

**Resistance training and endometriosis: a scoping review,
and online questionnaire to understand exercise practices,
perceptions and impacts among Australian women living
with endometriosis.**

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Abstract

Endometriosis is a chronic, progressive inflammatory condition affecting one in seven Australian women, with an average individual cost burden of AUD \$30,000 per patient annually. Despite recognised benefits of resistance training (RT) for inflammatory conditions, its impact on endometriosis remains unclear, with no specific guidelines for RT prescription in this population. This thesis aimed to: 1) map the extent and nature of evidence on RT prescriptions, outcomes, and knowledge gaps for women with endometriosis; 2) investigate RT practices (frequency/intensity/time/type), perceptions of RT as a symptom management strategy, and barriers to regular RT participation among Australian women with endometriosis; and 3) examine how these perceptions and barriers vary across the lifespan. To address aim one, a scoping review of RT studies and endometriosis was completed. To address aims two and three, a quantitative cross-sectional questionnaire investigated RT practices among Australian's living with endometriosis. The scoping review of eight studies indicated that while bodyweight and low-load RT appear feasible and generally well tolerated within multimodal programmes, the evidence base remains sparse, methodologically heterogenous, and inconsistent in reporting key training variable and symptom-management approaches, precluding clear guidance on who benefits, at what dose or intensity, and for how long. An online questionnaire was distributed nationally via support organisations, social media, and healthcare networks to women aged over 18 years with a confirmed clinical diagnosis of endometriosis. The questionnaire and subsequent analyses used descriptive statistics to assess demographics, general exercise and RT behaviours, barriers and perceptions of RT, evaluated within-questionnaire test-retest reliability of symptom severity scores using intraclass correlation coefficients (ICC) and Bland-Altman plots, and explored relationships between RT practices and symptom outcomes using Spearman's rho and Kendall's tau-b correlations. 60 participants completed questionnaires, with 44 respondents' data analysed. A prevailing sociodemographic consensus is that women with endometriosis are "white, lean, middle-class, career-driven", however, the present study found that while respondents were predominantly of white ethnic backgrounds, they diverged from this profile with an overweight BMI, lower annual incomes, and part-time work patterns. Symptom severity measures demonstrated moderate-to-

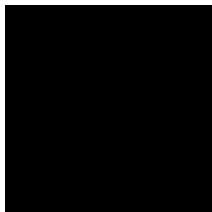
good test-retest reliability, with strongest agreement for fatigue, dyschezia, and dysuria, and weakest reliability for dysmenorrhoea, bloating, and headache/migraine. Among 29 respondents participating in RT, most completed two to three weekly sessions of 30-60 minutes, primarily using bodyweight and recreational lifting, training at commercial gyms or home with free weights and machines. Correlations between RT frequency, duration, and intensity and symptom severity were mostly weak or negligible, with a small number that reached moderate-strong effect thresholds having wide 95% confidence intervals. Among non-participants, barriers included lack of time, fatigue, symptom concerns, and limited guidance, with many identifying condition-specific programs, clear information, and professional support as facilitators. Preliminary lifespan patterns suggested differing priorities across age groups, underscoring the need for tailored rather than one-size-fits-all RT approaches. Findings indicate that Australian women with endometriosis engage in RT in diverse, adaptive, and individualised ways, often without adequate guidance, highlighting the need for co-designed, endometriosis-specific RT guidelines to support safe, effective participation and symptom management across the lifespan.

Declaration of Authenticity

“I, Dasha Banjanin declare that the Master of Research thesis entitled ‘Resistance training and endometriosis: a scoping review, and online questionnaire to understand exercise practices, perceptions and impacts among Australian women living with endometriosis’ is no more than 50,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work”.

“I have conducted my research in alignment with the Australian Code for the Responsible Conduct of Research and Victoria University’s Higher Degree by Research Policy and Procedures”.

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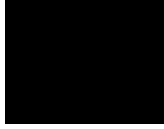


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Ethics Declaration

All research procedures reported in the thesis were approved by the Victoria University Human Research Ethics Committee [HRE25-013].

Signature:



Date: 11/01/2026

Statement on Use of Artificial Intelligence

Generative artificial intelligence tools (ChatGPT) were used as a supportive aid during the completion of this thesis to assist with clarifying appropriate statistical analyses and supporting the generation and formatting of figures. All analytical decisions, statistical testing, interpretation of results, and conclusions were independently conducted by the author. No raw data were uploaded to or analysed by AI tools, other than to generate and format relevant figures. Where AI-assisted code or guidance contributed to figure generation, this has been explicitly acknowledged in-text. The use of AI did not replace critical scholarly judgment or original intellectual contribution.

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List of Abbreviations

BMD	bone mineral density
BMI	body mass index
CI	confidence interval
EHP-5	Endometriosis Health Profile-5
EHP-30	Endometriosis Health Profile-30
ESHRE	European Society of Human Reproduction and Embryology
FITT	frequency, intensity, time and type
GnRH	gonadotropin-releasing hormones
HRQoL	health-related quality of life
ICC	intraclass correlation coefficient
IL-6	interleukin-6
IQR	interquartile range
LoA	limits of agreement
OTC	over the counter
PA	physical activity
PCOS	polycystic ovary syndrome
QoL	quality of life
RANZCOG	Royal Australian and New Zealand College of Obstetricians and Gynaecologists
RCT	randomised control trial
RIR	repetitions in reserve
RPE	rate of perceived exertion
RT	resistance training
SD	standard deviations
TNF- α	tumour necrosis factor-alpha
TPB	Theory of Planned Behaviour
RPE	Rate of Perceived Exertion
U.S.	United States
1RM	one-repetition maximum
6MWT	6-minute walk test

Chapter 1

Review of Literature

1.1 The Burden of Endometriosis

1.1.1 Burden of Endometriosis in the Global Context

Endometriosis is a progressive, inflammatory condition (Artacho-Cordón et al., 2023), that not only impacts the patient, but also their families, jobs, societies and countries (Soliman et al., 2018). It is a global health issue, affecting 10-15% (190 million) of women, and others assigned female at birth, worldwide (Soliman et al., 2018; Tragantzopoulou, 2024). However, these numbers may not accurately reflect the global prevalence, as the condition needs to be histologically diagnosed through laparoscopic surgery (Rowlands et al., 2022; Soliman et al., 2018). This diagnostic process can be complicated, and there are a plethora of social, economic, cultural, political and healthcare factors that dictate who receives a clinical diagnosis (Rowlands et al., 2022). On average, there is a 4–11-year delay from the onset of symptoms to diagnosis (Soliman et al., 2018), which is caused by a combination of non-specific symptoms, a lack of healthcare provider awareness (Sivajohan et al., 2022), and the large waitlists for laparoscopic surgery (Soliman et al., 2018). The presence of diagnostic delays is a global phenomenon, even occurring in countries with universal healthcare (Agarwal et al., 2019). A scoping review conducted by Fryer et al. (2025) found that the average diagnostic delay is 6.8 years, with an average of 1.5 years in Australia and just over 11 years in the United States (U.S.). They also found that the wait times for endometriosis care are longer for those seeking public (8.3 years) compared to private (5.5 years) healthcare (Fryer et al., 2025). This delay incurs further costs to the individuals' residing nations through increased expenses associated with unnecessary investigations, medical treatment therapies including steroidal and non-steroidal hormonal prescriptions (Sivajohan et al., 2022), hospital visits, emergency hospitalisations and other healthcare costs (Soliman et al., 2018; Armour et al., 2022).

Endometriosis has a complex disease process, which presents significant direct and indirect financial impacts to healthcare systems (Sivajohan et al., 2022). In the United States, the annual economic burden of endometriosis is estimated at approximately USD \$22 billion (Al-Lami et al., 2024), with affected individuals spending around 3.5 times more on healthcare than those without the condition (Soliman et al., 2018). Average direct healthcare costs, including hospitalisations,

surgeries, outpatient care, and medications, are estimated at USD \$12,118 per patient per year, while indirect costs associated with productivity losses and absenteeism reach approximately USD \$16,000 annually (Soliman et al., 2018). When contextualised against the average annual income for women in the U.S. ($\approx$ USD \$56,000), these costs represent roughly 22% of income in direct expenses and a further 29% in indirect losses (United States Bureau of Labor Statistics, 2025). Comparable patterns are observed in Australia, where the estimated annual cost of endometriosis is approximately AUD \$30,000 per patient, contributing to a total national economic burden of AUD \$9.6 billion per year (Armour et al., 2022). Notably, productivity losses account for most of this burden (84%), compared with 12% attributed to healthcare costs and 4% to carer costs (Armour et al., 2019). Relative to average annual female earnings in Australia ($\approx$ AUD \$100,000), the economic impact of endometriosis represents close to 30% of yearly income (Australian Bureau of Statistics, 2025). Despite differences in healthcare funding models and labour protections between countries, the proportionally high direct and indirect costs reported in both the U.S. and Australia suggest that the financial burden of endometriosis is broadly comparable across high-income settings, with productivity losses consistently representing the largest cost component. These international comparisons highlight that, while absolute cost estimates may not be directly comparable due to methodological differences, currency valuation, and healthcare system structure, endometriosis imposes a substantial and persistent economic burden across global contexts. Figure 1 provides a comparative overview of annual endometriosis-related costs across countries and cost categories, with all values converted to a common currency for comparability.

Figure 1. Annual Per-Person Cost of Endometriosis by Country

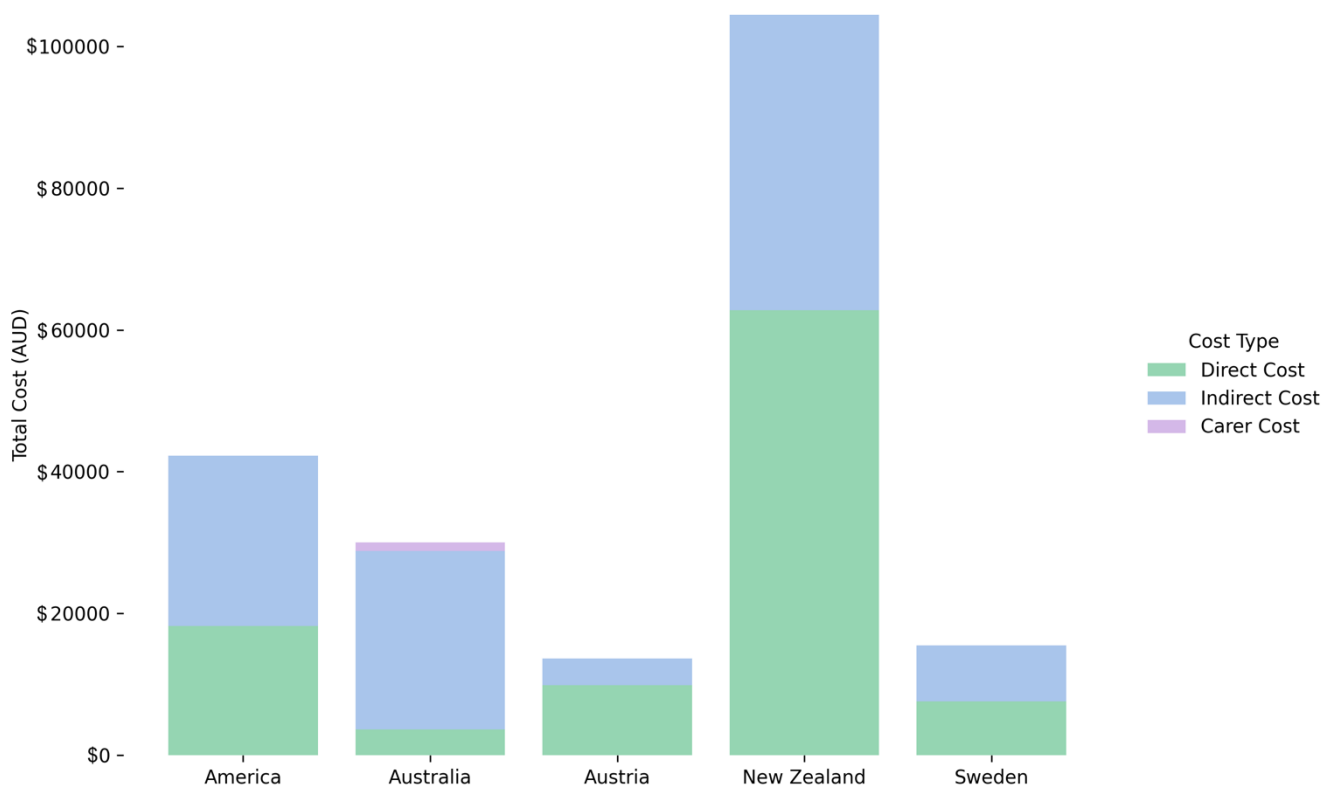


Figure 1. Annual cost of endometriosis per person. All costs have been converted into Australian dollars (AUD) for comparison purposes using current exchange rates at the time of analysis (9:30pm, 14/12/2025; NZD 1 $\approx$ 0.87 AUD). Data sources: Sweden (Grundström et al., 2020); Austria (Prast et al., 2013); USA (Ellis et al., 2022); Australia (Armour et al., 2019); New Zealand (Tewhaiti-Smith et al., 2025).

Beyond these direct and indirect financial costs, the economic burden of endometriosis is further compounded by substantial losses in work productivity and employment outcomes (Sivajohan et al., 2022). Sivajohan et al. (2022) synthesised global evidence from multiple studies, highlighting that indirect costs, particularly losses from reduced effectiveness at work (presenteeism), and absenteeism, often contribute to the largest component of the economic burden. For example, Nnoaham et al. (2011) examined 1,418 premenopausal women aged 18-45 across 16 clinical centres in 10 countries, reporting an average loss of 10.8 hours of work per week due to endometriosis, predominantly from presenteeism. The study also revealed substantial variation between countries, with the economic cost of lost productivity ranging from approximately US \$4 per week per woman in Nigeria to US \$456 per

week per woman in Italy, reflecting differences in wage levels, healthcare access, and socioeconomic context. Armour et al. (2022) further explored workplace impacts in an Australian cohort of 389 women, finding that chronic pelvic pain and fatigue considerably hindered working capacity, often leading to reduced hours, role changes, resignations, or increased sick leave, while workplace flexibility (e.g., flexible scheduling or working from home) mitigated some productivity losses. Collectively, these findings demonstrate that endometriosis exerts a considerable individual and societal productivity burden, affecting women across diverse employment settings and highlighting the interplay between symptom severity, workplace context, and economic consequences globally.

The burden of endometriosis is shaped not only by the presence of symptoms, but also by their severity, encompassing both the intensity of pain, and the broader functional impacts of symptoms. Symptom severity, for example, can be measured using a numeric pain rating scale (0 = no pain; 10 = worst possible pain), as reported by Armour et al. (2020), capturing the influence of pain intensity on daily functioning and work productivity. Other approaches, such as that used by Mitchell et al. (2024), assess severity more broadly, reflecting how disruptive or impactful the symptoms are across multiple aspects of life, including social participation, everyday activities, education, and employment. Across both approaches, higher symptom severity or symptom impact is associated with greater productivity loss, increased healthcare utilisation, reduced social participation, and a more profound impact on quality of life (QoL) (Armour et al., 2020; Mitchell et al., 2024). Women experiencing severe or unpredictable pain and fatigue report greater disruption to education, employment, relationships, and daily functioning, amplifying both direct and indirect costs associated with the condition (Soliman et al., 2016; DiBenedetti et al., 2020). Therefore, both the intensity and functional impacts of symptoms are key drivers of the individual, societal, and economic burden of endometriosis, and are particularly relevant when considering therapeutic interventions targeting symptom management and functional improvement.

1.1.2 Burden in the Australian Context

In Australia, one in seven women are diagnosed with endometriosis by the age of 44 (Australian Institute of Health and Welfare, 2023), making it a significant public health issue (Rowlands et al., 2021; Armour et al., 2022). Approximately 6% of these women have a clinically confirmed diagnosis via laparoscopic surgery, while the other 5% have “clinically suspected” endometriosis (Rowlands et al., 2021). Australians with endometriosis face many out-of-pocket expenses, including pharmaceutical medications, investigations and surgeries, carer support, fertility treatments (in vitro fertilisation), sanitary products, allied health and complementary therapies (Armour et al., 2022). A 2022 study by Malik et al. analysed out-of-pocket expenditure among a sample of 409 Australian women experiencing chronic pelvic pain using a two-month recall period. They reported that one-third of self-reported women with endometriosis accessed at least one allied health or complementary medicine service in a two-month timeframe, with an average individual out-of-pocket cost of AU \$480.32 (Malik et al., 2022), the largest categories of expenditure being physiotherapy, mental health services, naturopathy and acupuncture. Extrapolated over a year, this equates to approximately \$2,880 per woman regularly engaging in such care. Similarly, Armour et al. (2022) found that the main concern amongst Australian women with endometriosis was the financial burden of surgery, reduced work productivity, healthcare, complementary/allied health treatments, pain medication and sanitary products. These findings highlight that the economic impact of endometriosis extends beyond clinical care. Given the substantial personal costs, equitable access to symptom management services represents a significant policy issue (Armour et al., 2022; Malik et al., 2022).

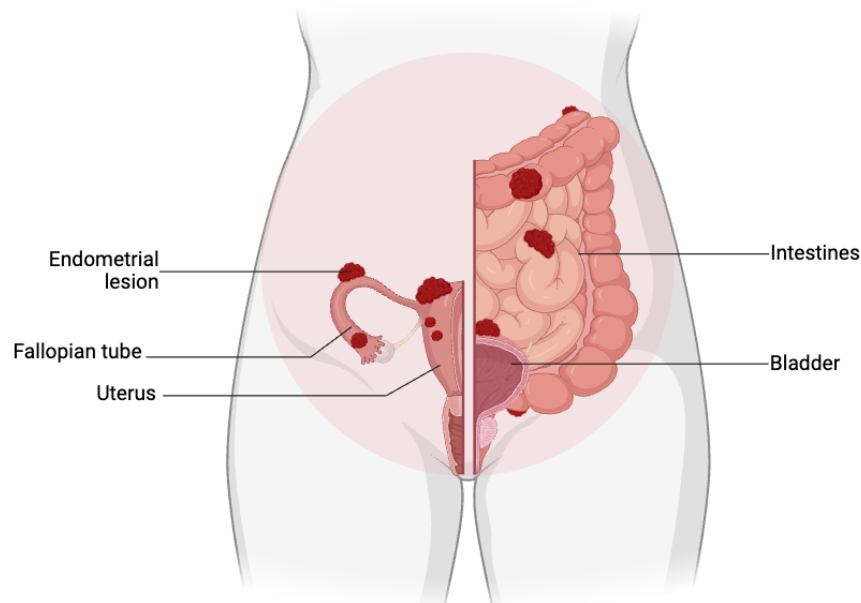
Geographical disparities, socioeconomic status and health literacy influence the availability and ease of access to medical services and alternative healthcare therapies (Rowlands et al., 2022) in Australia. Endometriosis is often framed through clinical stereotypes that depict those affected as “white, lean, middle class, career-driven women” (Rowlands et al., 2022). Such stereotype-driven assumptions can shape diagnostic and treatment practices, leading individuals who fall outside this stereotype to face additional barriers to recognition and care (Rowlands et al., 2022). This narrow stereotype also risks the exclusion of diverse groups of women, such as those from culturally and linguistically diverse backgrounds, lower socioeconomic

positions, or those with different body types, from representation in both research and treatment guidelines (Rowlands et al., 2022). Ethically, this may raise issues of equity and equality, as healthcare resources and evidence-based practices may be tailored towards a demographic that has better access to resources and support systems. From a societal standpoint, this may perpetuate inequalities with access to care and treatment, marginalise already vulnerable population groups, and limit our understanding of the varied experiences of endometriosis. Large-scale epidemiological data indicate that the burden of endometriosis, including disability and years lived with disability, is significantly greater in regions with lower sociodemographic development, reflecting the influence of socioeconomic disadvantage on disease impact and access to effective care (Xu et al., 2025). Women in low sociodemographic regions often face higher disability rates, which may translate into greater impacts on work productivity, economic participation, and QoL, especially where diagnostic and treatment resources are limited (Xu et al., 2025).

1.2 Pathophysiology

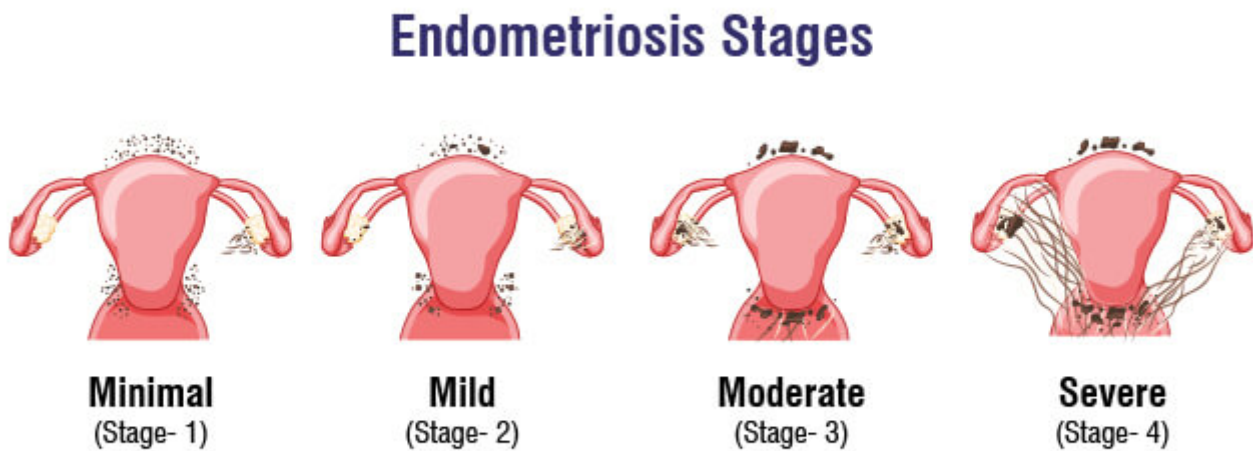
Endometriosis is characterised by the growth of endometrial-like tissue outside the uterus leading to severe pain, infertility, and other health complications (Abril-Coello et al., 2023) (Figure 2). While it primarily affects the pelvic cavity, ectopic tissue can also appear in the heart, lungs, and brain (Chen et al., 2023; Ochoa Bernal & Fazleabas, 2024). Unlike normal endometrial tissue, which sheds during menstruation, this misplaced tissue remains trapped, triggering inflammation, pain, and the formation of scar tissue and adhesions (Klemmt & Starzinski-Powitz, 2018).

Figure 2. Endometrial Lesions Found Within the Body. Created with [BioRender.com](https://www.biorender.com).



The condition manifests in stages, from minimal (stage 1) to severe (stage 4) (see Figure 3). However, symptom severity does not always correlate directly with stage classification (Chen et al., 2023; Ochoa Bernal & Fazleabas, 2024). The complexity of the condition lies in its multifaceted nature, involving hormonal imbalances, immune system dysfunction, and abnormal tissue growth, which persists due to oestrogen dependency and compromised progesterone signalling (Ochoa Bernal & Fazleabas, 2024).

Figure 3. Stages of Endometriosis



Note. From “Stem Cell Therapy for Endometriosis: A New Hope for Pain Relief and Fertility”, by P, D. Deb, 2025, Clinic Spots (<https://www.clinicspots.com/blog/stem-cell-treatment-for-endometriosis>).

