on men... very different anatomy.”
	Injury Risk	“Women are eight times more likely to tear their ACL and have knee injuries based on just anatomically the angle of our hips to our knees, and of course, hormones play a massive factor.”
	Recovery	“Women almost take injuries personally, whereas men jump into rehab quicker. Mentally, women struggle to adapt to their 'new normal'.” “Women often plateau at a certain stage and need a different approach to progress further.”
	Social Perceptions	“I think females are often second-guessed – like, maybe you're just exaggerating, or maybe it's nothing – when in reality, the pain is real.”
	Support + Access	“Women need reassurance. Compliments and encouragement go a long way.”

Table 2: Thematic coding classification

THEME 1: PHYSICAL RECOVERY

Physical recovery emerged as a long, complex, and often nonlinear process. Participants described extended timelines marked by progress followed by setbacks, as well as lingering limitations such as fatigue, pain, or reduced endurance. Rehabilitation strategies particularly strength training and targeted exercise were consistently identified as critical to rebuilding both function and confidence.

Recovery was described not only as the healing of the initial injury but also as adapting to a new physical reality. Participants shared the importance of managing persistent symptoms, pacing activities, and adopting preventative strategies to reduce the risk of re-injury, highlighting the ongoing nature of physical adaptation even after initial recovery milestones as described in table 3 (quote 4).

INTERVIEWEE	QUOTE
1 RTS ATHLETE (RECREATIONAL)	"I got shin splints, and I got a stress fracture... that led to being in a moon boot and on crutches on and off for about eight years. It was a long journey."
2 PHYSIO	"Regaining balance and coordination takes more time than just building strength."
3 PHASE 3 ATHLETE (SEMI-PROFESSIONAL)	"Being on double crutches for six weeks post-op, I hated it so much."
4 RTS ATHLETE (RECREATIONAL)	"Every now and then I get a bit of phantom pain... but now I'm working through that and knowing my body can take more."

Table 3: Physical recovery quotes

THEME 2: PSYCHOLOGICAL IMPACTS

The psychological toll of injury proved to be as significant as the physical challenges. Feelings of fear, anxiety, frustration, and even grief were common, often triggered by the loss of independence, disrupted routines, and the inability to participate in sport or physical activities. This emotional strain frequently led to isolation and shifts in self-identity as shown in table 4.

Despite these difficulties, recovery was also seen as an opportunity for mental growth. Participants described building resilience through consistency in training, setting realistic goals, and gradually rebuilding trust in their bodies, which collectively helped to restore confidence and reduce the fear of re-injury.

INTERVIEWEE	QUOTE
1 STRENGTH AND CONDITIONING COACH	"A lot of female athletes struggle mentally when returning—they constantly compare themselves to their old self."
2 PHASE 3 ATHLETE (SEMI-PROFESSIONAL)	"Lonely, sad. It's almost like grieving what I had."
3 RTS ATHLETE (RECREATIONAL)	"There's always that constant fear of re-injury... I just don't want to go backwards."
4 FORMER PROFESSIONAL ATHLETE	"Athletes do not know what to do with hidden injuries like confidence issues, anxiety, or mental health concerns."

Table 4: Psychological impacts quotes

THEME 3: SUPPORT SYSTEMS

Support networks were consistently highlighted as a critical factor in recovery journeys. Participants reported receiving a mix of emotional, practical, and professional support that helped them navigate the multifaceted challenges of injury.

Family members often played a central role, offering encouragement, accompanying participants to appointments, and assisting with daily tasks. Conversely, support from coaches, teammates, or peers was more limited, especially in recreational or non-elite sport settings, which sometimes heightened feelings of isolation as described in table 5 (quote 2 and 4).

Professional guidance from physiotherapists or sports doctors was valued, but limited appointment time occasionally hindered ongoing communication about progress and challenges. Participants suggested that access to mental health or counselling services could further strengthen recovery outcomes.

INTERVIEWEE	QUOTE
RTS ATHLETE (RECREATIONAL) 1	"As someone who isn't an elite athlete, there's not a whole team rushing to get you fixed... you're kind of on your own."
RTS ATHLETE (RECREATIONAL) 2	"I didn't feel much support outside my family... it was very isolating."
FORMER PROFESSIONAL ATHLETE 3	"We need better access for grassroots players...because 99% of clubs can't afford physios or sports trainers."
PHASE 3 ATHLETE (SEMI-PROFESSIONAL) 4	"Friends who play... just didn't have the same understanding because they haven't been through an injury."

Table 5: Support systems quotes

THEME 4: GENDER DIFFERENCES

Anatomical and physiological differences were also identified as key factors influencing recovery, performance, and training strategies. Variations in muscle distribution, hormonal fluctuations, and natural strength capacities shaped rehabilitation timelines, performance outcomes, and injury prevention efforts as seen in table 6.

Female athletes, in particular, were noted to experience slower strength development and performance fluctuations tied to hormonal cycles, which often affected both confidence and the pace of recovery. Social perceptions and stigma such as concerns about appearing "too muscular" were also cited as barriers, sometimes limiting engagement with strength training and rehabilitation practices despite their proven benefits.

INTERVIEWEE	QUOTE
STRENGTH AND CONDITIONING COACH 1	"Hormones play a role. During certain times of the menstrual cycle, injury risk goes up."
FORMER PROFESSIONAL ATHLETE 2	"Women are eight times more likely to tear their ACL and have knee injuries based on just anatomically the angle of our hips to our knees, and of course, hormones play a massive factor."
STRENGTH AND CONDITIONING COACH 3	"Pregnancy, menopause, these stages really affect recovery and rehab needs."
PHYSIO 4	"Joint laxity makes certain exercises riskier during particular times in the cycle."

Table 6: Anatomical difference quotes

SUMMARY OF FINDINGS

Overall, the interviews reinforced and expanded on the survey findings, highlighting that successful rehabilitation and return to sport are shaped by a complex interplay of physical preparation, psychological resilience, supportive networks, and individualized approaches. These insights provide a strong foundation for developing more targeted and holistic strategies to enhance recovery outcomes for athletes across different levels of sport.

03

- DISCUSSION
- DESIGN IMPLICATIONS
- CONCLUSION

To identify gaps and opportunities for assistive design supporting female athletes with lower limb injuries, findings from interviews with rehabilitation professionals and athlete surveys were compared with secondary research. This triangulated approach provided a comprehensive understanding of both practical and psychological factors affecting rehabilitation.

A key insight is that physical recovery protocols are well-documented, but psychological support is often underrepresented. Literature indicates female athletes typically return to sport around 10.8 months post-injury (PubMed, 2023), but data on barriers and delayed participation are limited. Interviews and surveys confirmed that fear of re-injury, reduced confidence, and frustration are common psychological challenges hindering adherence to rehabilitation programs.

Assistive products were highlighted as valuable for safe and gradual physical engagement, providing stability, reducing load, and enabling controlled movement. Professionals noted that these devices support therapy goals like weight-bearing and balance, enhancing both physical recovery and psychological resilience.

A notable difference between literature and primary research is the emphasis on individualized experiences. Recovery is highly variable, influenced by motivation, support networks, and sport-specific demands. Athletes using adaptive devices reported increased engagement and a greater sense of autonomy in their recovery. Including rehabilitation professionals as secondary users was also important, as their guidance and feedback ensure safe, effective use. Devices that are easy to adjust, transport, and integrate into therapy protocols were consistently preferred.

Overall, the findings indicate that assistive design can create a cycle of benefits: supporting safe, progressive rehabilitation, enhancing psychological well-being, improving therapy adherence, and increasing RTS rates. Future designs should prioritize comfort, adaptability, and motivational features to address the multifaceted challenges faced by female athletes recovering from lower limb injuries.

LIMITATIONS:

While this research provides valuable insights into the rehabilitation experiences of female athletes with lower limb injuries, the limitations should be acknowledged.

Firstly, the sample size for the surveys was limited to 32 responses, which may not fully represent the broader population of female athletes across different sports, levels of competition, or geographical locations. This small sample may limit how widely the findings can be applied.

Additionally, the study conducted three interviews with rehabilitation professionals and two interviews with female athletes at different stages of recovery. While these interviews provided rich, in-depth perspectives on both professional approaches and personal recovery experiences, a larger and more diverse pool of participants could have offered a broader range of insights.

Another limitation is the reliance on self-reported data from both athletes and professionals. Surveys and interviews can be subject to bias, including social desirability or recall bias, which may influence the accuracy of the responses.

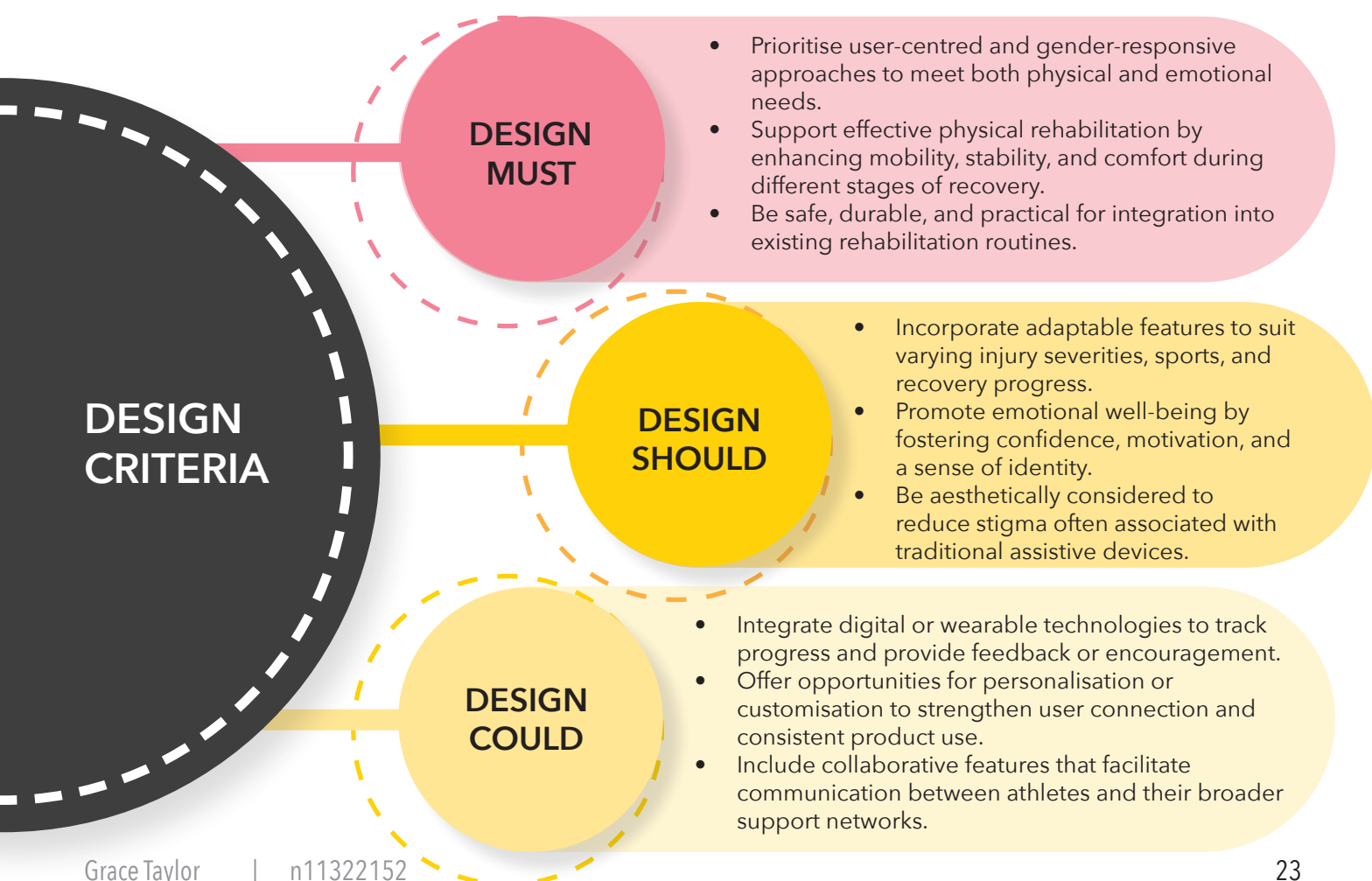
The insights gained from this research provide clear direction for the design process and highlight significant opportunities and gaps in the market for supporting the rehabilitation of female athletes with lower limb injuries. One of the most critical gaps lies in the lack of assistive products tailored specifically to the needs of female athletes, with many current solutions being either generic or male-oriented. This presents a strong opportunity to design products that are not only functional and effective but also adaptable, aesthetically considered, and emotionally supportive, bridging the divide between physical rehabilitation and psychological well-being.