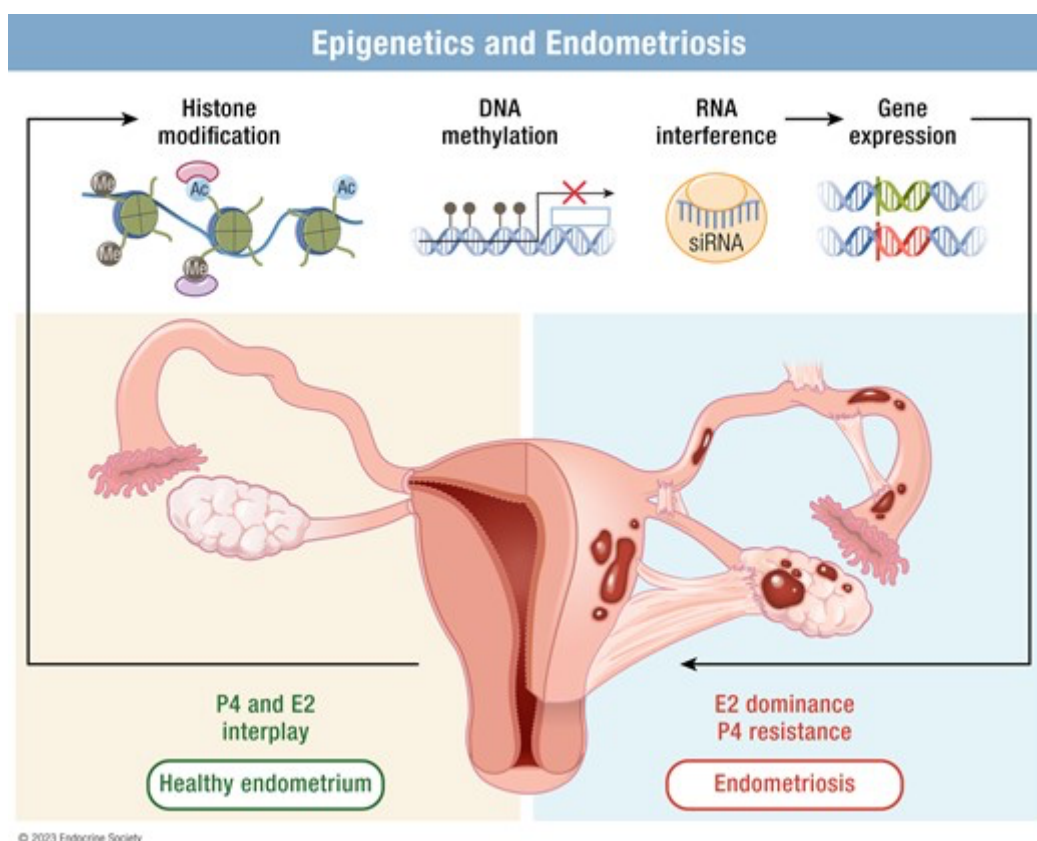
The aetiology of endometriosis is complex, with several theories proposed to explain the underlying pathogenic mechanisms (Ochoa Bernal & Fazleabas, 2024). Key theories include retrograde menstruation, coelomic metaplasia, the embryonic rests theory, and genetic/epigenetic factors (Gupta et al., 2015; Ochoa Bernal & Fazleabas, 2024). Although the retrograde menstruation theory, introduced by Sampson (1925), remains widely accepted, other theories provide explanations for cases that do not align with this model, such as the presence of endometriosis in distant sites or individuals without menstrual flow (Gupta et al., 2015; Ochoa Bernal & Fazleabas, 2024). A table summarizing these theories is provided below (Table 1).

Table 1. Theories and Descriptions of Endometriosis

Theory	Description
Retrograde Menstruation Theory	Proposed by Sampson (1925), suggests menstrual blood flows backward through the fallopian tubes into the pelvic cavity, allowing endometrial cells to implant and grow (Gupta et al., 2015; Ochoa Bernal & Fazleabas, 2024; Vercellini et al., 2024). Although widely accepted, this theory does not explain endometriosis found in distant sites or in individuals without menstruation (Chen et al., 2023).
Coelomic Metaplasia	Peritoneal cells transform into endometrial-like cells due to chronic inflammation, explaining cases in individuals without menstruation (e.g., pre-menarche, post-menopause) (Gupta et al., 2015; Ochoa Bernal & Fazleabas, 2024).
The Embryonic Rests Theory	Endometrial tissue arises from Müllerian duct remnants, differentiating into functioning endometrial tissue under appropriate stimuli, potentially explaining rare cases in men (Gupta et al., 2015; Ochoa Bernal & Fazleabas, 2024).
Genetic/Epigenetic Theory	Genetic and epigenetic changes, as well as cellular process redundancies, contribute to the development of endometriosis (Ochoa Bernal & Fazleabas, 2024). Evidence of familial clustering supports a hereditary component (Ochoa Bernal & Fazleabas, 2024).

Differential expression of key epigenetic regulators, including DNA methyltransferases and demethylases, histone deacetylases, histone methyltransferases and demethylases, and factors governing chromatin architecture, has been reported in endometriosis (Marquardt et al., 2023). Across endometriotic tissues, aberrant DNA methylation and histone modification patterns are consistently observed (Bedrick et al., 2024). These include hypermethylation of tumour-suppressor genes, hypomethylation of oncogenes, and altered methylation of steroid hormone-related genes (Bedrick et al., 2024). Epigenetically altered expression profiles have also been identified in genes involved in steroid hormone synthesis and signalling, immune regulation, and the maintenance of endometrial cell identity and function (Marquardt et al., 2023). Together, these changes are thought to contribute to the pathophysiology of lesion development and the associated infertility observed in endometriosis (Marquardt et al., 2023) (Figure 4).

Figure 4. Epigenetic Factors and Endometriosis



Note. From “Epigenetic dysregulation in endometriosis: implications for pathophysiology and therapeutics”, by R. M. Marquardt, D. N. Tran, M. S. Rahman and J. W. Jeong, 2023, *Endocrine reviews*, 44(6), Abstract, Figure 1 (<https://doi.org/10.1210/endrev/bnad020>). CC BY.

The molecular mechanisms of endometriosis involve hormonal, immune, and inflammatory processes that drive its progression (Ochoa Bernal & Fazleabas, 2024). As an oestrogen-dependent condition, oestrogen promotes the growth and survival of endometrial implants outside the uterus, with these implants also producing oestrogen locally, contributing to the ongoing progression of the disease (Ochoa Bernal & Fazleabas, 2024). Impaired progesterone signalling also disrupts cell growth regulation, leading to more invasive tissue behaviour (Ochoa Bernal & Fazleabas, 2024).

Immune dysfunction also plays a role, as leukocytes exhibit a reduced ability to eliminate misplaced endometrial tissue (Missmer et al., 2021; Ochoa Bernal & Fazleabas, 2024). This, combined with an inflammatory environment marked by elevated cytokines such as interleukin-6 (IL-6) and tumour necrosis factor-alpha (TNF- α), promotes lesion survival and proliferation (Missmer et al., 2021; Ochoa Bernal & Fazleabas, 2024). While the exact causes remain unclear (Chen et al., 2023), hormonal imbalances, immune dysfunction, and genetic factors appear to be key contributors (Missmer et al., 2021). Immune abnormalities in endometriosis include impaired clearance of ectopic endometrial cells, reduced natural killer cell cytotoxicity, and heightened activation of macrophages that release pro-inflammatory cytokines such as IL-6 (Reis et al., 2022). These changes create a chronic inflammatory environment that supports lesion implantation and persistence (Ahmed et al., 2024). Genetic susceptibility also plays a role, with twin and family studies indicating substantial heritability and genome-wide association studies identifying more than 40 risk loci linked to genes involved in hormone signalling, immune regulation, and inflammation (Sapkota et al., 2017; Rahmioglu et al., 2023). Together, these immune and genetic disturbances are thought to predispose individuals to heightened inflammatory responses and the survival of ectopic endometrial tissue (Sapkota et al., 2017; Reis et al., 2022; Rahmioglu et al., 2023; Ahmed et al., 2024).

Emerging evidence suggests that endometriosis is not a static condition, but one that may demonstrate variation in symptom presentation and disease characteristics across the lifespan. Yagur et al. (2025) reported age-related differences in both clinical presentation and disease complexity, with cyclic and non-cyclic pelvic pain

most prevalent in individuals under 25 years of age. Endometriosis severity (stage 3–4) was shown to peak between approximately 25 and 35 years of age and remain relatively stable thereafter, whereas surgical complexity continued to increase beyond 35 years, becoming most pronounced in individuals over 45 years. This progressive increase in surgical complexity has been attributed to factors such as fibrosis, adhesions, and anatomical distortion rather than ongoing disease spread (Yagur et al., 2025). In addition, patterns in lesion presentation also vary across age groups, with endometriomas increasing between 25 and 45 years and declining thereafter, potentially reflecting hormonal changes, menopause-related regression, and differences in clinical management (Yagur et al., 2025). Collectively, these findings indicate that both symptom burden and disease complexity may vary across the lifespan, contributing to heterogeneity in clinical presentation and functional impact among women with endometriosis.

1.3 Symptomatology

1.3.1 Key Physical Symptoms

Endometriosis causes debilitating symptoms that significantly impact quality of life (QoL) (Mitchell et al., 2024). Among Australian women with endometriosis, the most debilitating symptoms reported include pelvic pain, fatigue, period pain, infertility, mood fluctuations, and limitations in daily activities such as walking, sleeping, and eating (Mitchell et al., 2024). Pelvic pain, often beginning in adolescence and commonly linked to dysmenorrhoea, disrupts daily activities, and contributes to work and education-related absenteeism (Armour et al., 2020; Missmer et al., 2021; Maulenkul et al., 2024).

1.3.2 Pain and Fatigue

Pain is a primary and defining symptom of endometriosis, commonly experienced as chronic pelvic pain, dysmenorrhoea, and discomfort during daily activities (Leuenberger et al., 2022). It is highly prevalent and often severely impacts physical functioning, QoL, and participation in daily activities across the lifespan (Missmer et al., 2021). As such, pain represents a central symptom when considering both the lived experience of endometriosis and potential management strategies (Ramin-Wright et al., 2018; Silva et al., 2024). Pain arises through interrelated inflammatory, peripheral, and central mechanisms (Maddern et al., 2020). Inflammation within the

peritoneal cavity and at ectopic lesion sites is a key driver, where cyclical bleeding and tissue breakdown trigger immune responses characterised by cytokines and chemokines (Barcz et al., 2000), neutrophils and prostaglandins (Sacco et al., 2012; Králíčková & Větvíčka, 2015), and reactive oxygen species and growth factors (Donnez et al., 1998), all contributing to nociceptor activation and persistent pain signalling (Maddern et al., 2020). This inflammatory milieu also drives neurogenic inflammation, whereby mediators such as prostaglandin E2 and reactive oxygen species directly stimulate sensory nerve endings (Reeh and Steen, 1996; Holzer, 2011), promoting the release of proinflammatory modulators that further amplify local inflammation in a feedback loop (Tokushige et al., 2006). At the peripheral level, ongoing exposure to inflammatory mediators contributes to peripheral sensitisation through reduced neuronal function and increased responsiveness to painful stimuli (Chiu et al., 2012; Brierley & Linden, 2014). With continued nociceptive input, this may progress to central sensitisation, where persistent central nervous system activation alters pain processing, amplifies pain perception, and allows pain to persist beyond peripheral inflammation (Bajaj et al., 2003; Woolf, 2011). Cross-organ sensitisation may also occur, as converging afferent pathways within the spinal cord facilitate pain spread between anatomically distinct but neurologically linked pelvic organs, contributing to the diffuse pain presentation seen in endometriosis (Ge et al., 2019). Visceral hypersensitivity is also highly prevalent in endometriosis and may contribute to amplified pain perception, with evidence suggesting that symptom severity is often disproportionate to the extent of visible disease (Issa et al., 2012).

In addition to nociceptive and peripheral mechanisms, pain in endometriosis is increasingly understood through a contemporary pain science framework that incorporates non-nociceptive, central, and top-down processes (Moreira & Oliveira, 2025). Within this model, pain is conceptualised as an emergent experience shaped not only by peripheral inflammatory signalling, but also by central processing within brain networks involved in salience detection, cognitive appraisal, and sensorimotor integration. Lesion-related nociceptive input and inflammatory signalling may increase afferent drive to the central nervous system; however, pain intensity, spread, and persistence are simultaneously modulated by descending inhibitory and facilitatory pathways, which are influenced by psychological, cognitive, and affective states (Moreira & Oliveira, 2025). This helps explain the frequently observed

dissociation between disease burden and symptom severity in endometriosis, where pain experience is not always proportional to visible pathology.

Exercise may influence pain perception through central nervous system adaptations and changes in brain function (Palmer et al., 2023). In chronic pain populations, exercise interventions lasting ≥ 12 weeks, including aerobic and resistance training, (RT) have been shown to improve brain function and pain perception, with observed changes in key cortical regions such as the cortico-limbic pathway, default mode network, and dorsolateral prefrontal cortex, suggesting exercise may help restore or normalise maladaptive pain-processing networks (Palmer et al., 2023). These neurophysiological changes appear to coincide with improvements in pain and QoL, supporting the idea that exercise may improve the subjective experience of chronic pain through central reorganisation. Exercise may also influence the psychological dimensions of pain, as chronic pain is often accompanied by anxiety, depression, catastrophising, fatigue, and reduced daily functioning, all of which can exacerbate pain perception (Çalışkan & Gökkaya, 2025). Improvements in positive mood, emotional regulation, and self-efficacy, potentially mediated by regions such as the orbitofrontal cortex, may further strengthen pain resilience and improve coping (Çalışkan & Gökkaya, 2025). Emerging rehabilitation evidence in endometriosis also suggests that exercise-based interventions can improve pain and QoL; however, intervention heterogeneity and high risk of bias continue to limit conclusions regarding optimal exercise modalities or prescriptions (Rodríguez-Ruiz et al., 2025). Collectively, these findings suggest that RT may offer a promising avenue for improving pain responses through both central and psychological pathways, although direct evidence in women with endometriosis remains limited.

The nature of endometriosis-related pain varies widely, making management challenging (Xie et al., 2025). Pain mechanisms involve local pelvic factors, such as nerve fibre growth and inflammation, as well as central nervous system influences, including stress and psychological responses (Signorile et al., 2022). Unpredictable pain episodes, also known as “endo flares”, pose a significant challenge and can negatively impact work, education, sexual and social relationships, self-identity, and body image (Giese et al. 2023).

Fatigue is another common symptom that, when combined with pain, reduces productivity and social engagement (Álvarez-Salvago et al., 2020; Armour et al., 2020). In women with endometriosis, there is a strong relationship between chronic pain and fatigue, with individuals experiencing higher pain levels often reporting more significant fatigue (Ramin-Wright et al., 2018). This relationship may explain the elevated prevalence of chronic fatigue syndrome in individuals with endometriosis compared to the general population (Armour et al., 2020). Chronic fatigue is believed to be driven, in part, by immune dysregulation and inflammation from endometrial lesions, with elevated inflammatory cytokines positively correlated with fatigue severity (Ramin-Wright et al., 2018). During the activation of the immune system, a recognised feature of endometriosis, immune cells produce pro- and anti-inflammatory cytokines, which have the capacity to act on the central nervous system, and trigger behavioural changes, including the development of fatigue (Karshikoff et al., 2017). These cytokine signals reach the brain through several pathways, including by a neuronal pathway via the vagus nerve, where they induce modifications in neurotransmitter systems and neuroendocrine activity, and broader brain functioning (Karshikoff et al., 2017). Together, these processes initiate the behavioural alterations that characterise inflammation-related fatigue (Karshikoff et al., 2017). While treatment often focuses on pain and infertility, addressing fatigue is essential due to its significant contribution to overall symptom burden (Ramin-Wright et al., 2018). Personalised interventions that target pain, fatigue, and functional impairments may help reduce the long-term impact of endometriosis on QoL and physical functioning (Ramin-Wright et al., 2018; Silva et al., 2024).

1.3.3 Symptom Severity

Symptom severity represents a fundamental aspect of the endometriosis experience and is highly variable across individuals. While pain and fatigue are consistently identified as the most debilitating symptoms, their severity and unpredictability often determine the extent to which daily functioning, employment, relationships, and overall QoL are affected (Armour et al., 2020; Giese et al., 2023; Mitchell et al., 2024). Importantly, severity does not always align with disease stage, which further complicates clinical management and self-management strategies (Signorile et al., 2022). Given that severe and fluctuating symptoms frequently disrupt physical

activity (PA) behaviours, the consideration of symptom severity is critical when examining treatment options and lifestyle-based management strategies.

1.3.4 Multisystem Symptom Onset and Burden

Individuals with endometriosis experience a broad range of symptoms including chronic pelvic and back pain, abdominal pain, chronic fatigue, nausea and vomiting (Sivajohan et al., 2022), dysmenorrhoea (menstrual pain), dyspareunia (painful sex), dysuria (painful urination), dyschezia (painful defecation), metrorrhagia (mid-cycle bleeding), diarrhoea, constipation, infertility, myofascial pain (Ellis et al., 2022) and migraines (Capezzuoli et al., 2022). The onset of these symptoms begins at a young age, during what should be the most productive period of their lives (Ellis et al., 2022). The age at onset of endometriosis symptoms such as dysmenorrhoea, menorrhagia (abnormally heavy or prolonged menstrual bleeding), abnormal or irregular uterine bleeding, and at least one gastrointestinal and genitourinary symptoms, can begin as early as pre-menarche (ages 10-14) or in adolescents (aged 10-21) (Dun et al., 2020; Samanta et al., 2024). Pain and infertility are two of the most prominent symptoms, and individuals experiencing these face higher rates of depression, anxiety and chronic stress (Capezzuoli et al., 2022; Ellis et al., 2022), which significantly diminishes the patient's QoL (Sivajohan et al., 2022). Additionally, women with endometriosis are at greater risk of developing comorbidities compared to their healthy peers (Teng et al., 2016; Capezzuoli et al., 2022; Eisenberg et al., 2022; Ellis et al., 2022), including several cancers, autoimmune diseases, cardiovascular disease, atopic conditions such as asthma and allergies, musculoskeletal and psychological conditions (Kvaskoff et al., 2015). These comorbidities pose significant risks to the long-term health of women with endometriosis (Teng et al., 2016). Multiple hypotheses suggest that shared risk factors, such as genetic predisposition, immune dysfunction, and chronic inflammation, may contribute to the co-occurrence of endometriosis and other comorbid conditions (Kvaskoff et al., 2015).

1.3.5 Psychological Health and Health-Related Quality of Life

Endometriosis significantly impairs psychosocial functioning and health-related QoL (HRQoL) (Sivajohan et al., 2022). Compared to women without a diagnosis of

endometriosis, those with the condition experience particularly reduced physical HRQoL, specifically in terms of body pain and physical functioning scores (Sivajohan et al., 2022). When using the Endometriosis Health Profile-5 (EHP-5), 43% of 193 women with surgically diagnosed endometriosis reported that their pain considerably interferes with work, and 41% of 193 patients reported suffering from physical impairments, such as difficulties walking (Fourquet et al., 2011). Endometriosis can negatively impact all aspects of these women's lives, including work, education, body image, self-identity, sexual and social relationships (Armour et al., 2022), with many women reporting feelings of embarrassment about their symptoms (Ellis et al., 2022). Importantly, HRQoL outcomes appear to be shaped by the interplay between physical and psychological factors. Previous research has highlighted that pain, difficulties with emotion regulation, and psychological stress together explained 41% of the variation in physical HRQoL and 55% of the variance in mental HRQoL among 193 women living with endometriosis (Aerts et al., 2018). While the physical component of HRQoL was primarily driven by pain symptoms, the mental component of HRQoL was significantly influenced by pain either directly or indirectly caused by psychological stress (Aerts et al., 2018). In fibromyalgia patients, psychological comorbidities such as depression and anxiety are highly prevalent, and have been shown to exacerbate symptom severity and reduce QoL (Amezqueta & García González). In a study of 59 fibromyalgia patients, anxiety and depressive symptoms assessed via the Hospital Anxiety and Depression Scale were moderately correlated with symptom severity scores ($r = 0.442$; $p < 0.01$) and negatively correlated with both physical ($r = -0.417$; $p < 0.01$) and mental ($r = -0.678$; $p < 0.01$) QoL measures (Amezqueta & García González). These results suggest that greater psychological distress is closely associated with more severe fibromyalgia symptoms and poorer physical and mental health outcomes, highlighting the interplay between chronic pain and psychological wellbeing (Amezqueta & García González). Similar patterns have been observed in endometriosis, where higher levels of psychological distress, including anxiety and depression, have been associated with increased pain severity and poorer quality of life outcomes (Kalfas et al., 2022). Collectively, these findings highlight the interaction between chronic pain and psychological wellbeing, suggesting that similar biopsychosocial mechanisms may contribute to HRQoL impairments in endometriosis, where pain and psychological distress interact to influence overall health outcomes.

1.3.6 Psychosocial Outcomes

Psychosocial functioning is significantly impaired among women with endometriosis, extending across life opportunities, personal finances, sexual dysfunction, relationships with partners, general psychology and other everyday activities (Sivajohan et al., 2022). In particular, chronic pain symptoms related to reproductive anatomy can have greater psychosocial consequences due to the extensive impacts on fertility, sexual discomfort, and interpersonal relationships, compared to other chronic pain conditions (Aerts et al., 2018). Consistent with this, and compared to a non-endometriosis control group, women with endometriosis report significantly higher levels of functional pain disability ($p < 0.001$), which interferes with daily activities such as sleep, work and relationships (Evans et al., 2021). The disruption to social functioning is substantial, with studies estimating that 19-48% of women with endometriosis reduce social activities due to pain, fatigue, and concern about symptom onset, fostering social isolation and feelings of loneliness (Culley et al., 2013). These social impacts often intersect with challenges in intimate relationships, with incapacitating pain and dyspareunia symptoms frequently leading to avoidance of intimacy and in some cases contribute to relationship breakdown (Culley et al., 2013). These relational disruptions are compounded by broader psychological consequences. Women with endometriosis commonly report feelings of guilt towards partners, altered body image, and feelings of worthlessness and hopelessness (Aerts et al., 2018). Additionally, elevated levels of stress, anxiety, depression and pain catastrophising are consistently observed, intensifying the psychosocial burden (Aerts et al., 2018). Endometriosis substantially affects occupational functioning, with symptoms limiting work ability and productivity, and leading many women to change job or exit the workforce due to performance difficulties or the frequent use of sick leave (Aerts et al., 2018). These work disruptions have downstream financial consequences, as individuals with endometriosis experience lower and slower-growing salaries, earning approximately USD \$3,700 to \$6,600 less per year over a five-year period, along with greater workforce instability, and increased use of leave or short-term disability compared with matched controls (Estes et al., 2020). These findings highlight how the occupational impacts of endometriosis contribute to

reduced income stability and broader psychosocial and QoL consequences over time.

1.3.7 Comorbidities and Lifestyle Factors

Women with endometriosis experience a significantly higher risk of developing comorbid conditions such as infertility/subfertility, ovarian cysts, uterine fibroids, pelvic inflammatory disorder, interstitial cystitis, irritable bowel syndrome, constipation/dyschezia, ovarian cancer, and endometrial cancer ($p \leq 0.001$) compared to matched women without endometriosis (Surrey et al., 2018). These comorbidities further reduce QoL through various mechanisms (Capezzuoli et al., 2022). Uterine fibroids can contribute to heavy menstrual bleeding, pain, and infertility, compounding the symptom burden (Capezzuoli et al., 2022). Autoimmune disease may intensify systemic inflammation and exacerbate pelvic pain (Capezzuoli et al., 2022). Mental health conditions can heighten psychological distress and disability, reducing overall functioning and disrupting activities of daily living (Capezzuoli et al., 2022). Metabolic and cardiovascular risks are elevated, with endometriosis being linked to an increased risk of hypertension, coronary heart disease, hypercholesterolemia, abnormal liver metabolism and deficient thyroid function have (Holdsworth-Carson & Rogers, 2018). Lifestyle factors appear to contribute to this heightened risk, as women with endometriosis report lower levels of PA than their healthy counterparts, including fewer hours of sport per week ($p < 0.001$), and fewer stairs climbed ($p < 0.038$), which may intensify symptom burden and have long-term health implications (Sachs et al., 2023). Reduced levels of PA and increased sedentary behaviours often interact in a bidirectional manner, whereby low levels of PA can promote sedentary habits, and high sedentary time may further limit opportunities for PA and exercise (Mansoubi et al., 2014). Together, these behaviours can exacerbate comorbidities such as cardiovascular disease, metabolic dysfunction, and inactivity related muscle loss (Holdsworth-Carson et al., 2018; Sachs et al., 2023).