Findings from both primary and secondary research emphasise the importance of addressing the recovery process holistically. Rehabilitation is not solely about restoring physical ability; it is about rebuilding confidence, motivation, and a sense of identity, which are often disrupted by injury. Athletes, physiotherapists, strength and conditioning coaches, sports psychologists, and support networks each approach the recovery journey from different perspectives and priorities.

By understanding these viewpoints, design interventions can be developed that balance functionality, emotional support, and user experience, ultimately improving compliance, engagement, and long-term outcomes.

The design process should therefore prioritise user-centred and gender-responsive solutions that consider the full recovery journey. Products that integrate seamlessly into existing rehabilitation programs and align with athletes' routines and preferences have the potential to create a more positive, empowering recovery experience. Addressing these needs also opens opportunities for innovative, future-focused solutions that combine adaptability, technology, and inclusivity to create products that evolve alongside the athlete's recovery journey.

By addressing these priorities, the design process can evolve beyond simply supporting recovery to actively empowering athletes, creating innovative, inclusive, and emotionally intelligent solutions that restore physical function while strengthening confidence and resilience throughout the rehabilitation journey.



CONCLUSION | 03

Lower limb injuries are among the most common setbacks faced by female athletes, often impacting not only their physical performance but also their psychological well-being. Despite advances in sports medicine, there remains a gap in assistive design solutions that address both recovery and the broader emotional challenges associated with injury.

At present, assistive products tend to focus primarily on physical rehabilitation, overlooking the psychological resilience and confidence building that are critical to an athlete's return to sport. By integrating both physical and mental recovery into design, there is an opportunity to create solutions that support athletes holistically.

Through primary and secondary research, insights were uncovered into the physical, social, and emotional barriers experienced during rehabilitation. From these findings, design opportunities emerged to guide the development of assistive products that not only enhance mobility and strength but also foster motivation, self-identity, and connection within the sporting community.

A product in this space has the potential to accelerate recovery, improve overall well-being, and empower female athletes to re-engage with their sport. Beyond individual outcomes, such an innovation could help reshape approaches to sports rehabilitation, highlighting the importance of inclusive, athlete-centered design.

04

- REFERENCES
- APPENDICIES

AliMed. (2024, July 31). Common Physical Therapy Equipment for Effective Rehabilitation. Retrieved from AliMed: <https://www.alimed.com/blogs/rehabilitation-and-therapy/common-physical-therapy-equipment-for-effective-rehabilitation>

Anterior cruciate ligament injury. (2025, 08 31). Retrieved from Wikipedia: https://en.wikipedia.org/wiki/Anterior_cruciate_ligament_injury?

Boling, M. C., Padua, D. A., Beutler, A., Marshall, S. W., Guskiewicz, K., & Pyne, S. (2009, September 24). A Prospective Investigation of Biomechanical Risk Factors for Patellofemoral Pain Syndrome: The Joint Undertaking to Monitor and Prevent ACL Injury (JUMP-ACL) Cohort. *American Journal of Sports Medicine*. Retrieved from Sage Journals: <https://journals.sagepub.com/doi/abs/10.1177/0363546509337934>

Buckthorpe, M. (2025, April 30). Rehabilitation and Return to Sports of Lower Limb Muscle Injuries. Retrieved from Springer Nature Link: https://link.springer.com/rwe/10.1007/978-3-030-65430-6_66-1

Creswell, J. W., & Poth, C. N. (2023, December). *Qualitative Inquiry and Research Design*. Retrieved from Sage Publications: <https://uk.sagepub.com/en-gb/eur/qualitative-inquiry-and-research-design/book266033?>

Foothills Sports Medecine Physical Therapy. (2024, April 4). Retrieved from Foothills Sports Medecine Physical Therapy: <https://foothillsrehab.com/blog/tissue-healing-timelines/>

Forsyth, L., Donovan, L., Martin-Smith, R., & Rowe, P. L. (2025, July 08). Prevalence and impact of chronic ankle instability in female sport: a cross-sectional study. Retrieved from BMC Sports Science, Medicine and Rehabilitation: <https://bmcsportsscimedrehabil.biomedcentral.com/articles/10.1186/s13102-025-01211-5?>

Gribble, P. A. (2016). Evidence review for the 2016 International Ankle Consortium consensus statement on the prevalence, impact and long-term consequences of lateral ankle sprains. Retrieved from British Journal of Sports Medicine: <https://bjsm.bmj.com/content/50/24/1496>

Hardaker, N. J., Hume, P. A., & Sims, S. T. (2024, March 27). Differences in Injury Profiles Between Female and Male Athletes Across the Participant Classification Framework: A Systematic Review and Meta-Analysis. Retrieved from National Library of Medecine: <https://pubmed.ncbi.nlm.nih.gov/38536647/>

Hewett, T. E., Myer, G. D., & Ford, K. R. (2006, February). Anterior cruciate ligament injuries in female athletes: Part 1, mechanisms and risk factors. Retrieved from Mayo Clinic: <https://mayoclinic.elsevierpure.com/en/publications/anterior-cruciate-ligament-injuries-in-female-athletes-part-1-mec>

INJURY RECOVERY: WHY PRO ATHLETES RECOVER MORE QUICKLY THAN REGULAR INDIVIDUALS. (2023, August 28). Retrieved from Endurance Recovery Boots: <https://recoveryboots.com.au/blogs/news/injury-recovery-why-pro-athletes-recover-more-quickly-than-regular-individuals#:~:text=Recovery%20strategies%20employed%20by%20pro,use%20of%20performance%2Denhancing%20substances>.