1.4 Current Treatments

The European Society of Human Reproduction and Embryology (ESHRE) guidelines provide a structured approach for the treatment of endometriosis to alleviate pain, preserve fertility, and improve QoL (Uccella et al., 2016; Becker et al., 2022). First-line treatments prioritise pain management, with non-steroidal anti-inflammatory drugs used to manage pain and inflammation (Becker et al., 2017; Clemenza et al., 2018; Becker et al., 2022). Hormonal therapies, including combined hormonal contraceptives, progestins, and gonadotropin-releasing hormones (GnRH), are commonly prescribed to suppress ovarian function, reduce oestrogen production, and control endometriosis lesion growth (Berlanda et al., 2016; Uccella et al., 2016; Becker et al., 2017; Bedaiwy et al., 2017; Clemenza et al., 2018; Becker et al., 2022). When medical management is insufficient, or there is a severe symptom profile and infertility, surgical interventions, such as excision or ablation of endometriosis lesions, may be recommended (Uccella et al., 2016; Singh et al., 2020) (Table 2).

The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) guideline provides a complementary but more context-specific framework for Australian clinical practice, with its 2021 release and 2025 Living Evidence update reflecting an evolving national evidence base. While broadly aligned with ESHRE in recommending a stepwise escalation of care, including analgesia, hormonal therapy, and surgical intervention, RANZCOG places greater emphasis on implementation within the Australian healthcare system, particularly regarding referral pathways, multidisciplinary care access, and feasibility in primary and specialist settings (Royal Australian and New Zealand College of Obstetricians and Gynaecologists, 2025). In contrast, ESHRE functions as an established international benchmark with extensive integration in the global literature, whereas RANZCOG is oriented toward local clinical translation and ongoing evidence updating within a national context. Together, these guidelines provide complementary international and Australian perspectives on the management of endometriosis.

Table 2. Medications Used in the Management of Endometriosis

Drug Class	Reason for prescription	Pro's	Con's
Oestrogen-progestogen combinations	• Low-risk lesions • Ovarian endometriomas • Dysmenorrhoea as most disabling symptom	• Popular • Generally well-tolerated • Inexpensive • Long-lasting reduction in ovarian cancer risk • Reduction in post-operative endometrioma recurrence risk	• Venous thromboembolism • Limited and temporary increase in breast-cancer risk
Progestogens	• High-risk lesions • Deep dyspareunia as most distressing symptom	• Safe • Generally well-tolerated • Inexpensive	• Associated with depression • Reduced sexual functioning • Reduced BMD • Frequent breakthrough bleeding
GnRH agonists	• Nonresponse • Intolerance • Contraindications to oestrogen-progestogen combinations and progestogens	• Timing, type, dose, and delivery can be customised • Add-back therapy allows temporary discontinuation of breakthrough bleeding • Can be combined with	• Oestrogen-deprivation symptoms • Reduced BMD during prolonged use without add-back therapy • Expensive

hormonal replacement therapies (i.e., oestradiol)			
GnRH antagonists	• Nonresponse • Intolerance • Contraindications to oestrogen-progestogen combinations and progestogens	• Preferred delivery route (oral) • Can be immediately discontinued • Can be combined with add-back therapies in a single tablet	• Low doses suppress oestradiol synthesis • Associated with frequent erratic bleeding • Suboptimal pain relief

Note. Table adapted from “Update on medical treatment of endometriosis: new drugs or new therapeutic approaches?”, by P. Vercellini, C. Buffo, P. Viganò and E. Somigliana, 2025, *Gynaecologic and Obstetric Investigation*, 90(6), Table 2 (PMID: [39724866](#))

Despite these guideline-based approaches, lifestyle interventions are not considered primary treatments for endometriosis; however, they are frequently recommended as adjunct strategies within multidisciplinary care to support symptom management and overall health (Giese et al., 2023). In Australia, treatment satisfaction, particularly regarding healthcare services and medical outcomes, is often low, with many women expressing dissatisfaction with hormonal therapies and surgical interventions due to side effects and symptom recurrence (Evans et al., 2022; Giese et al., 2023). While successful treatment outcomes show potential improvements in pain relief and QoL (Uccella et al., 2016), deficiencies in current therapies, such as limited efficacy, high rates of symptom recurrence, and significant side effects, mean that many women remain symptomatic during or after treatment, or discontinue therapy due to intolerable side effects (Becker et al., 2017). Adverse events experienced by women with endometriosis following surgical interventions, such as damage to nearby organs, lesions and scarring (Uccella et al., 2016), infection, blood clots, blood loss and postoperative pain (Singh et al., 2020), suggest that exploring non-surgical approaches may be a preferable first-line option before resorting to surgery. More recently there has been growing interest in holistic, multidisciplinary approaches that

integrate medical and allied health (Giese et al., 2023) as well as complementary exercise-based treatments like RT (Afreen et al., 2024).

1.5 Physical Activity for Endometriosis

1.5.1 Conceptualisation of Physical Activity and Exercise

Physical activity (PA) and exercise offer broad benefits for managing endometriosis through various mechanisms (Tourny et al., 2023). Physical activity (PA) refers to any body movement produced by skeletal muscles that results in energy expenditure, including sport and conditioning activities as well as daily activities such as occupational and household tasks (Caspersen, Powell & Christenson, 1985). Exercise is a structured form of PA undertaken to improve or maintain physical fitness, such as gym-based training or organised sport sessions (Caspersen, Powell & Christenson, 1985).

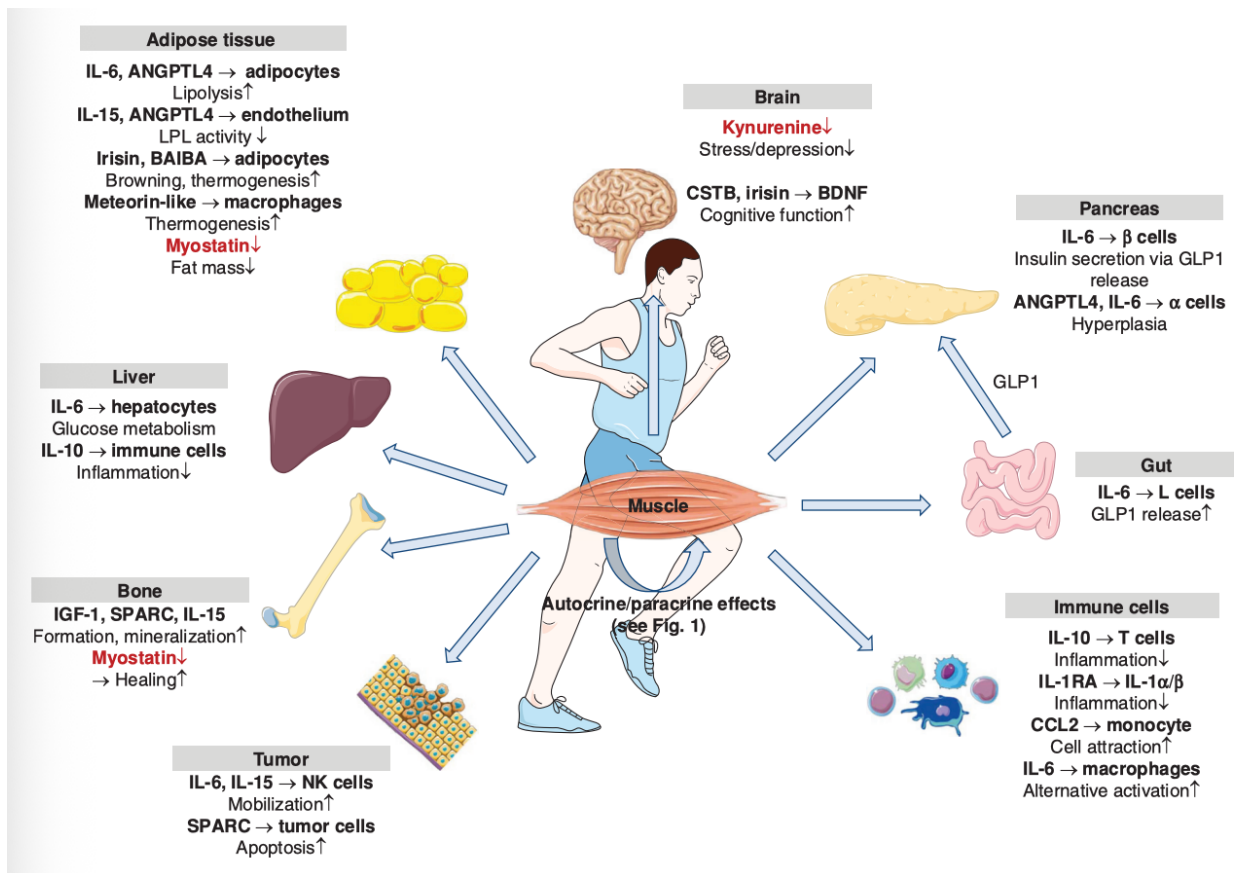
1.5.2 Biopsychosocial Mechanisms of Physical Activity in Endometriosis

A biopsychosocial perspective conceptualises PA as a complex behaviour shaped by the interaction of biological, psychological, and social determinants rather than isolated influences (John et al., 2020). This framework is particularly relevant in endometriosis, where symptom burden, cognitive-emotional responses, and environmental context collectively influence engagement in PA and exercise-based management strategies.

1.5.2.1 Biological Mechanisms

From a biological perspective, PA elicits a range of acute and chronic responses that may be relevant to symptom modulation in endometriosis. Skeletal muscles, acting as endocrine organs, release myokines during contraction, positively affecting organs such as the pancreas and liver (Tennfjord et al., 2021; Tourny et al., 2023). Through these pathways, exercise may improve insulin sensitivity and glucose metabolism, helping to mitigate chronic inflammation, which is often associated with endometriosis (Balakrishnan & Thurmond, 2022) (Figure 5).

Figure 5. Endocrine Effects of Exercise



Note. From “Skeletal muscle as an endocrine organ: the role of myokines in exercise adaptations.”, by C. Hoffmann and C. Weigart, 2017, *Cold Spring Harbor perspectives in medicine*, 7(11), Figure 2 (a029793). CC BY.

Exercise also increases leucocyte, cortisol and adrenaline production, which possess acute anti-inflammatory properties (Tennfjord et al., 2021; Tourny et al., 2023). Inflammatory cytokines are also altered after exercise, in which IL-6 produces an anti-inflammatory effect (Benatti & Pedersen, 2015; Docherty et al., 2022). However, its precise role is complex and context dependent, involving both pro-inflammatory and anti-inflammatory actions (Cerqueira et al., 2020). While these findings provide a strong theoretical rationale for the role of PA in modulating inflammation, much of the evidence is derived from general exercise physiology rather than the endometriosis population specifically. This limits the direct applicability of findings to endometriosis symptom management.

1.5.2.2 Psychological Mechanisms

Psychological factors are central to both the experience of endometriosis and engagement in physical activity (PA), shaping behaviour through cognitive, motivational, and affective processes (John et al., 2020; Netzl et al., 2024). Constructs such as attitudes, self-efficacy, perceived behavioural control, motivation, and illness perceptions consistently influence willingness and confidence to engage in PA, as outlined in the Theory of Planned Behaviour (Ajzen, 1991; Milane et al., 2025). In endometriosis populations, these determinants interact with perceived physical capability and symptom expectations, including fear of symptom exacerbation and kinesiophobia, which may reinforce avoidance of PA and reduce long-term adherence (Milane et al., 2025). In conjunction, negatively influenced body image, self-esteem, and perceived physical competence further diminish exercise confidence, reinforcing a cycle of reduced engagement (Milane et al., 2025). Collectively, these findings demonstrate that PA participation is not solely determined by physical capacity, but is strongly shaped by cognitive appraisal and emotional responses to the condition (Milane et al., 2025). Beyond behaviour, psychological processes also strongly influence broader health outcomes and pain experiences in endometriosis (Pickup et al., 2025). Self-efficacy, sense of coherence, coping capacity, and treatment satisfaction are associated with both physical and mental health, highlighting the role of adaptive psychological resources in supporting adjustment and wellbeing (Netzl et al., 2024). Conversely, symptom invalidation, fear-avoidance processes, and heightened symptom vigilance contribute to increased pain-related distress and reduced engagement in care, while undermining trust in healthcare systems (Pickup et al., 2025). In contrast, adaptive processes such as acceptance, flexible goal pursuit, and identity formation beyond illness are associated with reduced distress and improved wellbeing, reflecting the importance of how individuals interpret and make sense of chronic symptom experience and management (Pickup et al., 2025). Together, these psychological mechanisms illustrate a dynamic interplay between maladaptive and adaptive cognitive-emotional processes that influence both PA engagement and pain-related outcomes in endometriosis.

1.5.2.3 Social Mechanisms

Social and environmental factors, including interpersonal relationships, community context, and built environment characteristics, are recognised as important determinants of PA behaviour (John et al., 2020). Social and structural factors, including socioeconomic status, access to healthcare, and patient-clinician relationships, significantly influence health outcomes in women with endometriosis (Netzl et al., 2024). Interpersonal support from family and peers may facilitate participation in PA, while the quality of social relationships can influence motivation and adherence (Milane et al., 2025). Environmental factors, including perceived safety, and access to exercise facilities may further enable or constrain participation in PA, highlighting the role of both interpersonal and environmental influences in understanding and shaping exercise behaviours in this population (Milane et al., 2025). At a structural level, socioeconomic status, access to healthcare, and the quality of patient-clinician relationships significantly influence health outcomes in endometriosis (Netzl et al., 2024). Lower socioeconomic status and delayed diagnosis are associated with poorer physical and mental health, reflecting broader healthcare access inequities (Netzl et al., 2024). In addition, satisfaction with gynaecological care and quality of patient-doctor communication are important determinants of wellbeing, reinforcing the role of healthcare relationships in disease management (Netzl et al., 2024). In addition, experiences of symptom invalidation within healthcare settings, alongside wider gendered biases in medicine and the under-recognition of women's pain, contribute to stigma, reduced trust, and suboptimal care pathways (Pickup et al., 2025). Collectively, these social and structural influences interact with psychological and biological processes, shaping engagement in PA through their effects on perceived safety, access to resources, motivation, and healthcare trust, thereby reinforcing the broader biopsychosocial mechanisms underpinning exercise behaviour in endometriosis.

1.5.2.4 Integrated Perspective

Physical activity (PA) behaviour in endometriosis is best understood through an interacting biopsychosocial system in which biological capacity, psychological appraisal, and social-structural context continuously shape one another rather than operating independently (John et al., 2020). From a biological standpoint, symptom

severity and physiological responses to exercise may influence perceived capability and tolerance for PA, which in turn affect behavioural engagement. However, these physiological factors are filtered through psychological processes, including illness perceptions, self-efficacy, fear of symptom exacerbation, and cognitive appraisal of bodily sensations, which collectively determine whether PA is interpreted as beneficial or threatening (Ajzen, 1991; Milane et al., 2025).

These psychological processes are further embedded within social and structural environments that either enable or constrain engagement in PA. Access to healthcare, quality of patient–clinician communication, socioeconomic position, and broader sociocultural attitudes toward women’s pain shape both illness understanding and trust in exercise as a management strategy (Netzl et al., 2024; Pickup et al., 2025). Experiences of symptom invalidation and gendered bias within healthcare systems may further reinforce maladaptive cognitive-emotional responses, reducing engagement in PA through diminished confidence, reduced perceived legitimacy of symptoms, and lowered healthcare trust (Pickup et al., 2025). Conversely, supportive interpersonal relationships and accessible environments can facilitate engagement by enhancing motivation, perceived safety, and adherence.

Collectively, these interacting domains form dynamic feedback loops in which symptom burden influences psychological responses, psychological interpretations shape behavioural choices, and social-contextual factors either amplify or ameliorate these effects. The COmprehensive Model of Pain encompassing Agency, Systemic factors and Sense making model of endometriosis-related pain further extends this framework by demonstrating how systemic influences (e.g., healthcare structures and gendered norms) interact with psychological processes such as identity, validation, and sense-making to shape both pain experience and coping behaviours (Pickup et al., 2025). Together, this reinforces PA in endometriosis as a multidimensional behaviour that emerges from ongoing biopsychosocial interaction rather than isolated determinants, underscoring the need for integrated, context-sensitive approaches to exercise prescription and management.

1.5.3 General Physical Activity and Combined Exercise Interventions

Xie et al. (2025) conducted a systematic review and meta-analysis of six randomised control trials (RCTs), involving a total of 251 participants, to evaluate the effects of PA and exercise on women diagnosed with endometriosis. Across these studies, interventions ranged from aerobic training, stretching, resistance exercise, and flexibility work, to more specialised approaches such as yoga, virtual reality-delivered exercises, or telehealth-delivered programmes, and personalised aerobic sessions at 50-70% of maximal heart rate. Despite this heterogeneity in exercise intervention modality, the review reported beneficial effects on QoL, pain intensity ($p < 0.001$), mental health ($p < 0.001$), pelvic floor dysfunction ($d = 0.81$; 95% CI -0.30 to 1.32) and bone density, with secondary analyses highlighting significant improvements in QoL, particularly in the context of pain (95% CI -30.25 to -10.18, $p < 0.0001$), emotional well-being (95% CI -24.44 to -4.08, $p = 0.006$), and the sense of control and powerlessness (95% CI -31.59 to -14.45, $p < 0.00001$). These benefits were interpreted as consistent with proposed mechanisms such as enhanced pain modulation and anti-inflammatory cytokine responses (Xie et al., 2025). However, the evidence base remains limited by methodological weaknesses, including short intervention lengths, with differing training/exercise modes and dosages, and small sample sizes. Therefore, the authors emphasise the need for future research involving larger, high-quality, long-term RCTs to strengthen the evidence and support clinical recommendations for the use of PA and exercise in managing endometriosis-related symptoms.

1.5.4 Aerobic Exercise

Regular aerobic exercise, particularly performed at a moderate to higher intensity, appears to be beneficial for alleviating pain and improving QoL outcomes for women with endometriosis (Moncrieff et al., 2023, McKnight et al., 2024). Aerobic exercise may exert physiological effects through cardiovascular conditioning, autonomic regulation, and anti-inflammatory pathways (Masson et al., 2015). In some cases, psychosocial components such as group-based participation may also contribute to improved mental health outcomes and adherence (Palm et al., 2024; Pursley et al., 2025). Lower-impact aerobic activities, such as structured dance therapy, have shown preliminary benefits for mental health outcomes in endometriosis. For

example, in a prospective cohort study of six women, participation in a 12-session dance intervention over eight weeks was associated with statistically significant reductions in depression and anxiety and improvements in both mental and physical domains of quality of life ($p < 0.05$), despite no significant changes in pain (Rius et al., 2018). Given the small sample size and absence of reported effect sizes, these findings should be interpreted cautiously and viewed as exploratory.

In part, these benefits may stem from the social components embedded within certain forms of physical activities. In such cases, improvements may be less related to exercise intensity, and more attributable to the nature of the activity itself. For example, evidence from neurological conditions such as Parkinson's disease shows that group-based exercise produces better responses in depression and anxiety, largely due because participant's report valuing the opportunities for the social interaction and long-term adherence it provides (Palm et al., 2024). Individuals with Parkinson's also report that exercising in group settings enhances feelings of community and engagement, contributing to improved outcomes (Palm et al., 2025). Similarly, evidence from fibromyalgia interventions indicates that group-based PA interventions are valued for the social interaction, peer support, pain validation, and shared experiences they provide, which may enhance engagement and adherence to exercise (Pursley et al., 2025). The cumulative evidence suggest that the social context of exercise may play an important role in supporting ongoing participation in populations with chronic, fluctuating symptoms.

Regular aerobic exercise may also exert intensity-dependent physiological effects. High-intensity aerobic exercise has been defined as work above the second metabolic threshold but below maximal effort, corresponding to 6–7 on the Rate of Perceived Exertion (RPE) scale and typically perceived as “hard” (Bishop et al., 2024). In healthy adult populations, higher-intensity exercise elicits greater acute immune and inflammatory responses compared with moderate-intensity exercise, including larger changes in cytokines such as IL-6 and IL-10 (Cerqueira et al., 2020). However, in endometriosis, the evidence remains limited due to inconsistent reporting of exercise variables and a lack of systematic inflammatory outcome measurement, making dose-response relationships unclear. The role of progressive overload in this population also remains underexplored, further limiting

understanding of how exercise intensity and adaptation may influence inflammatory responses over time (Slade et al., 2016; Tennfjord et al., 2021). In the context of higher-intensity aerobic exercise, the primary outcomes considered in the literature include inflammatory markers (e.g., IL-6 and IL-10), with limited reporting of secondary outcomes including pain, fatigue, and broader measures of physical function and QoL; however, evidence in endometriosis remains limited across all domains.

1.5.5 Alternative Exercise

Among women with endometriosis, alternative modalities such as yoga, Pilates, stretching, and meditation are commonly used as self-management strategies, with 35% of women (n = 131) engaging in yoga/Pilates, 47% (n = 175) practicing meditation or breathing exercises, and 40% (n = 148) incorporating stretching (Armour et al., 2019). These activities have been seen to significantly improve well-being and QoL scores ($p = 0.0027$), however, are reported to be less effective for pain reduction ($p > 0.05$) (Tennfjord et al., 2021; McKnight et al., 2024). In these trials, pain was typically measured using the Visual Analogue Scale ($p > 0.05$) or the Endometriosis Health Profile-30 (EHP-30; $p < 0.001$), although these findings may be limited by small samples sizes (Tennfjord et al., 2021). In the combined exercise-relaxation programs reviewed by McKnight et al. (2024), premenstrual pelvic pain, assessed using the Present Pain Intensity scale, rated from 0 to 10, significantly improved ($p < 0.025$) following an 8-week muscle relaxation program, however, the absence of a control group and a small sample size (n = 20) limit generalisability. Conversely, a multimodal intervention targeting endometriosis-related chronic pelvic pain yielded no significant improvements ($p > 0.05$), again constrained by the small sample size (n = 26) and lack of a control group (McKnight et al., 2024).

Tennfjord et al. (2021) conducted a systematic review of alternative therapies beyond aerobic exercise for women with endometriosis. They included four studies involving 109 women with endometriosis that employed a variety of interventions including flexibility/stretching (Friggi Sebe Petrelluzzi et al., 2012), multimodal postural training (Awad et al., 2017), cardiovascular fitness (Carpenter et al., 1995), and yoga (Gonçalves et al., 2017). The review noted that the interventions varied in

duration (ranging from 8 to 24 weeks) and frequency (one to four sessions per week) with insufficient reporting of progression and adherence rates, hindering the ability to establish optimal exercise parameters for this population. Although PA and exercise show promise for improving outcomes in endometriosis, the authors of the review recommend prioritising high-quality RCTs that focus on the type and dose of PA, use reliable, validated outcome measures and consistently report core outcomes such as pain symptom severity, QoL, and patient-reported acceptability and satisfaction (Tennfjord et al., 2021).