KangaTech. (2025). MITIGATE INJURY RISK. Retrieved from KangaTech: <https://kangatech.com/>

Liu, Y., Zhang, Q., & Li, W. (2025). Enhancing lower-limb rehabilitation: a scoping review of augmented reality environment. *Journal of NeuroEngineering and Rehabilitation*. Retrieved from <https://jneuroengrehab.biomedcentral.com/articles/10.1186/s12984-025-01643-7>

Mai, H. T., Chun, D. S., Schneider, A. D., Erickson, B. J., Freshman, R. D., Kester, B., . . . Hsu, W. K. (2017, May 16). Performance-Based Outcomes After Anterior Cruciate Ligament Reconstruction in Professional Athletes Differ Between Sports. Retrieved from National Library of Medicine: <https://pubmed.ncbi.nlm.nih.gov/28510477/>

Messer, D. (2024, November 19). LOWER LIMB INJURY AND THE RISK OF SUBSEQUENT INJURY. Retrieved from Hammer Athletic: <https://www.hammerathletic.com.au/lower-limb-injury-risk-subsequent-injury/>

Mosewich, A. D., Truong, L. K., Holt, C. J., Le, C. Y., Miciak, M., & Whittaker, J. L. (2019). Psychological, social and contextual factors across recovery stages following a sport-related knee injury: a scoping review. *British Journal of Sports Medicine*, 11. Retrieved from British Journal of Sports Medicine: <https://bjsm.bmj.com/content/54/19/1149>

Mountjoy, M., Sundgot-Borgen, J. K., Burke, L. M., Ackerman, K. E., Blauwet, C., & Constantini, N. (2018). IOC consensus statement on relative energy deficiency in sport (RED-S): 2018 update. *Br J Sports Med*.

Nedder, V. J., Raju, A. G., Moyal, J. A., Calcei, J. G., & Voos, J. E. (2024, July 23). Impact of Psychological Factors on Rehabilitation After Anterior Cruciate Ligament Reconstruction: A Systematic Review. Retrieved from National Library of Medicine: <https://pubmed.ncbi.nlm.nih.gov/39041333/>

Niekerk, M. V., Matzkin, E., & Christino, M. A. (2023, June 2). Psychological Aspects of Return to Sport for the Female Athlete. Retrieved from National Library of Medicine: <https://pmc.ncbi.nlm.nih.gov/articles/PMC10461158/>

Northwest Medicine. (2023, November). Why Women Have More ACL Injuries Than Men. Retrieved from Northwest Medicine: <https://www.nm.org/healthbeat/healthy-tips/Why-Women-Have-More-ACL-Injuries-Than-Men>

Sampson, M. (2022, October 13). Best Knee Braces for Tennis Players. Retrieved from Tennis Universe: <https://tennisuniverse.org/reviews-best-knee-brace-tennis/>

Science Direct. (2024, June). Return to sports in female athletes after anterior cruciate ligament reconstruction: A systematic review and metanalysis. Retrieved from Science Direct: <https://www.sciencedirect.com/science/article/pii/S2059775424000087>

Smith, D. W. (2023, March 7). 5 Phases of Sports Physical therapy. Retrieved from Physical Therapy: <https://www.hidefpt.com/post/5-phases-of-sports-physical-therapy>

Sports Injuries. (2025, 08 31). Retrieved from Wikipedia: https://en.wikipedia.org/wiki/Sports_injury?

Supply Physical Therapy. (n.d.). COMPARING INCREDIWEAR WITH COMPETITORS. Retrieved from Supply Physicaltherapy: <https://supplypt.com/pages/comparing-incrediwear-with-competitors>

The 5 Stages of Rehabilitation in Sports. (2025). Retrieved from JAG Physical Therapy: <https://www.jagpt.com/blog/5-stages-of-sports-rehab/>

APPENDIX 1: THE SURVEY

Grace Taylor | n11322152

APPENDIX 2.1: SURVEY PARTICIPANT INFORMATION

PARTICIPANT INFORMATION FOR CAPSTONE RESEARCH PROJECT – Survey –

Design for Recovery in Female Athletes with Lower Limb Injuries

Research team Please list all members in this section.

Principal Researcher:	Grace Taylor	Industrial Design Student
Unit Coordinator(s):	Rafael Gomez	Unit Coordinator

School of Design/Faculty of Creative Industries, Education and Social Justice

Why is the study being conducted?

This research project is being undertaken as part of an Industrial Design Capstone project for Grace Taylor.

The purpose of this project is to explore how assistive design, meaning specially designed tools or equipment, can help female athletes recover better both physically and mentally after lower limb injuries. This includes understanding how these designs can improve their healing process and overall wellbeing.

You are invited to participate in this research project because you are a female athlete, making you an important representative of the people who would use assistive designs. Your experiences and insights will help shape better support tools that are designed specifically for athletes like you.

What does participation involve?

Participation will involve completing a 19 item questionnaire with Likert scale answers ranging from 1-10 and multiple choice questions. The questionnaire will take approximately 5-10 minutes to complete.

Questions will include examples such as:

- Did your injury affect your mental or emotional health?
- What physical challenges did you face the most during your recovery?
- On a scale of 1–10, how supported did you feel by the physical rehab tools/devices provided to you?

Your participation in this research project is entirely voluntary. If you agree to participate, you do **not** have to answer any questions you are uncomfortable with. Your decision to participate or not will in no way affect your current or future relationship with QUT (for example, your grades) or any associated external organisation.

Because this survey does **not** collect any personal identifying information, once you submit your responses it will not be possible to withdraw your data.

You will be able to review your responses before submitting the survey and save a copy of your responses after submission.

What are the possible benefits for me if I take part?

It is expected that this research project will not directly benefit you. However, the outcomes of the research may benefit female athletes in the future by contributing to the development of more effective, inclusive, and user-centered designs for lower limb injury recovery. These insights may also inform health professionals, designers, and sports organizations about the specific needs of female athletes during rehabilitation.

You can request a summary of the outcomes of the study by checking a box on the consent form, providing an email address.

What are the possible risks for me if I take part?

There are no risks beyond normal day-to-day living associated with your participation in this research project.

What about privacy and confidentiality?