Ensari et al. (2022) conducted a cross-sectional study involving 1,009 participants with endometriosis across 38 countries, investigating the associations between physical exercise patterns and pain symptoms. Participants self-reported their exercise frequency, type, and duration, as well as pain severity. The study found that regular engagement in exercise (at least three times per week) was associated with lower pain severity, suggesting a potential dose-response relationship. The authors noted several limitations, including the reliance on self-reported data, and heterogeneity in exercise types and intensity, highlighting the need for longitudinal, and interventional-based studies to confirm these associations and establish optimal prescriptions for symptom management (Ensari et al., 2022).

These studies collectively suggest psychological and QoL benefits from alternative exercise modalities, which may exert their effects through a combination of low-intensity physical movement, relaxation responses, and psychological regulation of stress and pain perception. However, some caution is needed when interpreting this data due to limitations in the methodological approaches used in the studies they reviewed. For example, small sample sizes, the use of self-reported measures, and poor reporting of exercise intensity and dosages (Tennfjord et al., 2021; Ensari et al., 2022). These limitations impede understanding of how exercise-induced adaptations differ by modality and intensity, particularly for those managing chronic pain and fatigue. This underscores the need for research incorporating rigorous quantitative measures and comparison with other exercise modalities, such as RT. Future research should employ objective monitoring to clarify the mechanisms through which exercise influences psychological and pain-related outcomes in women with endometriosis.

1.5.6 Physical Activity Habits

The most recent survey on PA habits of women with lived experience of endometriosis was by Brooks et al. (2024). They examined exercise participation among women with endometriosis in Australia and New Zealand and reported that 81% (n = 341 out of 424) of respondents considered themselves physically active, with 74% (n = 312 out of 424) engaging in exercise on a regular weekly basis. Walking (n = 274), home-based exercise (n = 121), and gym-based exercise (n = 121) were the most common forms of exercise, typically performed two to three times per week (n = 131). The primary motivations of respondents for exercising were to improve mental health (n = 261) and overall health (n = 250), underscoring the role of PA in supporting mental, emotional, and physical health outcomes in women living with endometriosis.

Despite this encouraging level of engagement, some women (n = 37) reported that exercise had a negative impact on their endometriosis symptoms, making it difficult to sustain regular participation (Brooks et al., 2024). This aligns with recent research on holistic care approaches adopted in the management of women living with endometriosis (Mazur-Bialy et al., 2024), highlighting the importance of tailored approaches to exercise that account for symptom variability and individual tolerances. While there is growing evidence for the role of PA in managing endometriosis, significant gaps remain, particularly around RT and exercise prescription, which may hold potential for improving symptom management and reducing long-term health risks. The study by Brooks et al. (2024) provides valuable descriptive data on PA participation. However, there are limitations which should be acknowledged. First, the reliance on self-reported measures may introduce recall and reporting bias, which may have influenced participants' perceived activity levels. Previous research indicates that self-report measures are generally less accurate than device-based measures for assessing physical activity and sedentary behaviours (Prince et al., 2020). Second, the cross-sectional design precludes causal inference, as outcomes are measured simultaneously, limiting the ability to determine whether exercise habits influence symptom fluctuations or vice versa (Pérez-Guerrero et al., 2024). Third, consistent with concerns regarding the

translation and replication of therapeutic exercise research, the lack of detailed reporting on exercise prescription parameters (e.g., intensity, duration, and adherence) within the survey limits reproducibility and practical clinical application (Page et al., 2017). Finally, the survey largely focused on general exercise participation, leaving an important gap regarding its role in endometriosis symptom management. For these reasons, it is important to build on the work of Brooks et al. (2024) by exploring RT practices, barriers, and perceptions among individuals with endometriosis. It is also important to determine whether RT is safe, feasible, and accessible, who engages in it, for what purpose, and whether it triggers symptom flares.

Given the substantial influence of symptom severity on physical functioning and daily life of women with endometriosis (Soliman et al., 2016; DiBenedetti et al., 2020), it is plausible that symptom burden also affects engagement in PA and exercise-based management strategies. Pain, fatigue, and fear of symptom exacerbation have been reported as common barriers that reduce participation in PA among women with endometriosis, particularly during periods of heightened symptom severity or symptom-flares (Blanco-Martínez et al., 2025; Sachs et al., 2023). However, the existing literature has largely focused on overall PA participation, with limited evidence distinguishing the impact of endometriosis on specific exercise modalities. While studies, such as Brooks et al. (2024) have provided valuable insights into general exercise participation among women with endometriosis, these investigations have largely focused on aerobic or general exercise, with limited attention to RT. This highlights a critical gap in understanding the feasibility, safety, and potential benefits of RT for this population, underscoring the need for research specifically examining RT practices, barriers, and perceptions.

Emerging evidence suggests that endometriosis is a heterogeneous condition across the lifespan, with age potentially influencing symptom experience, functional capacity, and health-related behaviours (Soliman et al., 2016; DiBenedetti et al., 2020; Yagur et al., 2025). These age-related variations may contribute to differences in PA engagement; however, evidence from broader PA literature indicates that barriers and facilitators to exercise participation vary across age groups (Brown & Trost, 2003; Brown et al., 2009; Dave et al., 2015), although it remains unclear

whether these patterns are consistent for women with endometriosis. Given the potential for differences in symptom severity, functional limitation, and disease burden across age groups, it is plausible that engagement in exercise, specifically RT, as well as perceived barriers and benefits, may also differ across the lifespan. However, this relationship remains largely unexplored, highlighting a gap in understanding how age is intertwined with symptom management behaviours and PA engagement in this population. Accordingly, given the limited understanding of how RT is engaged in and experienced across different stages of the lifespan in women with endometriosis, further consideration of its distinct physiological characteristics and potential clinical relevance is warranted.

1.5.7 Resistance Training

Compared with aerobic and alternative exercise modalities, RT provides a distinct physiological stimulus characterised by mechanical loading and progressive overload (Kraemer & Ratamess, 2004; Schoenfeld, 2010). This stimulus induces specific neuromuscular adaptations that are primarily reflected in improvements in muscular strength and functional capacity (Schoenfeld, 2010; Westcott, 2012; Fyfe et al., 2014; Lecce et al., 2026). These adaptations translate into enhanced ability to perform activities of daily living, which are closely linked to QoL and independence (Peterson et al., 2010; Westcott, 2012). While aerobic and mind–body-based interventions are more commonly represented in the endometriosis literature and are associated with cardiovascular, psychological, and relaxation-related benefits, they provide limited direct stimulus for muscular adaptations (Patel et al., 2024). Given evidence of reduced physical function and potential deconditioning in women with endometriosis (Sachs et al., 2023), RT may therefore offer complementary benefits that are not achieved through other exercise modalities alone. However, despite this physiological rationale, RT remains underrepresented in endometriosis-specific research, highlighting the need for targeted investigation.

A key mechanism underpinning these adaptations is RT-induced skeletal muscle hypertrophy, whereby increases in contractile protein content and muscle fibre size enhance muscular strength (Schoenfeld, 2010, 2017). In addition to structural adaptation, skeletal muscle functions as a metabolically active tissue, contributing to

glucose uptake and systemic energy regulation (Egan & Zierath, 2013). Increased muscle mass also expands the body's metabolic capacity for substrate storage and utilisation, while acting as an endocrine organ through the release of myokines and other signalling molecules (Pedersen & Febbraio, 2012). These muscle-derived signals have been implicated in broader metabolic and inflammatory regulation, suggesting systemic effects beyond musculoskeletal adaptation alone (Pedersen & Febbraio, 2012).

RT also contributes to improvements in bone health through mechanical loading, which stimulates osteogenic activity and promotes bone remodelling (Kohrt et al., 2004). This process is important for maintaining skeletal integrity and reducing age- and inactivity-related bone loss (Kohrt et al., 2004). Emerging evidence further suggests that RT may influence broader physiological systems, including potential effects on brain health and cognitive function, potentially mediated through exercise-induced systemic signalling pathways (Allison et al., 2025; Dhahbi et al., 2025). Although these systemic effects remain an evolving area of research, they highlight the multi-system influence of RT beyond traditional strength outcomes.

Collectively, the combined effects of improved muscle function, metabolic regulation, and bone health may contribute to reductions in low-grade systemic inflammation (Jiang et al., 2026). Given that inflammatory processes are thought to contribute to pain sensitisation and symptom burden in endometriosis, these adaptations may have indirect relevance for symptom modulation. In this context, RT provides a distinct physiological pathway compared with aerobic exercise, which primarily emphasises cardiovascular conditioning and energy expenditure, and mind–body modalities, which primarily target psychological regulation and relaxation responses. While exercise broadly exerts anti-inflammatory effects, RT may confer additional or complementary benefits through mechanical loading and muscle-derived endocrine signalling pathways that influence systemic inflammatory regulation (Dong et al., 2026).

Within a biopsychosocial framework, interventions that influence central nervous system processing may be particularly relevant for symptom modulation. RT may contribute to pain modulation not only through peripheral adaptations such as

improved musculoskeletal function, but also through central mechanisms, including enhanced mood regulation, improved self-efficacy, reduced stress responsiveness, and broader neurocognitive adaptations associated with exercise participation (Ma & Mumtaz., 2025). These factors may strengthen descending inhibitory pathways and shift pain processing towards a more adaptive central pain modulation balance, reducing pain perception and improving functional capacity in individuals with endometriosis.

Despite a growing recognition that exercise is broadly beneficial for physical, psychological, and functional health outcomes across the lifespan, evidence specific to women with endometriosis remains limited (McKnight et al., 2024). Recent reviews examining general exercise for endometriosis have reported improvements in pain, QoL, and fatigue (Tennfjord et al., 2021; Ensari et al., 2022; McKnight et al., 2024), however, these syntheses are constrained by heterogeneous exercise modalities, small sample sizes, and variable intervention quality. Critically, very few studies have isolated RT as a standalone modality, despite its well-established role in mitigating muscle loss, enhancing physical function, and reducing disability across adult and other chronic condition populations (Westcott, 2012; Fyfe et al., 2022; Mcleod et al., 2024). This gap is particularly relevant given that women with endometriosis may experience reduced physical activity levels, muscle weakness, and poor physical function (Álvarez-Salvago et al., 2020; Sachs et al., 2023; Silva et al., 2024; Silva de Barros et al., 2024), making RT a potentially valuable, low-risk, and underexplored therapeutic option.

Evidence from other chronic pain and fatigue-related conditions, such as fibromyalgia and chronic low back pain demonstrates that structured RT can reduce symptom severity and fatigue, and improve physical functioning, and HRQoL (Cortell-Tomo et al., 2018; Torres-Costoso et al., 2021; Vilarino et al., 2022). Yet, no studies to date have evaluated these RT-related outcomes in endometriosis, nor is there a comprehensive synthesis describing how RT has been prescribed, implemented, or studied in this population. Consequently, it remains unclear whether RT is efficacious, feasible, or optimally delivered for women with endometriosis. Chapter 2 addresses this evidence gap by presenting a scoping review that systematically maps and evaluates the existing literature on RT in endometriosis,

providing a detailed foundation for understanding current practices, identifying limitations, and guiding future intervention design.

1.6 Conclusions

Symptoms associated with endometriosis remains a complex challenge to undertaking exercise. While conventional treatments appear to provide variable symptom relief, RT presents a promising non-invasive, cost-effective intervention that may improve musculoskeletal health and modulate pain responses through multiple physiological mechanisms. However, existing research has predominantly focused on aerobic and multimodal exercise as self-management strategies for endometriosis, with minimal reference to RT, and to date, there has been no formal exploration of the RT habits among Australian women with endometriosis. While RT offers unique and important benefits for individuals with chronic conditions, its specific effects on endometriosis remain largely unexplored. This project addresses this gap by generating evidence around RT engagement/barriers, symptom flares, and training dosages, for women with endometriosis. In doing so, it generates context-specific evidence on how RT is undertaken outside of controlled exercise settings in this population group. This work provides a foundation for future research exploring how RT is integrated into the management of endometriosis, including its long-term efficacy. Such insights may inform the development of targeted exercise interventions and contribute to the refinement of clinical guidelines, with a specific focus on the optimal parameters of RT this population.

Research Aims

There has been insufficient exploration of the RT habits of Australian women with endometriosis, particularly in relation to how it is undertaken and experiences in real-world settings. While current literature has explored self-management strategies, exercise has received limited investigation as a therapeutic modality, particularly regarding the inclusion of RT. Although RT benefits and prescription recommendations are well-established in healthy individuals and in many clinical conditions, research is lacking for women with endometriosis.

The overarching aim of this thesis is to address this gap by examining RT engagement, perceptions, and self-reported experiences among Australian women living with endometriosis, in order to generate context-specific evidence to inform future clinical translation and the development of targeted exercise-based recommendations.

Accordingly, the aims of this thesis are to:

- 1) Use a systematic scoping review to summarise reported RT prescriptions and outcomes and identify knowledge gaps to inform future trials and clinical guidance.
- 2) Characterise RT practices, perceptions of RT for symptom management, and barriers to RT engagement among Australian women with endometriosis using a customised questionnaire.
- 3) Examine perceptions of RT as a symptom management strategy and barriers to regular RT engagement among women with endometriosis, with age included as a covariate in relevant analyses.

Significance and Contributions to Knowledge

1) Symptoms and RT influence on the management of certain symptoms

Women with endometriosis experience various symptoms that adversely impact physical performance, QoL and functional capacity compared to those without the condition (Artacho-Cordón et al., 2023; Silva et al., 2024; Tragantzopoulou, 2024). While evidence suggests regular exercise, including RT, has protective effects in the management and progression of several other chronic inflammatory conditions, research on the benefits of RT specifically for women with endometriosis is scarce (Bonoche et al., 2014). Given the limited literature supporting RT in preventing disease progression and alleviating endometriosis symptoms, this research seeks to deepen our understanding of its potential benefits and risks to enhance its effectiveness as a prescribed intervention for women with endometriosis (Bonoche et al., 2014; Sachs et al., 2023). This investigation of the RT habits and perceptions in women with endometriosis will improve knowledge surrounding exercise practices, specifically RT, in managing endometriosis.

2) Identifying barriers to RT participation

The physical limitations and barriers women with endometriosis face, including chronic pain, financial burdens, and reduced access to exercise opportunities (Armour et al., 2022; Ellis et al., 2022), emphasise the importance of investigating how RT can be tailored for this population. RT can be an accessible and affordable option, as it can be performed at home with minimal equipment, making it a practical option for women with endometriosis who face time constraints or limited access to gym facilities (Fyfe et al., 2022; Iversen et al., 2021). This approach can be tailored to brief, high-intensity sessions, such as two 20–30-minute workouts per week, falling into the “minimum effective dose” category, providing an efficient way to improve strength, muscle mass, and overall function in this population group (Fyfe et al., 2022). The exploration of the contextualised participation of Australian women with endometriosis in RT, including a critique of current practice compared to best practice guidelines, will contribute to establishing RT as an effective management strategy. Additionally, understanding short and long-term benefits of RT could have significant economic impacts for these women and their community, reducing reliance on medical interventions and lower healthcare management costs. For example, in chronic conditions like cancer, RT interventions have been successful at reducing the need for ongoing medication and decreasing the frequency of medical interventions, demonstrating its potential to serve as a cost-effective therapeutic intervention for other chronic conditions, including endometriosis (Kampshoff et al., 2018). Consistent RT habits may also lead to improved mood, well-being and reduced anxiety, lowering the risk of depression and further reducing healthcare costs (Boehm et al., 2012). This research has the potential to influence clinical practice, providing evidence to support the development of endometriosis-specific guidelines. Insights from this research may guide healthcare practitioners and treatment providers in prescribing safer, more effective RT interventions, and improving exercise adherence through better understanding of potential barriers experienced by this population group and tolerance and minimum dosages required for benefits. By contributing to clinical recommendations and public health policy, this research may help establish RT as a vital component of endometriosis management.

3) World Health Organisation exercise guidelines and their importance

Despite recommendations from the World Health Organisation (2020) suggesting adults with chronic conditions should engage in muscle-strengthening activities at least twice a week, no endometriosis-specific guidelines exist (McKnight et al., 2024). Medical professionals recommend strength training for individuals with chronic conditions (Ciccolo et al., 2014), yet specific prescription parameters for RT in this population have not yet been outlined. Additionally, clinical literature on exercise for endometriosis management heavily surrounds aerobic and therapeutic activities including yoga and stretching, with little representation of RT, despite its potential benefits for other chronic and inflammatory conditions (McKnight et al., 2024).

Chapter 2

Resistance training in endometriosis care: mapping the evidence and gaps – a systematic scoping review

Title Page

Title: Resistance training in endometriosis care: mapping the evidence and gaps - a systematic scoping review

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2.1 Abstract

This systematic scoping review mapped evidence on resistance training (RT) for women with endometriosis, summarising the RT component of exercise interventions, key outcomes, and gaps. Studies were included if they involved individuals with a clinical diagnosis of endometriosis, examined RT interventions, and were conducted in any setting or study design including experimental, observational, and qualitative studies. Searches across biomedical databases and grey literature identified a small number of heterogeneous studies ($n = 8$), with RT typically embedded within multimodal exercise programmes. Reported benefits included reduced pain and improved quality of life and function, but incomplete reporting of load, progression, supervision, and adherence limited inference about optimal dosing; follow-up was uncommon. Clinically salient outcomes including areas of fatigue and sleep, pelvic-floor symptoms, bone health, and inflammatory markers were rarely measured. RT appears feasible and promising as adjunct care when embedded in multimodal exercise programs. Priorities for future research include well-reported, suitably powered, standalone RT trials with longer follow-up and patient-important endpoints.

Key words: Endometriosis; Resistance training; Exercise prescription; Pelvic floor; Fatigue; Bone mineral density

2.2 Introduction

Endometriosis is a chronic, inflammatory condition affecting an estimated 10-15% of women globally (Ellis et al., 2022; Tragantzopoulou, 2024) and approximately 1 in 9 women in Australia (Rowlands et al., 2021), imposing substantial physical, psychosocial, and economic burdens. In Australia, the annual societal cost is estimated at AUD ~\$9.6 billion, which equates to approximately AUD \$30,000 per person/year, driven largely by productivity losses (Armour et al., 2019a). Women with endometriosis face significant out-of-pocket expenses for pharmaceuticals, investigations, surgery, carer support, fertility treatments (e.g., IVF), and allied or complementary therapies including dietary interventions and medicinal cannabis (Armour et al., 2019a, 2020b; O'Hara et al., 2021). Also, diagnostic delay frequently extends up to eight years, compounding symptom burden and care needs (Armour et al., 2020; Evans et al., 2022). Consequently, many women with endometriosis contend with reduced income (e.g., part-time work, sick leave, missed opportunities) alongside high ongoing costs associated with condition-specific management.

Endometriosis is associated with a broad symptom profile that extends beyond pain to include systemic manifestations such as fatigue, reduced physical function, and impaired musculoskeletal health. Physical function, as defined by Brach & VanSwearingen (2002), refers to the ability to perform activities of daily living, instrumental activities of daily living, and mobility tasks essential for independent living without substantial risk of injury. Women with endometriosis often demonstrate reduced muscle strength and poorer physical performance outcomes (Silva et al., 2024), as well as a higher prevalence of musculoskeletal disability compared with those without the condition (Silva de Barros et al., 2024). Endometriosis-related fatigue is a commonly reported symptom and is associated with persistent feelings of exhaustion, lethargy, tiredness and weakness (DiBenedetti et al., 2020). Collectively, these symptoms may contribute to reduced functional capacity and participation in daily activities, highlighting the importance of considering musculoskeletal and functional outcomes in this population.

Standard treatment approaches for endometriosis typically includes hormonal therapies to suppress endometriotic tissue and surgery to remove lesions, cysts, and adhesions (Armour et al., 2019). While these approaches can relieve pain and improve quality of life (QoL), they carry notable drawbacks, including side effects, symptom recurrence, and, in some cases, clinically important bone loss with hormone therapies (Sauerbrun-Cutler & Alvero, 2019; Vannuccini et al., 2022). Gonadotropin-releasing hormone (GnRH) agonists, in particular, induce a hypoestrogenic state associated with rapid declines in bone mineral density (BMD), elevating longer-term osteoporosis and fracture risk (Sauerbrun-Cutler & Alvero, 2019; Mohamad et al., 2021). Hormonal changes across the lifespan of women and how they interact with BMD trajectories is complex, and could be particularly relevant for women with endometriosis (Uehara et al 2022). Women with endometriosis also exhibit reduced muscle strength and poorer physical performance outcomes (Silva et al., 2024) and have a higher reported rate of musculoskeletal disability (Silva de Barros et al., 2024), compared to those without the condition. These issues underscore the need for adjunct, low-risk strategies that also support musculoskeletal health.

Exercise is frequently recommended within holistic, multidisciplinary care for women with endometriosis to support symptom management (Xie et al., 2025). However, specific exercise guidelines for women with endometriosis are lacking due to a paucity of randomized controlled trials (RCTs). In a recent review of six RCTs (n = 251), Xie et al. (2025) reported that physical activity and exercise improved QoL and pain, yet only one study examined bone outcomes despite the heightened relevance of BMD for women with endometriosis receiving GnRH therapies. The included interventions were heterogeneous and comprised lumbopelvic stabilisation training followed by stretching, aerobic and resistance exercise; supervised yoga combined with breathing, relaxation and meditation; telehealth or supervised exercise training sessions; individualised aerobic conditioning combined with flexibility work; structured walking and aerobic training alongside medical therapy; and group-based progressive muscle relaxation programmes combined with pharmacological treatment. That study found that, while exercise could not prevent GnRH-related bone loss during treatment, it facilitated greater post-treatment recovery of femoral-

neck BMD compared with controls over 12-months (Bergström et al., 2005). To our knowledge, no studies have explored the effects of exercise on skeletal muscle quality (e.g., changes in muscle cross-sectional area, muscle strength/power, or intramuscular fat) in women with endometriosis.

Resistance training (RT) is a particularly promising modality that, when appropriately prescribed and adhered to, may improve muscle and bone mass, cardiometabolic health, and functional capacity (Westcott, 2012; Fyfe et al., 2022). In a survey of 424 women with endometriosis, over half (51.6%) reported using RT or weight-based training as part of their symptom-management plan (Brooks et al., 2024), indicating both acceptability and real-world uptake. Yet endometriosis-specific evidence for RT remains sparse, and dedicated prescription guidance is lacking. Compounding this gap, RT prescriptions are often poorly reported across various healthcare settings. Reviews in physical therapy and oncology spanning hip osteoarthritis, chronic pain, and survivors of prostate and breast cancer consistently note incomplete reporting of the 'FITT' principles (frequency, intensity, time, type) as well as core exercise training principles such as specificity, rest intervals, progressive overload, reversibility, and programme adherence (Page et al., 2017; Meneses-Echavez et al., 2019; Neil-Sztramko, Medysky, et al., 2019; Neil-Sztramko, Winters-Stone, et al., 2019; Montaña-Rojas et al., 2020; Bland et al., 2021; Burgess et al., 2021; Arora et al., 2024). To date, no study has systematically mapped how RT is prescribed within exercise interventions targeting women with endometriosis.

Given the anticipated heterogeneity in interventions, outcomes, and reporting, we conducted a scoping review to: (i) map the extent and nature of evidence on RT for women with endometriosis; (ii) summarise reported RT prescriptions and outcomes, including any reported benefits on physical function, bone health, muscle quality and QoL; and (iii) identify knowledge gaps to inform future trials and clinical guidance.

2.3 Methods

Given the broad aim of mapping what is known about RT for women with endometriosis and, critically, where the gaps are, we undertook a scoping review following Arksey & O'Malley's (2005) framework and subsequent guidance from

Joanna Briggs Institute (Peters et al., 2020) and PRISMA-ScR (Tricco et al., 2018). Scoping reviews are well-suited to heterogeneous literatures, mixed outcomes, and emerging fields in which clarifying concepts and research gaps is as important as synthesis (Arksey & O'Malley, 2005; Munn et al., 2018; Tricco et al., 2018).