All comments and responses are anonymous i.e. it will not be possible to identify you at any stage of the research, because personal identifying information is not sought in any of the responses and no traceable information is collected via the server or survey tool.

Any data collected as part of this research project will be stored securely on personal computers or password protected cloud storage systems (not on public storage systems). Data will be deleted once the project is complete at the end of the semester.

How do I give my consent to participate?

The submission or return of the completed survey is accepted as an indication of your consent to participate in this research project.

What if I have questions about the research project?

If you have any questions or require further information, please contact the researcher:

Grace Taylor

n11322152@qut.edu.au

0426 281 705

What if I have a concern or complaint regarding the conduct of the research project?

The researcher is committed to research integrity and the ethical conduct of research projects. If you wish to discuss the study with someone not directly involved, particularly in relation to matters concerning policies, information or complaints about the conduct of the study or your rights as a participant, you may contact the Unit Coordinator on email (Rafael Gomez) r.gomez@qut.edu.au or (Tim Williams) tim.williams@qut.edu.au

Thank you for helping with this research project.

APPENDIX 2.2: CONSENT FORMS

CONSENT FORM FOR CAPSTONE RESEARCH PROJECT Interview
Assistive Design for Female Athletes with Lower Limb Injuries

Research Team:
Grace Taylor grace.m.taylor.04@gmail.com 0426281705

Statement of consent

By signing below, you are indicating that you:

- Have read and understood the information document regarding this research project.
- Have had any questions answered to your satisfaction.
- Understand that if you have any additional questions you can contact the research team.
- Understand that you are free to withdraw without comment or penalty.
- Understand that if you have concerns about the ethical conduct of the research project you can contact me by email @grace.m.taylor.04@gmail.com
- Agree to participate in the research project.

Please tick the relevant box below:

- ☐ I **agree** for the interview / focus group to be audio / video recorded.
- ☐ I **do not agree** for the interview / focus group to be audio / video recorded.

Name _____

Signature _____

Date _____

Please return the signed consent form to the researcher.

APPENDIX 2.4: INTERVIEW PARTICIPANT INFORMATION

PARTICIPANT INFORMATION FOR CAPSTONE RESEARCH PROJECT – Interview / Focus Group / Observations–	
Design for Female Athletes with Lower Limb Injuries	

Research team

Principal Researcher:	Grace Taylor.	Industrial Design Student
Unit Coordinator:	Rafael Gomez.	

**School of Design/Faculty of Creative Industries, Education and Social Justice
Queensland University of Technology (QUT)**

Why is the study being conducted?

This research project is being undertaken as part of an Industrial Design Capstone project for Grace Taylor.

The purpose of this project is to investigate how design can enhance both physical recovery and psychological well-being in female athletes recovering from lower limb injuries. By focusing on injuries such as ACL tears, ankle sprains, and other musculoskeletal trauma common in sport, this project explores the specific rehabilitation needs of women, considering factors such as anatomy, biomechanics, and access to support. Through qualitative research methods including interviews, surveys, and observational studies, the project aims to identify key functional and emotional challenges faced during different recovery phases. The ultimate goal is to develop informed design strategies or product concepts that are ergonomically tailored, emotionally supportive, and practically useful in helping female athletes return confidently to sport.

You are invited to participate in this research project because you are a healthcare professional (e.g. physiotherapist, occupational therapist, strength and conditioning coach or sports doctor) with expertise in injury rehabilitation. Your professional perspective is essential to understanding current rehabilitation practices, user needs, and opportunities for design interventions.

What does participation involve?

Your participation will involve an audio-recorded interview at a mutually agreed location, which will take around 30 minutes of your time. During the interview, you will be asked questions about your experiences with lower limb injury recovery, your rehabilitation journey, and your views on assistive tools or devices. The discussion will help inform the development of more supportive and inclusive assistive design solutions.

Questions will include:

- From your experience, what are the most common challenges female athletes face during lower limb rehabilitation?
- How well do current assistive devices meet the physical and psychological needs of your patients?

- Are there any gaps you've observed in the market for recovery tools, particularly for female athletes?

Your participation in this research project is entirely voluntary. If you do agree to participate you can withdraw from the research project without comment or penalty. You can withdraw anytime during the interview. If you withdraw with 4 weeks after your interview, on request any information already obtained that can be linked to you will be destroyed. Your decision to participate or not participate will in no way impact upon your current or future relationship with QUT. You will be able to review a transcript of your responses after the interview.

What are the possible benefits for me if I take part?

It is expected that this research project will not directly benefit you. However, the outcomes of the research may benefit female athletes in the future by contributing to the development of more effective, inclusive, and user-centered designs for lower limb injury recovery. These insights may also inform health professionals, designers, and sports organizations about the specific needs of female athletes during rehabilitation.

You can request a summary of the outcomes of the study by checking a box on the consent form, providing an email address.

What are the possible risks for me if I take part?

There are no risks beyond normal day-to-day living associated with your participation in this research project.

What about privacy and confidentiality?

Any data collected as part of this research project will be stored securely on personal computers or password protected cloud storage systems (not on public storage systems). Data will be deleted once the project is complete at the end of the semester.

As the research project involves an audio recording:

- You will have the opportunity to verify your comments and responses prior to final inclusion.
- The recording will not be used for any other purpose.
- Only the named researchers will have access to the recording.
- It is possible to participate in the research project without being recorded.

Every effort will be made to ensure that the data you provide cannot be traced back to you in reports, publications and other forms of presentation. For example, we will only include the relevant part of a quote, we will not use any names, or names will be changed, and/or details such as dates and specific circumstances will be excluded.

How do I give my consent to participate?

You can provide consent by confirming that you have read and understood the consent information via email.

What if I have questions about the research project?

If you have any questions or require further information please contact one of the listed researchers:

Grace Taylor n11322152@qut.edu.au 0426281705

What if I have a concern or complaint regarding the conduct of the research project?

The researcher is committed to research integrity and the ethical conduct of research projects. If you wish to discuss the study with someone not directly involved, particularly in relation to matters concerning policies, information or complaints about the conduct of the study or your rights as a participant, you may contact the Unit Coordinator on email (Rafael Gomez) r.gomez@qut.edu.au or (Tim Williams) tim.williams@qut.edu.au

Thank you for helping with this research project. Please keep this sheet for your information.