2.3.1 Protocol and reporting

We developed and piloted the protocol a priori, aligned with PRISMA-ScR. The protocol specified eligibility criteria, sources of evidence, screening/data-charting procedures, and planned synthesis. Reporting adheres to PRISMA-ScR. To enhance transparency and reproducibility, the study protocol and associated materials will be archived in a publicly accessible repository (e.g., the Open Science Framework). The archived materials will include the study protocol, data extraction framework, and relevant methodological documentation. The repository will be assigned a digital object identifier, ensuring a permanent and citable record of the study design. Public archiving will enable transparency in reporting and facilitate future replication, adaptation, and comparison of findings in research involving resistance training and endometriosis.

2.3.2 Eligibility criteria (PCC)

- **Population:** Individuals with a clinical diagnosis of endometriosis (any phenotype, stage, or treatment status).
- **Concept:** Any resistance training (RT) mode, including free weights, machines, bands, bodyweight activities. We included multimodal programmes only when an RT component was explicitly detailed.
- **Context:** Any setting including clinical, community, home, sport etc. Experimental (RCTs, quasi-experimental, single-group pre-post), or observational (cohort/case-control/cross-sectional) reporting RT exposure or RT-containing programmes; qualitative studies on experiences/barriers to RT participation.

We excluded exercise interventions without an RT component (e.g., yoga-only, aerobic-only), non-human studies, abstracts with no full text, opinion pieces, pregnancy or other women's-health cohorts without endometriosis, and non-English publications. Studies that included participants with endometriosis, even when

endometriosis was not the primary recruitment criterion, were eligible; for these, we retained the study and documented the basis for inclusion and the characteristics of the endometriosis subgroup.

2.3.3 Information sources and search

In consultation with an academic health sciences librarian, we searched MEDLINE (PubMed), Embase, CINAHL, SPORTDiscus, Scopus, Web of Science, and Cochrane CENTRAL, plus trial registries (ClinicalTrials.gov, WHO ICTRP) and grey literature (theses/reports) from database inception to search end date (18 August 2025). Grey literature was searched to capture unpublished and non-peer-reviewed evidence, including ProQuest Dissertations & Theses Global, Google Scholar, and relevant organisational and institutional repositories. Reference lists of included studies were also hand-searched to identify additional sources. Search strings combined controlled vocabulary and keywords for endometriosis (e.g., endometriosis, pelvic pain) and RT (e.g., resistance training; strength training; weightlifting; muscle strengthening). Where appropriate, filters were applied as per the database guidelines so search terms could be screened for and identified in the title and abstract. Full strategies are provided in Appendix A.

2.3.4 Selection process

We manually imported the search results into Endnote (EndNote 21, 2023), removed study duplicates, and performed title/abstract screening and later full-text screening of included studies, adhering the PRISMA-ScR processes (Figure 6). Titles/abstracts and full texts were screened independently by two reviewers (DB and DMH), with disagreements resolved by discussion with a third reviewer (AN). Title/abstract screening involved broad relevance assessment for endometriosis and RT. Full-text screening applied the full PCC eligibility criteria, including confirmation of an endometriosis diagnosis, presence of a defined RT component, and eligible study design.

2.3.5 Data charting

For the included studies, two reviewers (DB and DMH) independently charted data using a piloted form capturing 1) bibliographic details, 2) study design/setting, 3)

sample (size, age, diagnosis criteria, treatment status), 4) RT prescription (frequency, intensity/load, sets/ reps, volume, progression, intervention supervision, session length, equipment used), 5) co-intervention details, if multimodal, 6) training adherence and drop-outs, 7) primary outcomes and time points (e.g., pain, fatigue/sleep, function/strength, pelvic floor measures, bone health/BMD, QoL, adverse events), and 8) analytic approach. We also extracted author-reported limitations.

2.3.6 Synthesis

Given the heterogeneity in populations, RT prescriptions, and outcomes, we undertook a descriptive mapping and narrative synthesis organised by outcome domain. Based on a preliminary landscape search and research team discussion, we classified outcomes into six domains: (1) access/adherence; (2) pain and QoL; (3) fatigue/sleep; (4) physical function/strength; (5) pelvic-floor function; and (6) bone and metabolic markers. Physical function outcomes were extracted and categorised according to key domains, including mobility and fall risk, muscle strength, coordination, and general fitness. Within each domain, we summarised findings, clarified the definition of measures within domains (where relevant), noted consistencies and discrepancies, and identified knowledge gaps. Where feasible, we also reported ranges for key RT prescription variables (e.g., programme duration, frequency, intensity, sets/ reps, progression) and evaluated the completeness of FITT reporting.

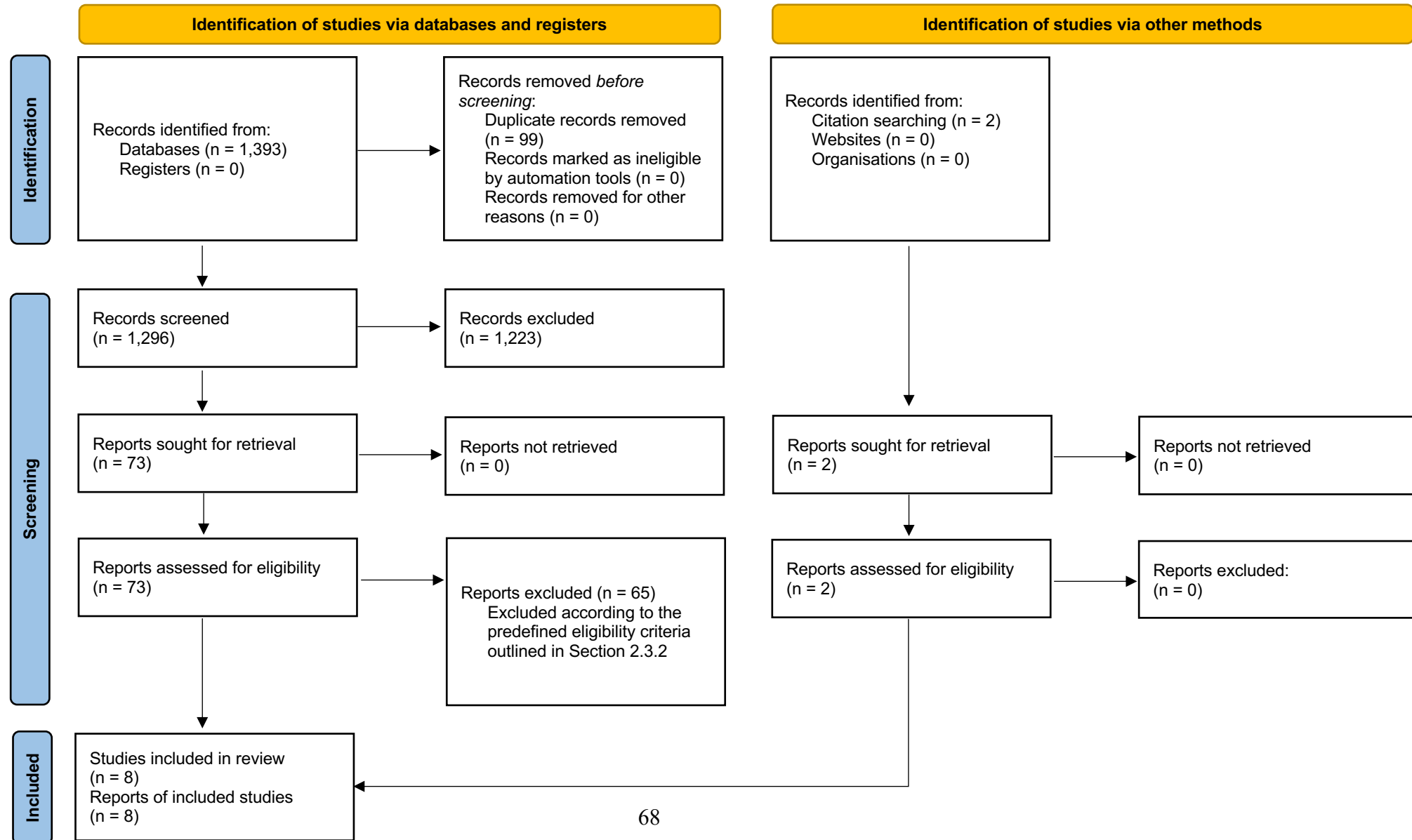
2.4 Results

2.4.1 Study selection

The search yielded 1395 unique records; 73 proceeded to full-text review and six met inclusion. An additional two sources were identified via citation chaining/grey literature. Citation chaining was conducted following full-text inclusion and involved both backward citation chasing (reference list screening), and forward citation chasing (Google Scholar and Scopus “cited by” tracking) to identify additional eligible sources. The PRISMA-ScR flow is shown in Figure 6. A total of 1,395 records were identified through database searching and grey literature. After removal of 99 duplicates, 1,296 records were screened, leading to the exclusion of 1,225 at

title/abstract stage. Full-text assessment was conducted for 73 articles, with 64 excluded, resulting in eight studies included in the final review.

Figure 6. PRISMA Flow Diagram of Study Selection Process



2.4.2 Characteristics of included evidence

Interventional studies (n = 6) including randomised controlled trials (parallel and crossover designs), quasi-experimental studies, and single-group cohort designs are summarised in Table 3. These predominantly had small samples (combined n = 200; range 20-47 participants per study) with short-to-moderate programmes (4-16 weeks) which were often multimodal (aerobic + bodyweight strengthening + motor control/stability + education) with an RT component, and highly variable in terms of exercise progression and program supervision (Artacho-Cordón et al., 2023; Awad et al., 2017; Poli-Neto et al., 2020; Tennfjord et al., 2024; Salinas-Asensio et al., 2025). Standalone, externally loaded RT programmes (i.e., training using external resistance such as free weights, machines, bands, or weighted implements) were not implemented in isolation for women with endometriosis. Instead, RT was typically embedded within multimodal interventions combining aerobic exercise, motor control or stability exercises, and/or education. Outcome domains assessed included pain (intensity/pressure pain thresholds), QoL (EHP-30), lumbopelvic strength/stability (Sahrmann core stability test), functional capacity (6-minute walk test [6MWT]), balance (flamingo test), flexibility (Shober test), pelvic floor measures (surface EMG, pressure transducer), and (less commonly) sleep/fatigue (Piper Fatigue Scale) or bone health. Follow-up beyond immediate post-intervention was limited, with only a single study subset reporting 6–12-month outcomes (Artacho-Cordón et al., 2023). Across interventional studies, participants were predominantly women of reproductive age with clinically or surgically confirmed endometriosis, although reporting of age ranges, BMI, disease stage, and medical treatment status was inconsistent across studies.

Observational studies (n = 2), comprising case-control or cross-sectional comparisons reported reduced strength, flexibility, balance, and functional capacity in women with endometriosis versus controls, as well as associations between pain/fatigue and poorer physical performance (Álvarez-Salvago et al., 2020; Silva et al., 2024).

Table 3. Summary of Current Exercise Interventions for Endometriosis

Authors (year)	Country of Study	Type of study	Population characteristics				Intervention Parameters				
			<i>N; age range, or group mean age</i>	<i>BMI (kg·m⁻²)</i>	<i>Stage of endometriosis</i>	<i>Medication status</i>	<i>Duration (wk)</i>	<i>Frequency (#sessions/wk)</i>	<i>Intensity</i>	<i>Time (session length)</i>	<i>Type</i>
Awad et al. (2017)	Egypt	Single group, cohort	N = 20 Age range 26-32 years	≤ 29 kg·m ⁻²	Stage II or Stage III endometriosis	Receiving 100 mg of Medroxyprogesterone Acetate once/month for 6 months	8	3	Low-impact exercise sessions with a 'moderately hard' perceived exertion	Between 30-60 minutes	Exercise sessions included postural correction, breathing exercises, general relaxation, diversion drill training, positional education, stretching and 20 minutes of treadmill walking
Poli-Neto et al. (2020)	Brazil	Quasi-experimental	N = 42 total (21 women with endometriosis and 21 healthy women) Age range 18-50 years	Mean 25.6 kg·m ⁻² ± 5.8	-	-	4	1	4 x 15 repetitions at 60% of 1RM in 1–2-minute intervals	-	Exercise session on extensor (knee extension) chair
Artacho-Cordon et al. (2023)	Spain	Parallel-group randomised control trial	N = 31 Mean age 36.31 ± 6.28	Mean 26.28 kg·m ⁻² ± 5.51	All stages of endometriosis (I-IV)	-	8	2	-	-	Physio-EndEA [®] program Multimodal exercise sessions (aerobic, bodyweight RT, stretching, motor control) Progressive overload was applied
Skaug et al. (2024)	Norway	Experimental crossover study	N = 47 Age range 18-35 years	Range of 20-32.6 kg·m ⁻²	-	-	1	1	4 x 4 at 75-85% of 1RM	Up to 60mins	Weightlifting session of back squat and deadlift
Tennfjord et al. (2024)	Norway	Randomised control trial	N = 41 Age range 18-45 years	-	-	-	16	1	'low-to-moderate' and 'moderate-to-hard' perceived exertion	Up to 60mins	Aerobic training, muscular strength training of large muscle groups and pelvic floor muscles, and flexibility and relaxation exercises

											Participants also performed an individually tailored progressive home exercise program following the same exercises
Salinas-Asensio et al. (2025)	Spain	Randomised control trial	N = 31	-	All stages of endometriosis (I-IV)	-	8	2	-	-	Physio-EndEA ¹ program Multimodal exercise sessions (aerobic, bodyweight RT, stretching, lumbo-pelvic stabilisation, breathing and relaxation exercises)

RT = resistance training; QoL = quality of life; EHP-30 = endometriosis health profile-30; 1RM = one-repetition maximum; N/A = not applicable.

p-values are reported as presented in the included studies. Statistical significance was defined as $p < 0.05$. Effect sizes (Cohen's d) are interpreted as small (0.2), medium (0.5) and large (≥ 0.8). 95% confidence intervals that do not cross zero indicate significant effects.

Table 4. Summary of Current Observational Studies on Exercise and Endometriosis

Authors (year)	Country of Study	Type of study	Population characteristics				Study Outcomes and Measures			
			<i>N; age range, or group mean age</i>	<i>BMI (kg·m⁻²)</i>	<i>Stage of endometriosis</i>	<i>Medication status</i>	<i>Key Variables Assessed</i>	<i>Outcome Measures</i>	<i>Outcome Variables</i>	<i>Key Findings</i>
Álvarez-Salvago et al. (2020)	Spain	Observational, case-control	N = 50 total (25 women with endometriosis and 25 age and height-matched women without endometriosis) Age range 25-50 years	Mean BMI (ENDO) 26.39 ± 6.05 kg·m ⁻² Mean BMI (controls) 22.98 ± 2.55 kg·m ⁻²	All stages of endometriosis (I-IV)	-	Physical performance/functional capacity	30-second chair-stand test 6-minute walk test (6MWT) Gait speed Handgrip strength	Lower-limb strength Aerobic capacity Walking performance Upper-limb strength	Women with endometriosis demonstrated significantly reduced physical function compared with controls, including lower chair-stand repetitions, reduced 6MWT distance, slower gait speed, and reduced handgrip strength (all p ≤ 0.001)
Silva et al. (2024)	Brazil	Cross-sectional	N = 115 Age range 20-40 years	Mean BMI (ENDO) 31.00 ± 4.71 kg·m ⁻² Mean BMI (controls) 25.49 ± 5.46 kg·m ⁻²	All stages of endometriosis (I-IV)	-	Health-related physical fitness (strength, flexibility, balance, functional capacity)	Back dynamometer Hand dynamometer Schöber test Flamingo test 6-minute walk test (6MWT)	Lower-limb strength Upper-limb strength Lumbar spine flexibility Postural balance Aerobic functional capacity	Women with endometriosis demonstrated significantly poorer performance in back strength (p = 0.006), lumbar flexibility (p = 0.011), balance (p = 0.021), and aerobic capacity (p < 0.001) compared with controls, while handgrip strength did not differ significantly between groups (dominant p = 0.712; non-dominant p = 0.295).

BMI = body mass index; 6MWT = 6-minute walk test; ENDO = endometriosis group; N/A = not applicable.

p-values are reported as presented in the included studies. Statistical significance was defined as p < 0.05. 95% confidence intervals that do not cross zero indicate significant effects.

2.5 Evidence synthesis by domain

2.5.1 Pain and quality of life (QoL)

No studies looked specifically at the effects of RT as a standalone therapy on QoL in women with endometriosis. One study included RT as part of a multimodal physiotherapy routine (Artacho-Cordón et al., 2023). The Physio-EndEA intervention was delivered twice weekly over eight weeks and consisted of a multimodal programme including aerobic exercise, bodyweight resistance training, stretching, and lumbopelvic stabilisation exercises, with progression guided by motor control capacity and symptom response (Artacho-Cordón et al., 2023). This study assessed QoL (using the EHP-30), pain pressure thresholds, and pain intensity via the numerical rating scale at baseline, post-intervention, and one year afterwards. Participants in the Physio-EndEA group ($n = 16$) demonstrated substantial reductions in pain immediately post-intervention, with a mean decrease of 20.76 units (95% CI, -27.89 to -13.47) compared with 6.69 units in the control group (95% CI, -15.27 to 1.90). The between-group difference was -14.08 units (95% CI, -24.62 to -3.53; $p < 0.05$, $d > 0.8$), indicating a large and statistically significant effect. At 1-year follow-up, pain remained lower in the intervention group (mean reduction 15.36 units; 95% CI, -23.23 to -7.49) compared with minimal change in the control group (1.78 units; 95% CI, -3.66 to 7.21), with a between-group difference of 17.13 units (95% CI, -26.41 to -7.86; $p < 0.001$, $d > 0.8$), demonstrating sustained, clinically meaningful reductions in pain (Artacho-Cordón et al., 2023). Participants also demonstrated large improvements in emotional well-being immediately post-intervention, with a mean improvement of -17.58 units (95% CI, -24.19 to -10.97) compared with 1.94 units in the control group (95% CI, -6.53 to 2.65). The between-group difference was -15.64 units (95% CI, -23.45 to -7.84; $p < 0.05$, $d > 0.8$), indicating a statistically significant and large effect. At 1-year follow-up, improvements in the intervention group were sustained, with a mean change of -9.26 units (95% CI, -16.93 to -1.58) compared with 3.19 units in the control group (95% CI, -3.24 to 9.61), with a between-group difference of -12.46 units (95% CI, -22.09 to -2.80; $p < 0.05$, $d > 0.8$), demonstrating clinically meaningful long-term benefits in emotional well-being (Artacho-Cordón et al., 2023).

Another intervention (Awad et al., 2017) was delivered three times weekly over 8 weeks and included forms of RT using mobility/postural exercises to improve pain and found a decrease in median endometriosis Pain Intensity Scale scores from 4 (interquartile range [IQR], 1) to 1.5 (IQR, 1.75) at four weeks and to 1 (IQR, 1) at eight weeks ($p < 0.025$). However, individual data were not shown, making interpretation of the nature of the reduction (e.g., broad improvement across most or all of the group versus responders and non-/limited-responders) impossible. In contrast, Poli-Neto et al. (2020) examined whether a short, low-dose strength protocol using the knee extensor chair could modulate pain thresholds in women with endometriosis compared to with healthy controls. Participants completed a single-session, low-volume resistance protocol consisting of 4×15 repetitions of knee extension exercise at 60% 1RM performed on an extensor chair. The study assessed heart rate, blood pressure and pain pressure thresholds via electric algometry before, immediately after, 10 minutes, and 20 minutes after exercise. In the final week of the intervention (week four), healthy women had higher pain pressure thresholds than women with endometriosis, with a between-group difference of $1.00 \text{ Kg}\cdot\text{cm}^{-2}$ immediately post-exercise (95% CI, 0.77 to 1.24), $0.91 \text{ Kg}\cdot\text{cm}^{-2}$ at 10 minutes (95% CI, 0.67 to 1.14), and $0.70 \text{ Kg}\cdot\text{cm}^{-2}$ at 20 minutes (95% CI, 0.46 to 0.93). Women with endometriosis showed minimal change in thresholds, likely reflecting insufficient progression/dose and the likely divergent chronic pain mechanisms as reported by the authors (e.g., central sensitisation).

2.5.2 Fatigue and sleep

Among the included studies, only one explored endometriosis-related fatigue (Salinas-Asensio et al., 2025). Salinas-Asensio et al. (2025) conducted a secondary analysis of data from the Physio-EndEA trial to examine the specific effects of twice weekly multimodal exercise sessions (including aerobic, bodyweight RT, stretching, lumbo-pelvic stabilisation, breathing and relaxation exercises) on fatigue in women with endometriosis after eight weeks. Fatigue was assessed using the Piper Fatigue Scale. At the end of the intervention and at 1-year follow-up, participants in the Physio-EndEA group ($n = 16$) demonstrated significantly greater reductions in fatigue compared with the

control group ($n = 15$), with large effect sizes ($d > 0.80$). The Physio-EndEA intervention reduced fatigue by 1.89 scale units (95% CI, -2.93 to -0.86) immediately post-intervention and by 0.81 scale units (95% CI, -1.79 to 0.17) at 1-year follow-up, compared with minimal change in the control group (0.18 scale units; 95% CI, -0.14 to 0.51). The between-group differences were -2.08 scale units (95% CI, -3.11 to -1.05) post-intervention and -1.12 scale units (95% CI, -2.13 to -0.10) at 1-year, indicating statistically and clinically meaningful reductions in fatigue (Salinas-Asensio et al., 2025). These improvements occurred in the absence of between-group differences in sleep quality at either time point.

2.5.3 Physical function and strength

Only one study specifically assessed physical function in women with endometriosis. Silva et al. (2024) examined 115 women (half with endometriosis) over a cross-sectional design and measured outcomes including muscle strength (handgrip and chair stands), functional capacity, and physical performance. Four tests were used to evaluate overall functional capacity: 1) handgrip strength to evaluate overall strength, 2) 30-second chair-stands test to assess lower-limb strength, 3) gait speed to measure walking performance (walking at their habitual pace), and 4) 6-minute walk test to evaluate submaximal aerobic capacity and overall functional endurance. Women with endometriosis demonstrated significantly reduced functional capacity compared with control participants. Specifically, they performed worse on the 6MWT with a mean difference of -83.46 m (95% CI, -121.38 to -45.53; $p < 0.001$), gait speed (-0.11 m/s, 95% CI, -0.18 to -0.04; $p = 0.003$), chair-stand repetitions (-8.44 reps, 95% CI, -10.64 to -6.25; $p < 0.001$), and handgrip strength (-3.32 kg, 95% CI, -5.30 to -1.33; $p = 0.001$). These results indicate substantial deficits across multiple domains of functional performance in women with endometriosis relative to controls, after adjusting for relevant covariates (Silva et al., 2024).

Only one RCT assessed the effects of multimodal exercise, with elements of RT (using the Physio-EndEA program), on physical function and strength in women with endometriosis (Artacho-Cordón et al., 2023). The study used the

Sahrmann core stability test to assess lumbopelvic stability, trunk flexor and extensor resistance tests to assess lumbar and abdominal muscle strength, and ultrasound to determine muscle architecture at baseline, post-intervention, and one year afterwards. Participants in the Physio-EndEA group ($n = 16$) demonstrated significant improvements in lumbopelvic stability immediately following the 8-week intervention, with a mean increase of 1.56 units (95% CI, 0.81 to 2.32) compared with 0.13 units in the control group (95% CI, -0.33 to 0.60). The between-group difference was 1.43 units (95% CI, 0.57 to 2.29; $p < 0.05$, $d > 0.8$), indicating a statistically significant, large effect. At 1-year follow-up, improvements were not maintained, with minimal between-group difference (0.03 units; 95% CI, -1.17 to 1.24), suggesting the intervention's effect was primarily short-term (Artacho-Cordón et al., 2023). The authors reported improvements in lumbar muscle flexor and extensor strength ("the effect size was large for isometric abdominal and lumbar strength"), however, the trunk muscle assessments were flexion and extension endurance tests, and the reported change was measured as a duration. Interestingly, for flexion the between-group difference showed a clear improvement for the Physio-EndEA group at eight weeks of 34 seconds (95% CI, 12 to 57) and similarly at one year of 30 seconds (95% CI, 11 to 49); for extension, the improvement was only clear at eight weeks (33 seconds; 95% CI, 9 to 56) (Artacho-Cordón et al., 2023). While lumbar strength reflects traditional muscular strength and capacity, lumbopelvic stability and transverse abdominis muscle thickness are better conceptualised as components of neuromuscular control and core stability, contributing to functional performance. However, it is unclear what effects RT as a standalone therapy has on these outcomes due to the lack of RT-only trials. Other case-control studies that explored strength and physical function in women with endometriosis have shown that women with endometriosis reported lower functional capacity (Álvarez-Salvago et al., 2020). Women with endometriosis ($n = 25$) exhibited significantly lower functional capacity compared with age- and height-matched controls ($n = 25$). Specifically, they walked a mean of 561 m (95% CI, 537 to 585) during the 6MWT compared with 651 m (95% CI, 624 to 673) in controls, representing a mean difference of 90 m ($p < 0.001$). These results indicate substantial impairments in aerobic functional capacity in women with endometriosis (Álvarez-Salvago et al., 2020).

2.5.4 Pelvic floor health

One study (Skaug et al., 2024) examined the impact of heavy weightlifting on pelvic floor muscle activity across 47 strength-trained women (between 18 and 35 years) across one week. Participants completed an acute heavy-load resistance exercise session consisting of back squats and deadlifts performed as 4 × 4 repetitions at 75–85% 1RM. While this study did not exclusively examine women with endometriosis, 25.5% of participants reported at least one chronic condition which included endometriosis among others (e.g., IBS, ulcerative colitis, vulvodynia, anaemia, neurological disease, migraine, frequent herpes virus, ovarian cysts). Surface electromyography was used to assess pelvic floor muscle resting activity, pressure transducers were used to assess pelvic floor muscle resting pressure, strength, and endurance before and after both weightlifting and rest sessions. In trained women, a controlled session of heavy back squats and deadlifts (75-85% 1RM) did not significantly alter pelvic-floor muscle function. Specifically, pelvic-floor muscle resting pressure changed by a mean of 0.9 cm H₂O (95% CI, -0.2 to 2.0; p = 0.096), strength by -0.2 cm H₂O (95% CI, -2.5 to 2.1; p = 0.857), and endurance by -30 cm H₂O·s⁻¹ (median change; IQR, -18 to 28; p = 0.876) immediately post-lifting compared with baseline. Similarly, after a rest session, no significant changes were observed in resting pressure, strength, or endurance. Between-condition comparisons also showed no significant differences (all p > 0.05). These results indicate that acute high-load resistance exercise does not compromise pelvic-floor muscle function in trained women, suggesting that well-trained individuals may tolerate heavy lifting without immediate pelvic-floor muscle impairment (Skaug et al., 2024).

2.5.5 Bone health and metabolic/inflammatory markers

No studies in this review measured BMD or systemic inflammatory markers alongside RT. Trials testing whether externally loaded RT preserves BMD and modulates inflammatory/myokine profiles (e.g., CRP, IL-6, TNF-α; irisin) in endometriosis are absent.

2.5.6 Reporting quality and RT prescription transparency

Reporting of FITT variables was inconsistent across studies. Exercise frequency was the most consistently documented component, with all interventions delivering between one and three sessions per week. Four studies explicitly reported session load and intensity, with two studies employing quantitative measures (%1RM) (Poli-Neto et al., 2020; Skaug et al., 2024) and two utilising subjective assessments of intensity (e.g., “moderately hard”) (Awad et al., 2017; Tennfjord et al., 2024). In contrast, descriptions of sets and repetitions were often vaguely described, with only two studies providing explicit details (Poli-Neto et al., 2020; Skaug et al., 2024), thereby limiting the clarity and interpretation of total training volume. Principles of progression and overload were similarly underreported, with only three studies outlining how the training loads or volumes were adjusted over time (Artacho-Cordón et al., 2023; Tennfjord et al., 2024; Salinas-Asensio et al., 2025). For example, Artacho-Cordón et al. (2023) and Salinas-Asensio et al. (2025) increased duration, intensity and number of repetitions of resistance exercises over time, once adequate lumbopelvic motor control was maintained, and based on fatigue perception. Tennfjord et al. (2024) monitored and adjusted training intensity following the principle of 2-3 repetitions in reserve for muscular strength training and the Borg rating of perceived exertion.

Adherence rates and fidelity of training programs were infrequently reported. Only one intervention reported adherence data, indicating that participants completed 90.6% of prescribed sessions (Artacho-Cordón et al., 2023). Reasons for dropout were not reported in any study. Symptom flare-ups as a result of the exercises undertaken were also not reported. Adverse events were also inconsistently reported, with most studies providing no explicit information regarding their occurrence. As such, it was unclear whether adverse events did not occur or whether they were not systematically assessed or reported. This lack of reporting limits conclusions regarding the safety and tolerability of RT interventions in this population. Of the included studies, only two extended their outcome assessment to a long-term follow-up, reassessing participants again at one-year post-intervention (Artacho-Cordón et al., 2023; Salinas-Asensio et al., 2025).

Table 5. Directional Synthesis of Resistance Training Effects in Women with Endometriosis

Outcome Domain	Direction of Effect	Evidence Strength
Pain	↓	Moderate
QoL	↑	Moderate
Fatigue	↓	Moderate
Sleep Quality	→	Low-moderate
Physical Function	↑ / →	Moderate
Muscle Strength	↑	Moderate
Pelvic Floor Function	→	Low
Bone Health/Inflammatory Markers	—	None

↑ = improvement or increase in outcome (e.g., reduced symptoms or improved function/quality of life)

↓ = decrease or worsening in outcome

→ = no overall change or mixed/inconsistent findings across studies

— = not assessed or no available evidence in included studies

Evidence strength reflects the quantity, consistency, and study design of included evidence, where moderate is a limited number of studies and/or mixed designs with generally consistent direction of effect and low is single study evidence and/or small sample sizes and/or inconsistent or indirect evidence

2.6 Discussion

This scoping review mapped a small body of RT evidence for women with endometriosis and clarified where the literature is most, and least, developed. Most interventions demonstrating benefits to pain, QoL, and lumbopelvic function embedded RT within broader, multimodal programmes (e.g., aerobic work, motor control, stretching), which makes it challenging to isolate the specific contribution of RT to outcomes. In these studies, RT was frequently delivered as bodyweight or remedial strengthening rather than externally loaded, progressive programmes, and key prescription variables such as RT intensity and progressive overload were often not reported, with only three studies outlining intensity or volume adjustments over time. Follow-up reporting was rare, with only one larger scale RCT using a multimodal exercise program (PhysioEnd-EA) reporting 6-12-month outcomes (Artacho-Cordón et al., 2023; Salinas-Asensio et al., 2025). Given the limited number of RCT studies performed, long-term benefits of RT specifically remain unclear. Thus, although RT may be a plausible component of multidisciplinary rehabilitative care, its independent efficacy as well as the benefits that it provides over time remain uncertain and should be interpreted cautiously until confirmed by well-designed, transparently reported and adequately powered RCT trials are available.

2.6.1 FITT prescription

Currently, no formal RT prescription guidelines exist for women with endometriosis. Although there are established consensus statements on the management of endometriosis (Johnson et al., 2013; Becker et al., 2022), these documents primarily emphasise pharmacological strategies such as non-steroidal anti-inflammatory drugs, and a range of hormonal therapies including combined contraceptives for symptomatic relief. In contrast, lifestyle-based approaches, including physical activity and structured exercise, are only briefly mentioned and are not strongly recommended, largely due to a limited and low-quality evidence base. Specifically, RT is not addressed in these guidelines, highlighting a gap in the current endometriosis management recommendations.

Of the limited exercise-based interventions available, most have generally embedded RT within broader multimodal programs that incorporate aerobic, flexibility or motor-control components. Within these programs, RT is most commonly prescribed using bodyweight or low-load exercises rather than externally loaded, progressive RT (Artacho-Cordón et al., 2023; Awad et al., 2017; Tennfjord et al., 2024; Salinas-Asensio et al., 2025). Notably, all studies included in this review were published within the past seven years, with 86% published in the last five, indicating a growing research interest in RT as a management strategy for endometriosis. However, further robust, well-designed studies are still needed before clinical recommendations can be confidently established. Additionally, the core exercise prescription variables, including frequency, intensity, time and type (e.g., FITT principles), progressive overload and adherence, are inconsistently reported and often unclear, constraining replication and clinical translation (Arora et al., 2024; Bland et al., 2021). In response to these challenges, it is recommended that future exercise intervention studies adopt established reporting frameworks and methodological guidelines, such as the Consensus on Exercise Reporting Template, to enhance transparency, standardisation, and reproducibility in exercise intervention reporting. Incorporating these principles into endometriosis care could enable more structured, evidence-based RT prescription that accommodates fluctuations in pain, fatigue, and hormonal treatment status. Future larger RCT's exploring RT exercise effects should prioritise transparent FITT-principles reporting. Specifically, objective monitoring of RT progression is needed, as well as how progressive overload is applied. Trials should also adopt long-term follow-ups to identify training reversibility effects and post-intervention RT-related adverse effects for women living with endometriosis.

2.6.2 Pain and QoL

Only a small number of studies have examined pain and QoL outcomes in women with endometriosis following exercise interventions. Two studies used multimodal exercise programs that included RT components and reported reductions in pain (Awad et al., 2017) and improvements in QoL (Artacho-Cordón et al., 2023). However, these findings are difficult to compare directly

because of substantial heterogeneity in how pain was assessed, the variation in pain intensity scores and anatomical location (e.g., pelvic, low back), underlying pain mechanisms or drivers (nociceptive, neuropathic, nociplastic), and the extent to which pain-related functional impacts were measured (e.g., how did pain impact activities of daily living). One study found that a single-session RT intervention improved pain thresholds in healthy women but not those with endometriosis (Poli-Neto et al., 2020). These findings may reflect differences in exercise-induced hypoalgesia, potentially driven by central sensitisation, altered nociceptive processing, or heightened inflammatory responses commonly observed in endometriosis (Bajaj et al., 2003). In contrast, Artacho-Cordón et al. (2023) demonstrated that a nine-week supervised and individualised rehabilitation program consisting of aerobic, RT, lumbopelvic motor control work and flexibility training was able to reduce pain and improve QoL for women with endometriosis who had previously not responded to conventional care. These improvements may relate to several therapeutic mechanisms, including enhanced neuromuscular control, reduced muscle tension and desensitisation of pain pathways. Although the intervention included a single resistance-based exercise that may technically meet a definition of resistance exercise (Phillips & Winett, 2010; Fleck & Kraemer, 2014), it remains questionable whether this approach constitutes resistance *training* (Artacho-Cordón et al., 2023), given then limited progressive overload control (Kraemer & Ratamess, 2004). These findings suggest that individualised, progressive exercise-programs may offer meaningful benefits for pain and QoL in women with endometriosis. However, although pain-related outcomes are promising, small samples, short interventions, heterogenous outcomes, absent control groups, and limited functional measures restrict causal inference and weaken conclusions about RT as a standalone pain therapy.

2.6.3 Fatigue and sleep

In women with endometriosis, fatigue reflects physical, cognitive, emotional, and motivational components rather than simply peripheral muscle fatigue or loss of force (Billones et al., 2021). It is a common, multifaceted symptom, affecting around half of individuals with endometriosis (51%) compared with

about one-fifth of women without the condition (22%) (Ramin-Wright et al., 2018). Endometriosis-related fatigue has a pervasive impact on the functioning of women living with the condition, with women reporting an impact on daily and physical activities, social relationships, work and school, and mood and emotions (DiBenedetti et al., 2020). Despite the high prevalence of both fatigue and sleep disturbance in this population (Ramin-Wright et al., 2018; Soliman et al., 2021), very few exercise studies have examined these outcomes. Of the trials included in this review, only one specifically assessed fatigue, using the Piper Fatigue Scale (Salinas-Asensio et al., 2025). They found that fatigue showed substantial improvement following the Physio-EndEA program ($d > 0.80$). In the Physio-EndEA group, fatigue scores were reduced significantly post- intervention and at one-year follow-up (38.2% and 16.3% respectively). Notably, the post-intervention fatigue levels were comparable to those reported by women without endometriosis using the same scale (Salinas-Asensio et al., 2025). This suggests that the intervention may not only reduce fatigue in women with endometriosis but also restore fatigue levels to a normative range.

Some observational studies indicate that women with endometriosis have reduced physical performance and heightened fatigue compared with controls (Álvarez-Salvago et al., 2020; Silva et al., 2024), supporting the rationale for therapeutic approaches such as RT to reduce fatigue and enhance functional independence. Indirect evidence from other chronic conditions (e.g., fibromyalgia, multiple sclerosis) shows that RT can reduce fatigue and improve health related QoL (Taul-Madsen et al., 2021; Torres-Costoso et al., 2021; Vilarino et al., 2022). Chronic RT has been shown to improve subjective sleep outcomes, specifically sleep quality, across both healthy and clinical populations (Kovacevic et al., 2018). Acute RT, as well as combined aerobic and resistance programs, may also confer sleep benefits, though evidence is currently limited (Kovacevic et al., 2018). RT improved neuropsychological outcomes such as anxiety and depression, which are often comorbid with sleep disturbances, may further support better sleep outcomes (Kovacevic et al., 2018). Higher frequency, intensity, and duration of RT appear to offer the greatest benefits, suggesting that RT may be a viable long-term strategy for managing impaired

sleep (Kovacevic et al., 2018). Given the substantial impact of fatigue in endometriosis, this represents a key evidence gap for RT-focused trials using validated fatigue and sleep measures. Embedding RT within a broader biopsychosocial framework may help address pain, physical inactivity, and functional decline in this population group (Wilson et al., 2025). Future research should also clarify which fatigue dimensions (e.g., physical, cognitive, mental, motivational, emotional) ought to be routinely assessed among women with endometriosis to improve consistency and comparability across studies.

2.6.4 Physical function and strength

Only two RCT interventions assessed muscle strength, endurance, and stability in women with endometriosis following exercise training (Artacho-Cordón et al., 2023; Salinas-Asensio et al., 2025), and none reported significant improvements in these outcomes. However, interpretation of strength findings is complicated by inappropriate use of outcome terminology and measurement. Artacho-Cordón et al. (2023) described a strength outcome that was operationalised as time-to-task completion, which reflects muscular endurance rather than maximal or submaximal strength. This conflation of strength and endurance potentially limits translation and clinical implementation of findings, as it obscures known improvements in muscle force output associated with RT, and highlights inadequate prescription in research that fail to specifically target the physiological attribute being assessed. Four studies incorporated either bodyweight strengthening or low-load single- or multiple-exercise RT, without externally loaded moderate-to-heavy exercises (Awad et al., 2017; Artacho-Cordón et al., 2023; Tennfjord et al., 2024; Salinas-Asensio et al., 2025). While low-load RT can elicit meaningful gains in strength and muscle mass, the magnitude of adaption depends on factors such as baseline fitness, progression, intervention duration, exercise type (compound vs. isolation), equipment (machines vs. free weights), rest periods, and type of muscle contractions (Schoenfeld et al., 2017; Lopez et al., 2020), factors that remain largely unexplored in women with endometriosis.

The type of RT prescribed among the studies included in this review mirrors broader RT research in chronic pain populations, where low-dose, remedial exercise is often prescribed to minimise symptom exacerbation (Lopez et al., 2021; Polaski et al., 2019). Nevertheless, evidence from other chronic pain populations such as fibromyalgia, indicates that appropriately prescribed, progressively overloaded RT can elicit meaningful neuromuscular adaptations, including increases in muscle strength, hypertrophy, and endurance, which contribute to improved functional capacity (Larsson et al., 2015; Vilarino et al., 2023). For example, Larsson et al. (2015) conducted a 15-week RCT in women with fibromyalgia using person-centred, progressive, RT, involving large muscle groups and exercises aimed at improving core stability and power, performed twice weekly, with loads progressed every three to four weeks. Participants in the RT group showed significant improvements in current pain intensity ($p = 0.033$), pain disability ($p = 0.055$), 6MWT ($p = 0.003$), isometric knee-extension force ($p = 0.010$) and isometric elbow flexion force ($p = 0.02$) compared to controls. Similarly, Vilarino et al. (2023) conducted a systematic review of multiple RCTs examining the effects of resistance training on symptoms and functional capacity in individuals with fibromyalgia. Interventions lasted 8-21 weeks, were performed twice weekly, and involved 8-12 exercises per session at 40-80% 1RM. Most programs began with 15-20 repetitions at a low load, gradually increasing load while reducing repetitions. Across these studies, RT consistently improved pain, muscle strength, fatigue, and overall functional capacity.

Taken together, these findings suggest that well-designed, progressively challenging RT programs can provide clinically relevant benefits in both physical function and pain management for individuals with fibromyalgia. At present, there is a need for future research in women with endometriosis to implement externally loaded, progressive RT programs tailored to individual tolerance and symptom profiles, to more robustly evaluate neuromuscular and functional benefits.

2.6.5 Pelvic floor

Endometriosis-associated pelvic pain is highly prevalent and often challenging to manage, with up to 79% of women with endometriosis experiencing pelvic pain, with specific subtypes including dysmenorrhoea (70.2%) and dyspareunia (49.5%) (Matalliotakis et al., 2008). For some women, pain persists or recurs despite medical or surgical treatment, resulting in persistent pelvic pain, defined as intermittent or constant pain in the lower abdomen or pelvis lasting at least six months (Allaire et al., 2017). This heightened pain sensitivity may lead to central sensitisation, which may contribute to the frequent co-occurrence of conditions such as painful bladder syndrome, irritable bowel syndrome and myofascial dysfunction (Allaire et al., 2017). Women with persistent pelvic pain often experience psychological distress, catastrophising thoughts, kinesiophobia, and sleep disturbances, highlighting the multifaceted impact of chronic pelvic pain in this population (Allaire et al., 2017). Concerns regarding pelvic floor safety during heavy lifting are, at present, not strongly substantiated. Individuals with endometriosis exhibit altered muscular and sensory functions in the pelvic floor, which contribute to increased pain and dysfunction of the pelvic floor (da Silva et al., 2023). In strength-trained women, a crossover study using back squats and deadlifts at 75–85% 1RM found no detrimental acute changes in pelvic floor resting pressure, strength, or endurance. Although this study used a mixed population (some of whom were women with endometriosis), these results suggest that heavy weight training may be safe when using symptoms to guide prescription, and with progressive exposure and close monitoring (Skaug et al., 2024).

2.6.6 Bone health and metabolic/inflammatory markers

Hypoestrogenic therapies commonly prescribed for endometriosis, such as GnRH agonists, can increase bone turnover and are associated with clinically important bone loss (Bergström et al., 2005; Mitwally et al., 2022). In women with endometriosis specifically, approximately 16% of cases in Europe and 20% in the United States receive hormone-related therapies pre-surgery, increasing to 26% and 63% post-surgery, respectively (Schweppe, 2005). Given the large

number of women exposed to these treatments, there is a clear need to identify strategies that mitigate their adverse effects on bone.

In a pilot trial, Bergström et al. (2005) randomised women with endometriosis receiving GnRH therapy to either a physical training group (three 30-minute brisk walks and two 1-hour aerobic sessions per week for 12 months; $n = 8$) or a control group ($n = 11$). Results from this study showed that the aerobic training did not prevent BMD decline during active GnRH treatment, however it did substantially increase the rate of bone regeneration after therapy cessation. However, this finding is not surprising given that the combination of RT and aerobic exercise, or RT as a standalone therapy, may well promote osteogenic effects more so than aerobic exercise alone (Armamento-Villareal et al., 2020; Xiaoya et al., 2025). RT has led to increases in bone mineral density at the lumbar spine, femoral neck, and total hip across multiple populations, including older adults (Hong & Kim, 2018) and post-menopausal women (Zhao et al., 2025). As such, the incorporation of RT into multidisciplinary management plans of women with endometriosis on hormone replacement therapy to help preserve and restore bone health may be an important area of study for future trials.

2.7 Future Directions

Future trials should be designed to isolate the effects of RT from co-interventions by including RT-only arms or factorial designs, with full reporting of FITT parameters, clear progression rules (%1RM or RPE/RIR), supervision protocols, adherence, and pre-specified flare-up management. The Physio-EndEA programme offers a useful template for RT reporting in endometriosis-specific trials. Longer follow-up, and stratification by treatment status (e.g., GnRH exposure) and endometriosis phenotype, will help clarify for whom and under what conditions RT is most effective. Moreover, adequately powered RCTs are needed which include outcomes that matter to patients and clinicians: pain and pain interference, fatigue and sleep, functional capacity and strength (particularly trunk and hip), pelvic floor symptoms, bone health, and adverse events. Contemporary RT prescription frameworks from other populations can guide dosing while endometriosis-specific evidence develops, alongside

evaluation of pragmatic delivery models (e.g., supervised starts with supported transition to home/hybrid formats) for adherence, cost, and scalability. Finally, future RT trials in endometriosis should carefully consider exercise order within multimodal programs. Appropriately prescribed session volumes and intensities of multimodal exercise and their suitable progression can have additive benefits in healthy and athletic individuals (Chtara et al., 2005; Mikkola et al., 2007; Ribeiro et al., 2018; Prieto-González et al., 2022). However, care needs to be taken when structuring resistance exercises after progressively increasing or fatiguing aerobic components or prolonged stretching, as these may attenuate the capability to perform RT (through accumulated central and/or peripheral fatigue) reducing the effectiveness of interventions on strength, power, muscular endurance, and hypertrophy outcomes across a training regimen (Häkkinen et al., 2003; Wilson et al., 2012; Doma & Deakin, 2015; Lundberg et al., 2022), although some negative effects may be greater in males (Huiberts et al., 2024)

A strength of this review is the systematic searching and screening of research, as well as the transparent mapping of interventions and outcomes which assisted in highlighting reporting gaps that currently limit translation. However, our conclusions remain constrained by small samples, multimodal exercise program designs that obscure RT-specific effects, incomplete reporting of intensity/progression of RT, and limited long-term follow-up data.

2.8 Conclusion

In conclusion, bodyweight and low-load RT appear feasible and generally well tolerated within multimodal programmes for women with endometriosis. However, the evidence base is still early and methodologically heterogeneous, so clear guidance on “who benefits, at what dose and intensity, and for how long” is not yet possible. Future work should test standalone, externally loaded, progressive RT against usual care or alternative exercise over adequate durations ($\geq 12 - 16$ weeks), with supervised progression, transparent FITT reporting, and long-term follow-up ($\geq 6 - 12$ months) using clinically salient outcomes (pain, fatigue/sleep, function and strength, pelvic-floor symptoms,

bone health, biomarkers, and adverse events), alongside adherence and flare-up management. Stratifying by hormonal therapy status, endometriosis phenotype, and life stage, will help identify who benefits most. In the meantime, integrating progressive, symptom-responsive RT within multidisciplinary care, with clear reporting and patient-centred adaptation, represents a pragmatic path forward.