APPENDIX 3: PRODUCT BENCHMARKING TABLE

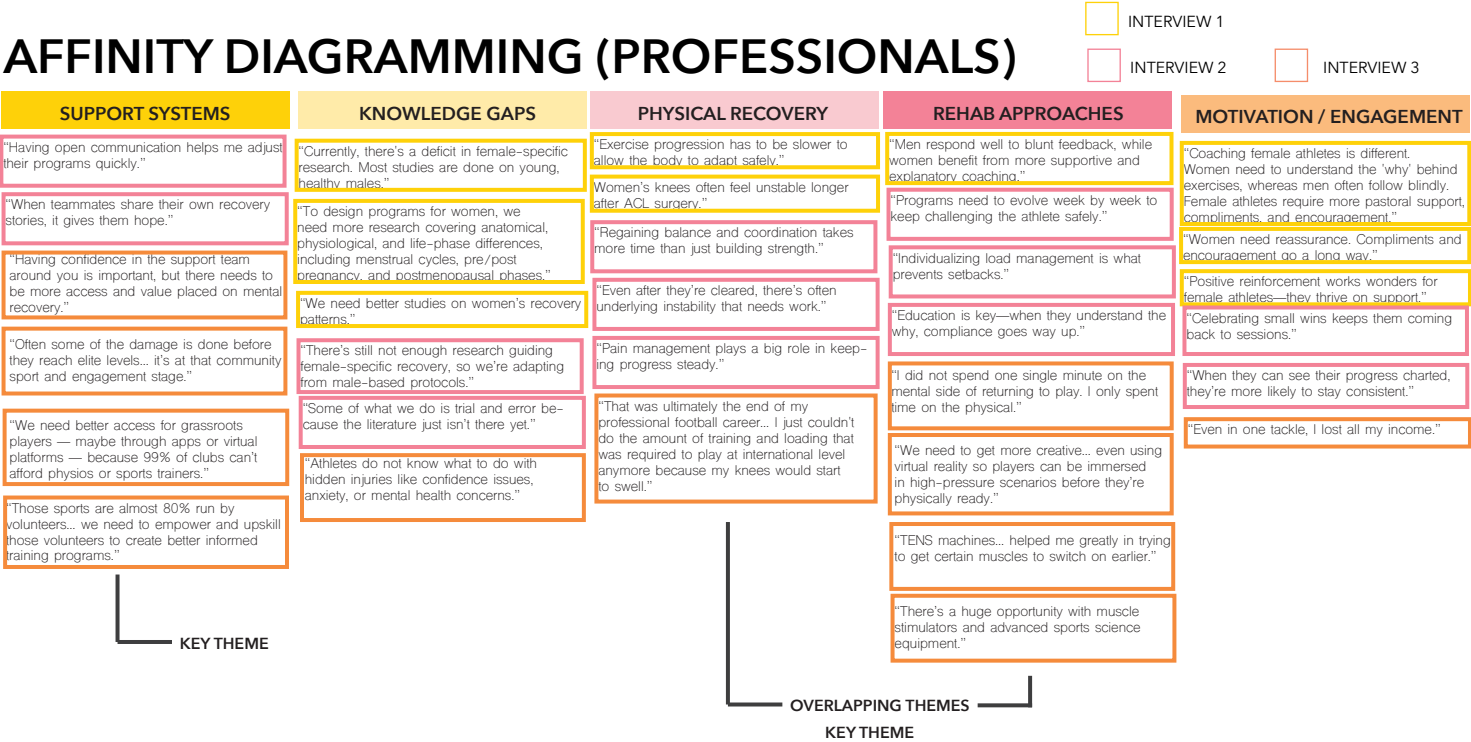
Product	Price	Functions + Features	Aesthetics	Reputation	Strengths	Weaknesses
 DonJoy Unloading Reaction Knee Brace	\$109.99 AUD	- Patented silicone web technology - Open breathable framework - Soft silicone Cordyle pad - Four-way adjustable wraparound design - Includes undersleeve - Low-profile, discreet design - Models for medial or lateral support	- Sleek minimalist design - Soft, skin friendly materials - Discreet colours and form	- Clinical credibility - Trusted orthotic brand - Patient and therapist favourites - Promotion of natural gait	- Effective pain relief and offloading - Comfort and breathability - Discreet and practical appearance - Highly adjustable and adaptive fit - Proven offloading performance	- Limited to mild to moderate osteoarthritis - Sizing sensitivity - Potential gait impact - Warm weather discomfort
 Mueller The One Premium Ankle Brace	\$72.80 AUD	Figure 8 strapping; speed lacing; anti-slip interior; comfort band; breathable low-profile build	Sleek, discreet, sporty; neutral colours; ergonomic design	- Respected brand; athlete/trainer favourites; praised for support, comfort, reliability "Truly amazing support and surprisingly comfortable." "Awesome knee brace, fits perfectly and allows me to move more easily."	Tape-like support; quick fit; stabilizes both inversion/eversion; comfortable; broad sizing	Slightly bulkier than sleeves; requires practice to don; may get warm
 Bio-Logix™ Knee Brace (4200)	\$401.01 AUD	Semi-rigid structure, dual-axis hinges, C supports, Flex Fit pads, anti-migration straps, compression sleeve included, unisex/side-specific design	Sleek, athletic appearance; streamlined profile; breathable and clean lining	Clinically trusted, award-winning, highly rated by users, recommended for active recovery and performance	High-level support for serious knee injuries, smooth motion, customizable fit, comfortable with breathable pads, strong user reviews	Greater bulk than simple sleeves, requires careful fitting, occasional reports of strap wear or comfort issues
 Physimax	Physimax itself does not have a public "cost"	Physimax is an AI-powered, marker-less movement assessment platform that uses computer vision to analyse musculoskeletal (MSK) performance. It employs standard video (2D or 3D), advanced motion analytics, and machine learning to evaluate parameters like mobility, stability, strength, and movement control—without the need for physical markers or wearables.	Clean, dynamic UI with movement overlays and intuitive scores/dashboard	Trusted by pro teams, military, academic labs; now part of Dario Health's digital therapeutics ecosystem	Real-time marker less analysis; validated against motion capture; scalable cloud deployment; actionable insights; elite adoption	Requires proper setup; aimed primarily at institutions; integration infrastructure needed
 KangaTech's KT360	Full Body Screenings: \$250 + HST Individual Area Screenings: \$55 + HST	Fixed-frame dynamometry; push-pull load cells; goniometer; 360° rotation; 80+ protocols; gamified software; portable.	Sleek, sturdy design; intuitive gamified interface; athlete comfort prioritized.	Elite sports adoption; strong research support; award-winning design.	Extremely reliable (ICC ~0.99); validated accuracy; trusted in elite rehab and performance; portable with quick setup.	Commercial-grade complexity; less suited for home users; requires infrastructure and training.
 Knee Compression Sleeves: McDavid	\$180 AUD	- Closed-cell foam that absorbs shocks and flexes with your movement for knee protection. - Wraps above and below the knee for better fit, abrasion protection, and compression - Keeps you dry and comfortable during extended activity. - Durable and convenient for regular use.	- Slim profile in black or white, with a visual hex pattern over the knee for a modern, sporty look. - Hex padding is graduated and ergonomically shaped to wrap the knee area seamlessly.	- Continually best-selling and imitated—sought-after by athletes across sports. - Delivers confidence in motion, without compromising flexibility or support. - Well-Regarded In Reviews: High user ratings and frequent praise for effectiveness, comfort, and fit.	- Favoured by high school, collegiate, and professional athletes in impact sports like basketball and volleyball. - The extended design and flexible padding conform to body movement while maintaining coverage. - Keeps legs cool during intense play. - Many users praise comfort and protection—especially for knee impacts	- Some reports note the hex shell can rip or peel during hard slides or surface impacts. This sleeve is designed more for body-to-body contact, not floor slides. - Proper fit is important sizing varies slightly by colour and region.
 Fusion® Women's Knee Brace by Breg	\$800 - \$1000 depending on seller	- Airtech™ Frame pads - innovative windows and channels in the pad permit cooling air flow while allowing moisture and heat to move away from the skin - Pivot Point Strap tabs - pivoting strap tabs allow straps to contour to the leg for superior fit, comfort and suspension	- Sleek, low-profile design - Professional finish	- Specialist grade performance - Highly regard comfort and fit - Trusted and supported brand	- Anatomy specific for women - Proform technology - Airtech Frame pads - Pivot point strap tabs - Robust support for multiple ligaments - Durable, high-quality build - Customization and sizing	- Premium price point (\$800 - \$1000) - Complex sizing process - Not intended for osteoarthritis
 Sensoria Smart Knee Brace	\$598 AUD	Dual IMU sensors, Bluetooth, remote dashboard, guided ex. content, FDA Class I	- Built as a soft neoprene brace embedded with mechanical hinges and sensors, the device maintains comfort while housing advanced tech. - The patient app delivers guided exercises and feedback visually; the clinician dashboard uses color-coded analytics to highlight adherence, ROM, and rehab milestones. - Designed to motivate users remotely via structured coaching, reminders, and a sense of progression.	Respected tele-rehab provider, clinically tested, reimbursable via Medicare, future-oriented	- Precise movement tracking. - Improved patient compliance. - remote monitoring. - clinical integration	- While the brace is sold for around \$598, operation requires a Sensoria Developer Kit license, which adds to cost and administrative setup. - This system is primarily designed for institutional applications—it's less consumer-friendly for individual use outside of a clinical or rehab setting.
 Single-Leg Rehabilitation Exoskeleton	\$5000+	Adaptive stiffness knee orthosis, integrated gait sensors, personalized kinetic/kinematic feedback	Lightweight, ergonomic wear, discreet design, clinical feedback integration	Emerging Rehabilitation Tool Still relatively nascent, devices like the MAK Active Knee are gaining attention in clinical settings for their promise in improving gait recovery after surgery or injury. Support from Scientific Evidence Clinical findings—such as notable reductions in recovery time and increased gait normalization—support their growing adoption among rehabilitation professionals.	Speeds up recovery, reduces pain, boosts compliance, data-driven rehab	Mostly clinical use, modest consumer availability, setup/monitoring required