Chapter 3 Preface

Questionnaire Theoretical Framework

The preceding chapters have highlighted the significant burden of endometriosis across physical, psychosocial and economic domains, and identified major gaps in the literature surrounding the role of exercise, specifically RT, in its management. While the scoping review systematically mapped existing evidence, it revealed a distinct lack of research focused on isolated RT interventions for women with endometriosis. Most studies have centred around aerobic or multimodal interventions, with limited recognition of RT dosage, progression, or its effects on endometriosis symptomatology. Furthermore, the lived experiences of Australian women with endometriosis, including their motivations, perceived barriers, and attitudes towards RT, remain underexplored. This lack of data constrains the ability to design practical, evidence-based recommendations to support safe and effective RT participation within this population group.

In response to these gaps, the following preface presents the conceptual and theoretical framework for the online questionnaire component of the study, which aims to capture current RT practices, perceptions, and barriers among Australian women with endometriosis. The questionnaire also aims to contextualise how these women engage in RT within their daily lives and quantify the psychosocial and behavioural determinants influencing participation. This phase of the study complements the scoping review by translating its findings into an applied investigation of real-world experiences, generating descriptive information about what women are doing, why they do or do not engage in RT, and how symptom burden and social context shape their exercise habits.

Theoretical Framework

The questionnaire is underpinned by the Theory of Planned Behaviour (TPB) (Ajzen, 1991), which offers a structured framework for understanding and predicting health-related behaviours. The TPB proposes behavioural intentions, and behaviours themselves are determined by three key constructs: attitudes (the individual's beliefs about the outcomes of the behaviour), subjective norms (perceived social pressures or expectations to perform the behaviour), and

perceived behavioural control (the individual's confidence and perceived ability to perform the behaviour) (Ajzen, 1991). In the context of endometriosis, these constructs provide a meaningful lens through which women's beliefs about the benefits or risks of RT, the influence of social and professional support networks, and their perceived capacity to exercise safely despite pain, fatigue, and symptom variability can be examined.

Although the TPB has been applied within endometriosis research, its use has focused on non-exercise behaviours. The TPB has been used to predict and understand intentions of seeking endometriosis-related information and social support on social media (specifically, Facebook), with attitudes and past behaviours emerging as key predictors of intention (Lores et al., 2025). It has also been used to examine women's intentions to discuss severe menstrual symptoms, demonstrating that attitudes, subjective norms and perceived behavioural control differ across social contexts and strongly influence intentions to seek advice, particularly in settings like the workplace, where stigma is typically higher (Eitze & Reinhardt, 2025). Beyond behaviour prediction, the TPB has been used to design educational interventions that improved knowledge, attitudes, behavioural intentions, and reproductive-health behaviours among women with endometriosis (Zandi et al., 2023). Collectively, these studies do highlight the usefulness of the TPB as a framework for understanding and modifying health-related behaviours in endometriosis. Despite this, its application to exercise, and specifically RT has not yet been explored in this population. Extending the TPB to exercise and RT among women with endometriosis therefore offers a novel contribution to better understand how attitudes, perceived control, and social influences shape engagement in exercise behaviours that are rarely clinically encouraged, yet which may offer therapeutic benefits for this group.

Philosophical Positioning

This research adopts a pragmatic worldview, which aligns with the applied nature of the study and its goal to generate practical, contextually relevant insights (Creswell & Creswell, 2018; Giacobbi et al., 2005). Pragmatism acknowledges that both objective and subjective realities influence behaviour

(Garcés, 2022; Pueyo-Ibáñez, 2021) and prioritises the use of methods that best address the research problem rather than adhering strictly to a single epistemological stance (Dixon, 2019; King, 2022). Within this framework, the online questionnaire was selected as a flexible, accessible tool to capture descriptive and correlational data from a geographically dispersed population (Klieve et al., 2010), allowing for both theoretical testing and real-world relevance. The pragmatic approach also supports the integration of quantitative and secondary qualitative items (Creswell & Creswell, 2018), recognising that understanding complex behaviours such as exercise engagement requires both measurable and experiential dimensions.

Justification of Approach

While the TPB has been critiqued for its limited ability to account for emotional, identity-based, and habitual influences on behaviour (Manstead, 2011), it remains a suitable theoretical framework for addressing the current research aims. Its structured focus on intention formation and perceived control provides a clear pathway for identifying modifiable factors that could enhance RT participation among women with endometriosis. It should be noted that the use of the TPB in endometriosis research may be limited due to narrow measurements of its core constructs, including single-item or low-reliability measures of subjective norms, perceived behavioural control and behavioural intention, and its failure to capture endometriosis-specific predictors such as public and self-stigma (Lores et al., 2025; Eitze & Reinhardt, 2025). Its applicability may be further constrained by context-specific factors, with subjective norms and perceived behavioural control varying across social settings, and by study design limitations (small sample sizes and short follow up) which may reduce the explanatory power of the TPB-based predictions in this population (Eitze & Reinhardt, 2025; Zandi et al., 2023). However, when integrated within a pragmatic paradigm, the TPB supports both theoretical inquiry and the generation of actionable knowledge. This dual perspective enables the research to not only examine relationships between attitudes, norms, and behavioural control, but also to inform future intervention strategies

that may improve participation, adherence, and clinical recommendations for RT in this population.

In summary, the following chapter details the conceptual framework and methodological procedures underpinning the online questionnaire. Guided by the TPB and informed by a pragmatic worldview, this study aims to explore how Australian women with endometriosis perceive, experience, and engage in RT. The findings may contribute to the refinement of theoretical understanding, the identification of modifiable behavioural determinants, and the development of future evidence-based exercise guidelines for women with endometriosis.

Chapter 3

Questionnaire Conceptual Framework and Methodology

Table 6. Definitions of Key Physical Activity and Resistance Training Terms

Term/Component	Definition
Physical activity	Any body movement produced by the skeletal muscles that expend energy, including sport and conditioning activities and daily activities such as occupational, household activities (Caspersen, Powell & Christenson, 1985).
Planned physical activity	Also referred to as exercise , is a structured type of physical activity, to improve or maintain physical fitness (Caspersen, Powell & Christenson, 1985), which may include activities like going to the gym or sports training sessions.
Resistance training	Resistance training is defined as a form of planned periodic exercise, often performed in a home or commercial gym setting, utilising external weights and/or equipment, such as, free-weights (dumbbells, barbells, kettlebells), machines, bands, and bodyweight movements (Phillips & Winett, 2010; Fleck & Kraemer, 2014).
Frequency	The number of (exercise) training sessions in a defined period (e.g. one week) (Lambert et al., 2008).
Intensity	A measure of how hard the exercise is, and can be measured through heart rate, oxygen consumption, blood lactate or the perception of effort for aerobic exercise, and the RPE scale, % of 1RM or RIR for RT (Bishop et al., 2024). In this questionnaire, the RPE scale was used, which provides a measure of “how hard it feels that the body is working” during exercise based on the physical sensations experienced, including an increase in; heart rate, breathing rate, sweating and/or muscle fatigue (Williams, 2017).

Time	Refers to the duration (length) of the training session, or otherwise known as the time it takes to complete the exercise session (Lambert et al., 2008).
Type	Training type refers to the kind of exercise being performed, including the kind of equipment being used, including machines, free weights, single-joint or multi-joint exercises (Kraemer & Ratamess, 2004).

3.1 Methodology and Conceptual Framework

To address the research aims, a quantitative cross-sectional questionnaire-based design was implemented, reflecting pragmatic perspectives using numerical data to examine real-world behaviours and outcomes (Simpson & Fletcher, 2020) related to RT in Australian women with endometriosis. While mixed-methods designs are typically associated with pragmatism, the paradigm itself does not restrict research to any one methodological approach, encouraging the use of methods most appropriate to effectively address the research questions (Creswell & Creswell, 2018). In this study, quantitative data were collected to generate a measurable understanding of PA and RT practices, and their associations with symptom management and participation levels, thereby supporting and informing the development of future interventions. While the questionnaire was designed to yield primarily quantitative data, supplementary qualitative responses were incorporated to explore secondary research questions. Much like pragmatism itself, which is not bound to a single worldview or epistemology, this approach embraced flexibility and utility in research design (Dixon, 2019; King, 2022). As emphasised by Creswell and Creswell (2018), pragmatic inquiry is problem-driven and aims to produce real-world, applicable findings, making it a suitable foundation for this study, which aimed to generate practical knowledge to inform future research.

3.2 Ethics Approval

This study received ethical approval from the Victoria University Human Research Ethics Committee (HRE25-013).

3.3 Participants

Participant recruitment was conducted using a combination of systematic online and in-person strategies to maximise reach and diversity across Australia (Webber-Ritchey et al., 2021). A flyer containing information about the study details, participant requirements, researcher contact information, and the link for the questionnaire was distributed both online and in-person. It was shared through national platforms such as Endometriosis Australia, (<https://endometriosisaustralia.org/research/research-notice-board/>) and EndoZone (<https://www.endozone.com.au/node/241>), via social media support groups, and was posted at various medical clinics and healthcare centres across Victoria.

Participants accessed the study information (detailed information about the study's purpose, procedures, risks, and benefits) and informed consent page, and subsequent questionnaire, via the flyer link. In order to be eligible to complete the questionnaire, participants had to confirm they were aged over 18, proficient in English, living in Australia, and had a confirmed medical diagnosis of endometriosis through laparoscopic surgery, MRI, or ultrasound. Participants confirmed these requirements as part of informed consent, which was obtained before proceeding with the questionnaire. The questionnaire was provided in English only. There were no exclusion criteria beyond failure to meet these requirements.

3.4 Study Design Overview

3.4.1 Questionnaire Design

Quantitative data were gathered through an online questionnaire developed and administered via Qualtrics (Provo, UT). The questionnaire was developed to align with the research aims, and provide a comprehensive understanding of RT practices, perceived impacts, and barriers among Australian women living with endometriosis. Questions were designed to cover key domains including PA engagement, RT patterns, perceived symptom impact, and participant demographics. A stepwise approach was used to design and refine the questionnaire before dissemination, following the processes outlined by

Lumsden (2007). This involved first defining the research objectives, followed by dividing the research question into sub-categories and profiling the target audience. The questionnaire content was then designed based on these considerations, before undergoing pilot testing to refine clarity and functionality. Following this refinement phase, the final questionnaire was administered for data collection. Questions were designed based on their alignment with the research aims and their order structured based on a logical flow across the three main question blocks to capture information in a coherent sequence from demographic characteristics to exercise practices and perceptions and minimise participant burden. The questionnaire was piloted by seven people including field experts and women with endometriosis. Following pilot refinements to questions, the questionnaire was administered to the wider public.

The final questionnaire (provided in Appendix B) consisted of 19 questions, comprising a total of 78 individual response items organised into three key domains: 1) demographic and clinical characteristics, including endometriosis history and symptomatology; 2) PA participation and RT practices; and 3) perceived impacts of RT on symptom management and barriers to regular RT participation.

Each question block was designed with reference to existing literature and in response to identified knowledge gaps arising from the Chapter 2 scoping review. Demographic and clinical characteristics were collected to 1) define the population sample who have completed the questionnaire to confirm current clinical stereotypes; and 2) to allow for sub-group analysis between variables (Ferreira et al., 2017). This section also aimed to evaluate whether the sample reflected the existing clinical stereotype of women with endometriosis as “white, lean, middle-class, career-driven women” (Rowlands et al., 2022). Questions included in this section captured attributes related to ancestry, geographic location, and endometriosis history. State/territory listings were ordered according to current population density (Australian Bureau of Statistics, 2024), and ancestry response options were selected based on those represented in the most recent Australian national census (Australian Bureau of Statistics, 2021). Diagnostic questions reflected current medical standards (American

College of Obstetricians and Gynaecologists, 2010), and symptom lists were informed by clinical symptoms (Horne & Missmer, 2022) and modified to incorporate symptoms reported by those with lived experience.

The PA and RT question block aimed to determine how women with endometriosis engage with RT, and how FITT principles are currently implemented within their RT regimen. Additionally, the general exercise habits of women with endometriosis were explored, with a focus on the proportion of their overall PA that consisted of RT. Capturing PA patterns provided necessary context for understanding RT behaviours within participants' broader exercise routines. Although similar PA-related questions have been explored in previous research, their inclusion in this study was intended to generate confirmatory data and assess whether current findings align with or diverge from existing literature. Several questions were adapted from Brooks et al. (2024) and refined to improve precision in measuring training dosages for both PA and RT independently (Appendix B; questions 8d, 8e, 8f, 8g, 10a, 10b and 10c). Types of RT (Appendix B; question 9b) were informed by the strength training types outlined by Suchomel et al. (2018), ensuring alignment with recognised classifications in exercise science. RT intensity (Appendix B; questions 11a and 11b) was graded using the rate of perceived exertion (RPE) scale, a validated measure of subjective effort (Williams, 2017).

The final section of the questionnaire examined barriers, facilitators, and perceptions of RT. Barriers to RT participation were primarily assessed using quantitative survey items, with a limited number of qualitative open-ended questions (Appendix B; questions 13c and 18b) included to provide additional contextual insight. These questions aimed to understand what enables or limits Australian women with endometriosis to participate in RT, as well as their subjective views on its potential for symptom management. Questions in this block were guided by the TPB (Ajzen, 1991), including response items (Appendix B; questions 13e and 16c) assessing perceived behavioural control (e.g. confidence to engage in RT without worsening symptoms). These items were developed to align with the key TPB constructs of attitudes, subjective norms, and perceived behavioural control, ensuring coverage of the theoretical

framework in the questionnaire design. Common barriers faced by the Australian population in participating in regular exercise (Appendix B; question 13a) were drawn from work by Hoare et al. (2017). Finally, questions specific to those who do not participate in RT, but would consider doing so, were included to inform future research directions and the development of tailored interventions (Appendix B; question 13). These responses provide valuable insight into potential entry points for increasing RT participation and expanding knowledge in this area.

The questionnaire incorporated matrix questions, Likert scales, rating scales and fixed multiple-choice questions to generate quantifiable data. RT behaviours were quantitatively assessed using the FITT principles (see Table 6), and exercise intensity was measured using the RPE scale. Most questions were modified to improve relevance for the endometriosis population, while others were drawn from existing validated instruments (Appendix B; questions 2g, 11a, 11b, 19). Where applicable, open-ended questions were included to collect optional contextual information.

3.4.2 Data Protection and Integrity

Consistent with best-practice data management recommendations by Griffin et al. (2022), several measures were implemented to ensure the protection, integrity, and reliability of the questionnaire data. These procedures were designed to minimise incomplete, inconsistent, or duplicate responses, thereby strengthening the validity of the dataset. Selected quantitative items (Appendix B; question 2g and question 19) were intentionally repeated in varied forms to assess internal consistency and strengthen construct validity (Griffin et al., 2022). Carry forward of reported endometriosis symptoms (Appendix B; question 2g) was used for subsequent impact of exercise and RT on symptoms items (questions 8c, 17b, and 17c) to prevent inconsistent responses. To maintain data completeness, only responses with more than 50% of questionnaire items completed were included in the final analysis. Data integrity was further supported through the activation of the “Prevent Ballot Box Stuffing” feature in Qualtrics, which restricted participants from submitting multiple

entries. Additional screening processes were conducted to identify and remove duplicate IP addresses, and demographic data (e.g., age and gender) were examined to ensure responses were appropriate and consistent with inclusion criteria (Griffin et al., 2022). Collectively, these procedures ensured that the final dataset was accurate, reliable, and reflective of the target population, thereby supporting the overall rigour and integrity of the study.

3.4.3 Questionnaire Validity and Reliability

Ensuring the validity and reliability of the questionnaire instrument was a key methodological consideration to support the accuracy and consistency of the data collected. Reliability was supported using repeated or thematically related items that measured similar constructs in different ways, allowing for cross-verification and pattern consistency in participant responses (Wehner et al, 2020). This was assessed through multiple symptom-related questions (Appendix B; questions 8c, 17b and 17c) asking participants to reflect on the effects of exercise and RT. Content validity refers to the extent to which a questionnaire adequately captures all relevant aspects of the construct it is intended to measure (Singh, 2017). Content validity was established through the development of distinct constructs and question types that addressed multiple aspects of the research aims and is often further established through input from subject-matter experts (Singh, 2017). As discussed in Section 3.4.4, a preliminary pilot was conducted to assess item clarity, response variability, construct relevance, and overall questionnaire content. Feedback was obtained from pilot participants, including discipline experts, and recommendations were made to refine terminology, improve clarity of diagnosis and symptom-related items. This feedback was implemented into the final version of the questionnaire, enhancing its content validity and ensuring response items aligned with the research aims (see Table 7). Face validity, which refers to how appropriate and relevant the instrument appears to its users (Singh, 2017; Allen et al., 2023), was also assessed through consultations with the supervisory team and content experts who reviewed question order, terminology, clarity and relevance (Allen et al., 2023).

An internal validity check was applied to responses related to PA and RT sessions. For example, the number of RT sessions per week (Appendix B; question 10b) and total RT duration (Appendix B; question 10c) were expected to fall within the total reported PA frequency (Appendix B; question 8f) and duration (Appendix B; question 8g). RT specific sessions should not exceed total planned PA unless due to misreporting. Additionally, the total number of exercises reported (compound (Appendix B; question 10f) and isolation (Appendix B; question 10j) exercises) was expected not to exceed the total number of exercises per session (Appendix B; question 10d).

Internal reliability is defined as the consistency of a test (Wen & Ye, 2011). Internal consistency, defined as the extent to which similar questions produce similar responses (Singh, 2017) was also assessed in the questionnaire. To evaluate internal reliability, identical items were placed in different sections of the questionnaire (Kachroo & Kachen, 2018). For example, participants were asked to rate their current or most recent endometriosis symptom severity on a 1-10 scale at both the beginning of the questionnaire (Appendix B; questions 2g and 19). This allowed for an internal consistency check across the questionnaire duration. Items regarding motivation to participating in RT and how RT contributes to participant health and well-being (Appendix B; questions 14a and 16a) had repeat response items. These were included deliberately, as a means of built in redundancy to assess for internal consistency.

Intraclass correlation coefficients (ICCs) were used to provide a measure of the reliability between symptoms severity items asked at the beginning (Appendix B; question 2) and end (Appendix B; question 19) of the questionnaire. Agreement (consistency), and association, between another set of related items (Appendix B; questions 14a and 16a) was assessed using Cohen's κ and percent agreement, and Mann-Whitney U test with non-parametric effect size (Cliff's δ), respectively. These answered the following questions: 1) to what extent do endorsed motivations align with endorsed perceived effects; and 2) do people tend to report as benefits the same things they report as motivators?

3.4.4 Pilot Testing

In line with the recommendations of Rattray and Jones (2007), six key steps were followed in the development and refinement of the questionnaire instrument: 1) identifying what the questionnaire would measure; 2) determining the scales used to capture responses; 3) generating and ordering questionnaire items; 4) conducting pilot testing; 5) assessing reliability, and; 6) ensuring validation (Figure 7).

Figure 7. Questionnaire Development Process

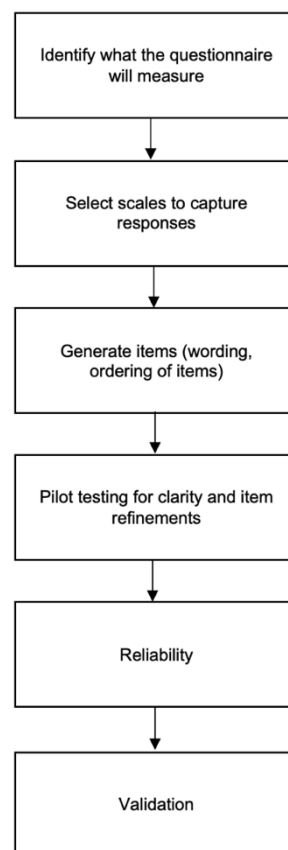


Figure 7. A six-point stepwise approach to questionnaire design, in line with the suggestions by Rattray & Jones (2007).

First, the focus of the questionnaire was established through an extensive review of the literature, which identified key gaps concerning RT practices, perceptions, and impacts among women with endometriosis. This process guided the development of a tool designed to explore these constructs

comprehensively. Second, a range of quantitative scales were incorporated within the Qualtrics platform, including Likert scales, categorical variables, and continuous measures, to effectively capture both behavioural and perceptual data. Third, item generation and sequencing were undertaken collaboratively with the supervisory team to ensure logical flow, clarity, and alignment with the study objectives.

Fourth, a preliminary pilot testing phase was conducted to determine item clarity and refine question wording and structure. Following questionnaire design, pilot testing was undertaken with seven individuals comprising members of the supervisory team, experts in the research area, and women with lived experience of endometriosis. This small-scale testing phase enhanced the face validity of the instrument by ensuring that items accurately measured the intended constructs and improved reliability through refinement of question design to promote consistency in responses (Malmqvist et al., 2019). Involving women with lived experience in the preliminary testing phase also aligns with recommendations that considering patients' perspectives in endometriosis research enhances research quality, promotes acceptance by target users, increases study effectiveness, and strengthens the appropriateness of study design (Giese et al., 2023). Studies involving end-user participation in pilot testing have further demonstrated higher rates of positive outcomes (Giese et al., 2023). Pilot participants completed the questionnaire via Qualtrics and provided feedback on operational and structural elements, including question flow, clarity, grammatical accuracy, and overall usability (Draugalis, 2008). The inclusion of women with endometriosis aimed to empower participants and ensure that questionnaire items reflected relevant, meaningful, and beneficial content for the target population (Giese et al., 2023).

Amendments were made based on feedback obtained during pilot testing to enhance functionality and precision (Table 5). This resulted in modifications to two complete questions and 19 individual response items across several multi-part questions. The final questionnaire, presented in Appendix B, consists of 19 questions and 78 individual response items. Following pilot testing, the procedures used to assess reliability and validation of the questionnaire are

detailed in Section 3.4.3, ensuring that the instrument is both consistent and accurately measures the constructs of interest.

Table 7. Questionnaire Amendments Based on Expert Feedback

Question Number	Original Question	Feedback Provided	Final Question
Q2a	Have you been diagnosed with endometriosis by a surgeon?	The question about being diagnosed by a surgeon is a bit ambiguous, as many surgeons use TVUSS and other methods to diagnose. If you want to know if they have been diagnosed via surgery that needs to be clear.	Have you been diagnosed with endometriosis by laparoscopic surgery?
Q16a	In what way/s has resistance training helped you manage your endometriosis symptoms?	Consider adding more examples or response items throughout to help people not misunderstand or misinterpret what you are asking them.	How does resistance training contribute to managing your health and well-being as someone living with endometriosis? (select all that apply)
Question Number	Original Questionnaire Items	Feedback Provided	Final Questionnaire Items
Q2d	Text box response	Some women may not know the qualification of the person who diagnosed them.	• General practitioner • Gynaecologist • Fertility specialist • Endometriosis specialist

			• Other (please specify)
Q2f	• Chronic pelvic pain • Dysmenorrhoea • Dyschezia • Dyspareunia • Fatigue • Other (please specify)	Add more endometriosis symptoms, as there are many not on the list, which is missing bladder pain (dysuria). Also, no mention of gastro-intestinal symptoms such as bloating or nausea which are also very common.	• Chronic pelvic pain • Dysmenorrhoea • Heavy menstrual bleeding • Dyschezia • Dysuria • Dyspareunia • Fatigue • Bloating • Nausea • Headache/migraine • Other (please specify)
Q7b	• Anxiety • Depression • Osteoporosis • Sarcopenia • Obesity • Diabetes • Cardiovascular disease • Autoimmune disease (please specify) • Neurological condition (please specify) • Other (please specify)	For additional diagnoses, add a few more relevant to endometriosis populations such as anxiety, inflammatory bowel disease, polycystic ovarian syndrome, adenomyosis, etc.	• Polycystic ovarian syndrome (PCOS) • Adenomyosis • Irritable bowel syndrome (IBS) • Inflammatory bowel disease (IBD) • Anxiety • Depression • Osteoporosis • Sarcopenia • Obesity • Diabetes • Cardiovascular disease • Autoimmune disease (please specify) • Neurological condition (please specify) • Other (please specify)

3.4.5 Feasibility and Sample Size

An online questionnaire was chosen to enhance study reach and practicality of data collection, allowing participation from a broader demographic compared to traditional methods (Wright, 2005). The questionnaire was structured to be 12-15 minutes long, maximising completion rates and reducing participant dropout (Sharma, 2022). The recommended online questionnaire time is approximately 10 to 20 minutes (Revilla & Ochoa, 2017), with an ideal maximum completion time of 28 minutes (Revilla & Hohne, 2020). This is because studies have shown that longer completion times are associated with increased participant dropout rates, reduced data quality due to rushed responses, and a higher likelihood of missing data (Sharma, 2022). Previous research has successfully targeted this population, providing strong foundations for participation and recruitment (Liljas, 2017). A substantial response rate was anticipated, consistent with studies conducted by Armour et al. (2019) and O'Hara et al. (2021), which adopted similar dissemination approaches, receiving 484 and 620 responses respectively, within a timeframe of two months. Based on the sample-to-item ratio for survey research, recommended by Memon et al. (2020), the required sample size for this study was at least 90 participants. Given that the questionnaire consisted of 19 questions, a minimum of 90 participants was necessary to ensure compliance with sample-to-item ratio guidelines (Memon et al., 2020). Furthermore, releasing the questionnaire in the middle of the year provided sufficient time for data collection and analysis for the thesis (while remaining open for longer for a downstream publication) ensuring the project was completed within the allocated timeframe of 12 months.