LINK TO ANALYSIS:

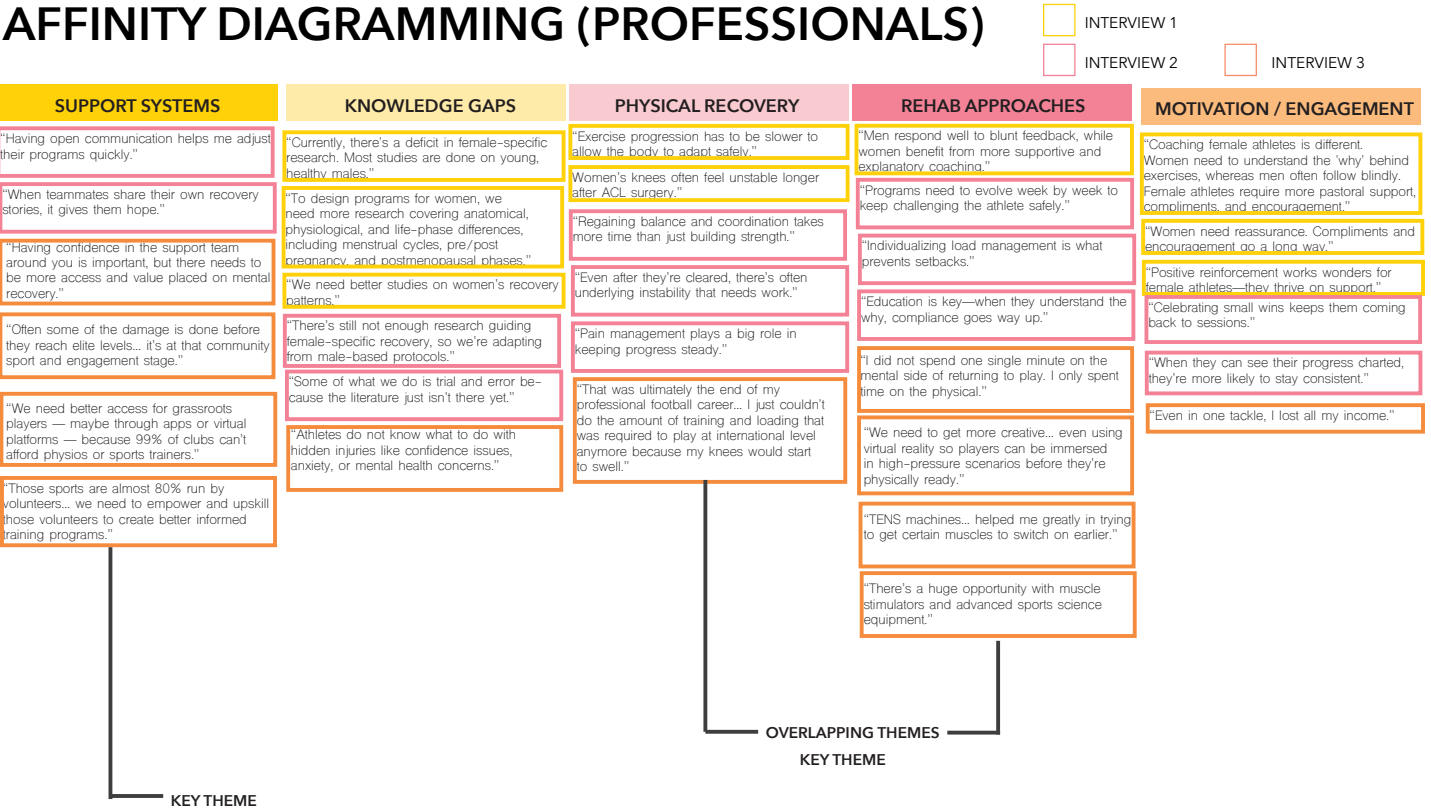
https://drive.google.com/file/d/1OLnRFmdjyFQZfvXCf2VTQ8mVKd8zto2a/view?usp=share_link

APPENDIX 5: AFFINITY DIAGRAMMING PROCESS

AFFINITY DIAGRAMMING (PROFESSIONALS)



AFFINITY DIAGRAMMING (PROFESSIONALS)



AFFINITY DIAGRAMMING (ATHLETES)

RTS PHASE

PHASE 3

SUPPORT SYSTEMS	PSYCHOLOGICAL RESPONSES	PHYSICAL RECOVERY	MOTIVATION / ENGAGEMENT	GENDER DIFFERENCES
"Family and Hayden have helped out a lot... but at the same time, I feel like I'm being a burden."	"It was quite hard to be like, I could be on the field with those girls... it was kind of just like, oh, I'm just replaced just like that."	"It physically hurt quite a lot to bend."	"Sport is my main coping strategy and now I can't do it."	"Women have to work so much harder to build strength... it's not like we're just going to get jacked."
"As much as you'd expect they did, but... I don't know how to say that there should have been or could have been more."	"Lonely, sad. It's almost like grieving what I had."	"I had to get that range of motion back before I could have the surgery."	"The strong desire to get off crutches... I hated it so much that I just wanted to be off."	"Women have to work so much harder to build strength... it's not like we're just going to get jacked."
"Friends who play... just didn't have the same understanding because they haven't been through an injury."	"I probably left most games sad and had a cry after."	"Now that I'm off the non-weight-bearing restrictions, I have to get it back again."	"Mostly just sheer will. I just really didn't want to do it, but I miss sport so I just do it."	"Women have hormones that fluctuate so much. Some weeks I can lift insane numbers, and the next week I feel like a stick on the bench."
"Emotionally, I think I probably should have accessed a psychologist... maybe more knowledge and access to sports injury psychologists."	"My mental health has dropped big time just because I don't have that access anymore."	"I got shin splints, and I got a stress fracture... that led to being in a moon boot and on crutches on and off for about eight years. It was a long journey."	"I started crocheting... just to have something else to focus on."	Females are kind of... more emotional and more dramatic when it comes to things, so when I first spoke about it, it was like, 'Are you sure it's not just that you're tired?' rather than seeing it as a real injury."
"Coaches-wise, not very supportive... my teammates kept moving forward while I felt stuck."	"I went home and had a massive... mental breakdown because I was like, holy fuck, I can't play until 2027."	"I think I'd get really good and then, you know, a couple weeks later, the pain would come again."	"I just want to run again... because that's my main mental health coping strategy."	"I actually wrote down a big list of goals... be able to carry something... be able to sit cross-legged."
"I didn't feel much support outside my family... it was very isolating."	"I do have that fear of like, how is it going to go?"	"Every now and then I get a bit of phantom pain... but now I'm working through that and knowing my body can take more."	"The thing I'm most excited about again is that social connection... being physically challenged, being active."	"I think females are often second-guessed — like, maybe you're just exaggerating, or maybe it's nothing — when in reality, the pain is real."
"Having a therapist or counsellor probably would have helped me deal with the grief."	"Definitely frustration... I just wanted to keep getting to the point where I was able to walk again."	"My body fatigues a lot faster now... I have to be more mindful."	"I actually wrote down a big list of goals... be able to carry something... be able to sit cross-legged."	
"As someone who isn't an elite athlete, there's not a whole team rushing to get you fixed... you're kind of on your own."	"Am I going to be able to go back to playing straight away or am I going to be really psyched out about it?"	"Strength training is such a good tool, especially for lower limb injuries."	"Two years ago, I never thought I could deadlift 95 kilos... but consistency and pushing my limits got me there."	
	"If anything feels slightly off, then I worry that it's going to get turned into something else."	"Being on double crutches for six weeks post-op, I hated it so much."	"In the initial weeks post-op... I just had no motivation to do anything."	
	"The first six months out of the moon boot were a mental struggle — I'd think, 'I can't walk, I can't run, I can't jump,' but in reality, I could."	"It was hard to articulate what I was feeling — like, is it sharp or dull pain? I didn't even know how to answer that."	"It was like a fear of missing out... everyone kept dancing while I sat out."	
	"When I first returned, it was terrifying — am I going to break my body in half?"			
	"There's always that constant fear of re-injury... I just don't want to go backwards."			