3.5 Data Storage

Data were extracted as a Microsoft Excel file and stored on the Qualtrics platform via the Victoria University license. Exported data from Qualtrics were stored on a secure Victoria University institutional research drive. Responses were exported into Microsoft Excel for initial data cleaning, where missing data were handled, and duplicates were removed. Duplicate data were identified through multiple responses from the same IP address and timestamps and

subsequently excluded from the dataset. Dates of birth were also checked, with implausible values (e.g., birth year of 1904) flagged and excluded. Questionnaire progress was then reviewed to identify incomplete responses. Specifically, datasets were excluded if they 1) failed to complete the demographic question block and subsequent questions, or 2) completed demographics and indicated participation in RT but did not complete that section, which would prevent valid comparisons between participants who did and did not engage in RT. These incomplete cases (generally ~52% or less of the questionnaire completed) were considered as missing datasets and were excluded from analysis. All data was de-identified and coded for analysis. Data were subsequently exported into JASP (Version 0.97.0; JASP Team, 2025) for statistical analysis. Upon completion of this study, all data will be stored in the Victoria University research storage system, in accordance with university policies on data security and confidentiality. No identifying information was collected, ensuring participants' anonymity throughout the research process.

3.6 Statistical Analysis and Data Reporting

3.6.1 Variable Selection and Prioritisation

A structured matrix of questionnaire variables was developed to guide analysis, grouped into four categories: demographics, physical activity/resistance training, symptom severity, and health/function outcomes. Variables were prioritised into three tiers. Tier one included essential descriptors and outcomes widely reported in gynaecological and exercise science research, such as age, body mass index (BMI), clinician-confirmed diagnosis, RT frequency and duration, barriers, self-efficacy, numeric rating scales for pelvic pain and related symptoms, and multi-domain QoL measures. Tier two captured contextual factors to aid interpretability, including training location, advisor/support, assistance needs, work hours, and acute responses to exercise. Tier three encompassed detailed RT programming metrics (e.g., sets, repetitions, compound vs. isolation exercises), considered exploratory due to self-reported errors. Prioritisation was informed by established outcomes in the endometriosis and women's health literature and by exercise science guidelines.

3.6.2 Analysis and Reporting

All quantitative data analyses were conducted using JASP (version 0.95.4). Prior to analysis, data were screened for missing values and outliers. Descriptive statistics were used to summarise participant demographics, general exercise and RT behaviours. Categorical variables (e.g., RT type, participation status, perceptions) were summarised using frequencies and percentages. Continuous variables (e.g., weekly RT frequency, symptom severity) were summarised via means with SDs, and ranges. The relationships between selected dependent (e.g., symptom severity, pain levels, QoL, and perceptions of RT) and independent variables (e.g., RT dosages, intensity and duration) were assessed. Age and comorbidities were included as covariates for all analysis.

ICCs were used to quantify reliability between symptom severity questions at the beginning and end of the questionnaire. Agreement between repeated symptom severity ratings (Appendix B; Q2 and Q19) was assessed using Bland-Altman analysis, which is recommended for evaluating systematic bias and random measurement error between two administrations of the same scale (Bland & Altman, 1986; Bland & Altman, 1999). For each symptom item, the mean difference (bias) and its 95% CIs were calculated to quantify systematic error. The standard deviation (SD) of the paired differences was used to compute the 95% limits of agreement (LoA), defined as $\text{bias} \pm 1.96 \times \text{SD}$, representing the range within which 95% of individual measurement differences are expected to fall under the assumption of normally distributed errors. (Bland & Altman, 1986). Confidence intervals (CIs) around both the bias and LoA were obtained to quantify the precision of the estimated agreement parameters (Giavarina, 2015). Because the sample size for each symptom item was modest, visual inspection of Bland-Altman plots was not relied upon for analytical interpretation; instead, numerical agreement indices (bias, LoA, and their CIs) were prioritised, consistent with recommendations for small-sample agreement studies (de Vet et al., 2006).

Reliability of the symptom severity ratings was interpreted using two complementary criteria: proportionality to the 0-10 scale width and expected

thresholds for meaningful within-person change. Given that clinically important changes in subjective symptom or pain ratings are typically in the range of 1-2 points on a 0-10 scale (Farrar et al., 2001), the limits of agreement (LoA) were compared against these benchmarks to determine the degree to which measurement error might obscure meaningful variation. However, because not all the symptoms relate to pain (i.e., heavy menstrual bleeding, fatigue, bloating, nausea), the interpretive approach was aligned with COSMIN (COnsensus-based Standards for the selection of health Measurement INstruments) guidance and broader standards for evaluating reproducibility of patient-reported outcomes (Terwee et al., 2007; de Vet et al., 2006; de Vet et al., 2011). LoA narrower than ± 2 points were interpreted as indicating strong reproducibility, as measurement error falls within or below the range of meaningful clinical change. By contrast, LoA ± 3 points or greater were interpreted as indicating moderate reproducibility, where measurement error may exceed typical clinically important differences. In such cases, the measure remains useful for group-level comparisons but may be insufficient for detecting small individual-level changes.

In order to investigate potential relationships between RT FITT variables and symptom severity, a correlational matrix was developed. Only symptoms which exhibited large or greater test-retest reliability ($ICC \geq 0.50$) were included in the analysis; dysmenorrhoea was, therefore, excluded. One outlier was excluded from the reliability data analysis due to the total completion time of the questionnaire spanning two days, potentially affecting symptom severity ratings. Spearman's rho (ρ) was calculated to examine associations between nine symptom severity variables, and the frequencies and durations of RT. Kendall's tau-b (τ) were calculated to examine associations between nine symptom severity variables and the intensity of RT.

The resulting correlation coefficients were interpreted to assess the magnitude and direction of relationships between RT variables (Spearman's rho for interval data, i.e., number of sessions, session duration; and Kendall's tau for ordinal data, i.e., session intensity) and symptom severity. Large-scale correlational analyses were conducted to explore whether any robust and meaningful

relationships existed between frequency, intensity and time training characteristics and endometriosis symptoms. This approach was chosen to identify potential patterns warranting further investigation before undertaking more complex modelling. Based on established guidelines (Schober et al., 2018), Spearman's rho values were interpreted as negligible (< 0.10), weak (0.10 to 0.39), moderate (0.40 to 0.69), strong (0.70 to 0.89), and very strong (> 0.90) correlations. Kendall's tau-b was used as a measure of association due to the small sample size and ranking based on a Likert-based scale (Kendall, 1948) and values interpreted as negligible (< 0.10), small (0.10 to < 0.20), moderate (0.20 to < 0.30), or strong (≥ 0.30) associations (Gignac & Szodorai, 2016).

Agreement between motivations for RT (Appendix B; question 14a) and perceived contributions of RT to overall health, well-being, and physical performance management (Appendix B; question 16a) was examined at the option level (e.g., "improve endometriosis symptoms", "improve strength") using Cohen's kappa (κ) with corresponding percentage agreement, restricting analyses to respondents with complete endorsement data for the option at both items. Kappa magnitude was interpreted using commonly applied benchmarks by Landis & Koch (1977), where < 0 is poor, 0.00 to 0.20 is slight, 0.21 to 0.40 is fair, 0.41 to 0.60 is moderate, 0.61 to 0.80 is substantial, and 0.81 to 1.00 is almost perfect. Associations between endorsement of an option as a motivator (Q14a; yes/no) and its corresponding impact rating in Q16b (1 to 5) were evaluated using a Mann-Whitney U test. For Mann-Whitney analyses, effect sizes were quantified using Cliff's delta (δ) and interpreted as negligible (< 0.15), small (0.15 to < 0.33), medium (0.33 to < 0.47), or large (≥ 0.47) (Cohen, 1988; Meissel & Yao, 2024).

In this study, statistical significance was set at $p < 0.05$, consistent with conventional thresholds used to control for Type I error (Davies, 2009). A 95% confidence interval (CI) was reported to reflect the precision and reliability of the findings (Davies, 2009; Greenland et al., 2016). Figures 9, 11, 12, 15, 16, 21, 22, 23 and 24, 25, and 26 were created with ChatGPT 5.0. Figures 17 and 18 were created with [BioRender.com](https://www.biorender.com).

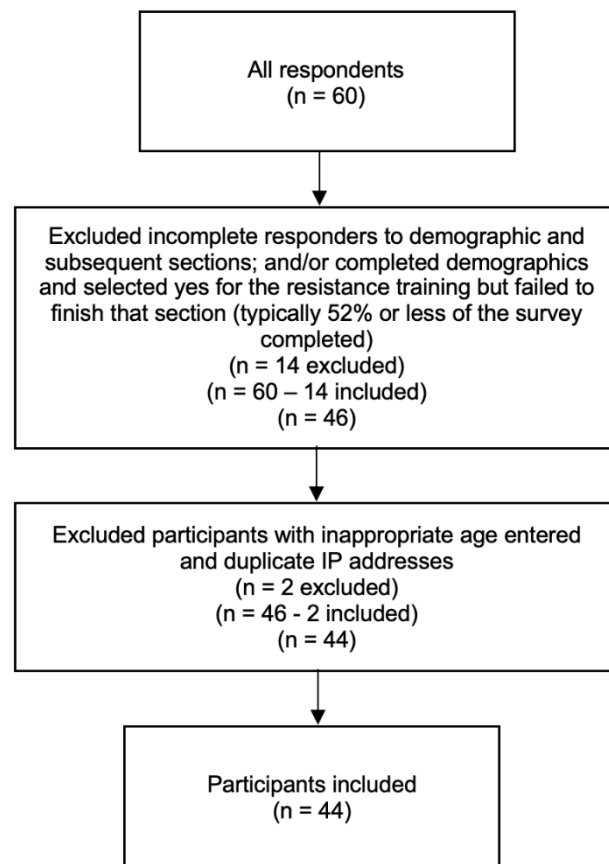
Chapter 4

Results

4.1 Questionnaire Recruitment Accrual and Adequate Completion Rate

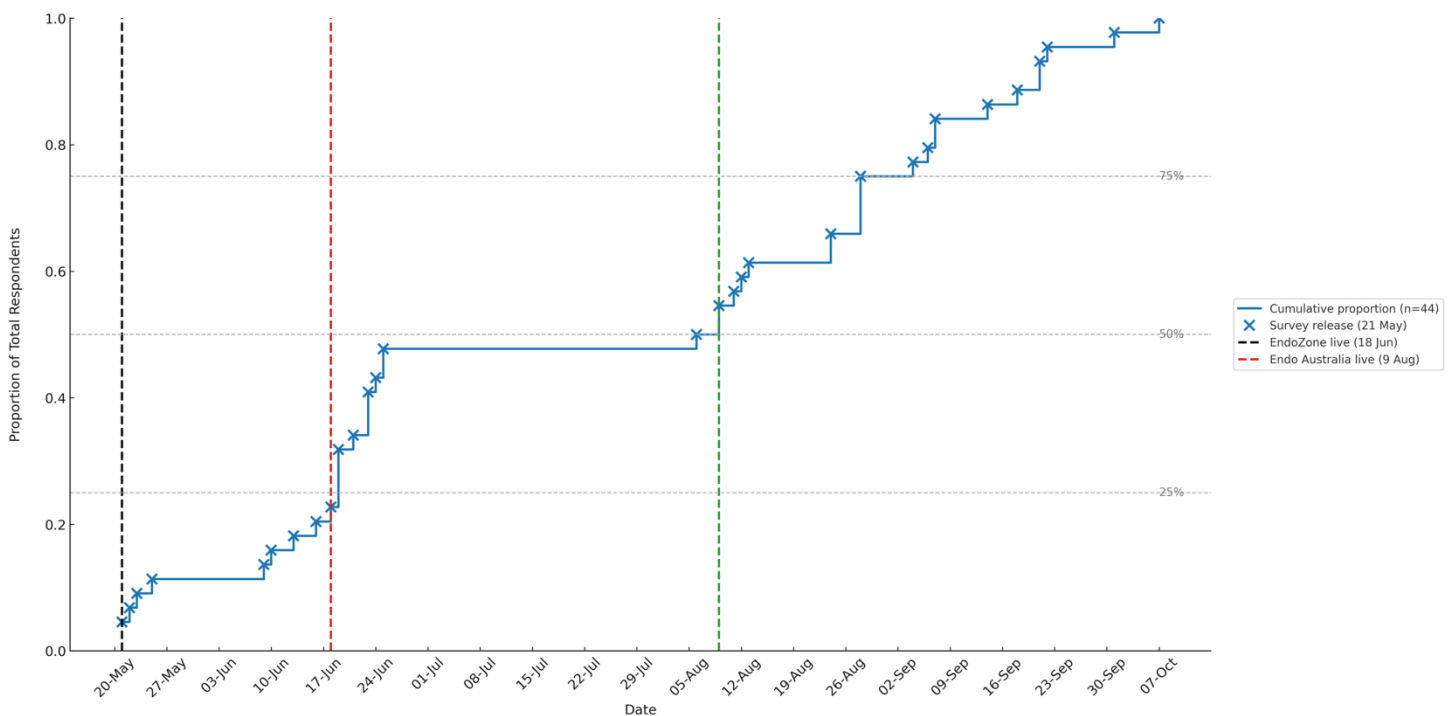
Of the 60 respondents as of 7th October 2025, only 44 were deemed to have provided sufficient detail (defined as > 52% completion of the questionnaire, which included completion of all demographic questions and one quarter of the RT question block) for inclusion in the present data analysis (figure 8).

Figure 8. Flow Chart of Data Exclusion



Recruitment occurred primarily in three waves (Figure 9). Initial recruitment by word of mouth and flyers drew in approximately 25% of respondents within one month. Advertising through EndoZone contributed to subsequent recruitment with 60% of respondents achieved by the third month. Finally, advertising through Endometriosis Australia in conjunction with existing recruitment led to a small surge in respondents in the fourth month.

Figure 9. Endometriosis Questionnaire Respondent Timecourse



4.1.1 Questionnaire Duration

Respondents exhibited variability in questionnaire completion time (Figure 10). The mean completion time of 77 minutes was heavily skewed due to one extreme outlier and several other respondents who recorded unusually long durations (e.g., potential periods of inactivity or leaving the questionnaire open). Given this non-normal distribution, median and IQRs were selected as the most appropriate summary statistics, providing a more robust representation of typical completion times than the mean. The median duration was 13 minutes, with an IQR spanning 9 minutes (lower quartile) to 24 minutes (upper quartile), highlighting that half of the respondents completed the questionnaire within this time range.

Figure 10. Distribution of Questionnaire Completion Duration

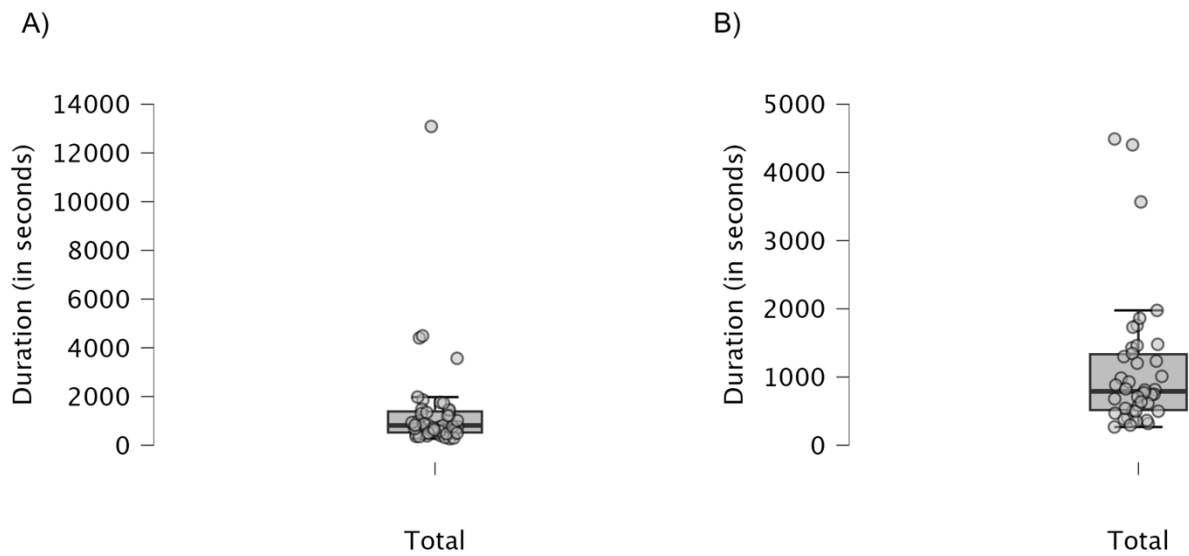


Figure 10. Distribution of questionnaire completion durations. Shown are the distribution of completion times with the extreme outlier retained, (Panel A; $n = 44$); and the distribution after removing the extreme outlier (Panel B; $n = 43$).

4.2 Respondent Characteristics

4.2.1 Sociodemographic Characteristics

Respondent physical characteristics are shown in Table 8. Respondents (n = 44) were young- to middle-aged adults. BMI ranged from underweight (< 18.5 kg·m⁻²) to obese class III (> 40 kg·m⁻²).

Table 8. Respondent Sociodemographic Characteristics (n = 44)

Characteristic	Mean	SD	Range
Age (yr)	31	10	19 - 50
Weight (kg)	72	18	43 - 130
Height (m)	1.66	0.07	1.49 - 1.81
BMI (kg·m ⁻²)	26.4	6.4	17.0 - 47.8

Geographic and socioeconomic characteristics of respondents are shown in Figure 11. The five most prevalent ethnic backgrounds reported were Australian, English/British, Italian, Irish, and Greek. Respondents represented four Australian states, primarily from Victoria and New South Wales. Reported annual income, classified using the Australian income brackets, was most commonly within the \$1-\$18,200 category, with most respondents working a single job (mean ± SD; range) for an average of 29 ± 12 hours (6-46 hours) per week. 41% of respondents reported working full time hours (defined as > 35 hours per week for this study).

Figure 11. Geographic and Socioeconomic Characteristics of Respondents

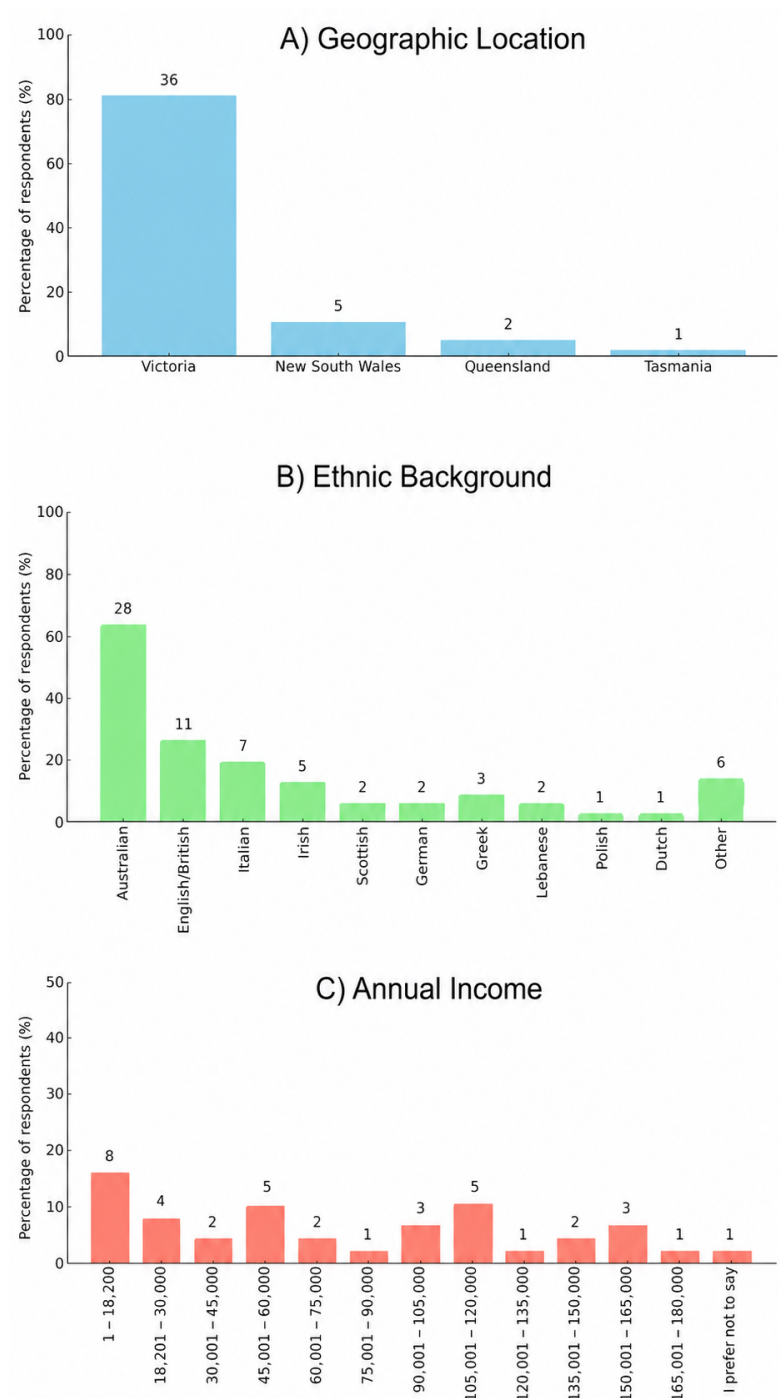


Figure 11. Questionnaire respondent geographic and socioeconomic factors. Shown are the geographic location of respondents within Australia respondent geographic and socioeconomic factors. Shown are the geographic location of respondents within Australia (panel A; n = 44), their identified ethnicity (panel B; n = 44, multiple responses allowed), and respondent current annual income based on Australian tax brackets (panel C; n = 38). Numbers above each bar represents the number of respondents who selected that option.

4.2.2 Clinical Characteristics

Respondent endometriosis clinical characteristics are summarised in Figure 12. The average age of diagnosis was (mean $\pm$ SD) 24.7 ± 7.4 years (range, 13-44 years). Nearly one-third of respondents reported a family history of endometriosis, most commonly the maternal grandmother (54%) or mother (38%), followed by sister (8%). 15% were unsure if they had a family history of endometriosis. Approximately 14% of respondents were not diagnosed via laparoscopic surgery (Figure 12B), with one-fifth unsure about what stage of endometriosis they were, and the remaining 68% spread between stages one and four.

Figure 12. Clinical Characteristics of Respondents

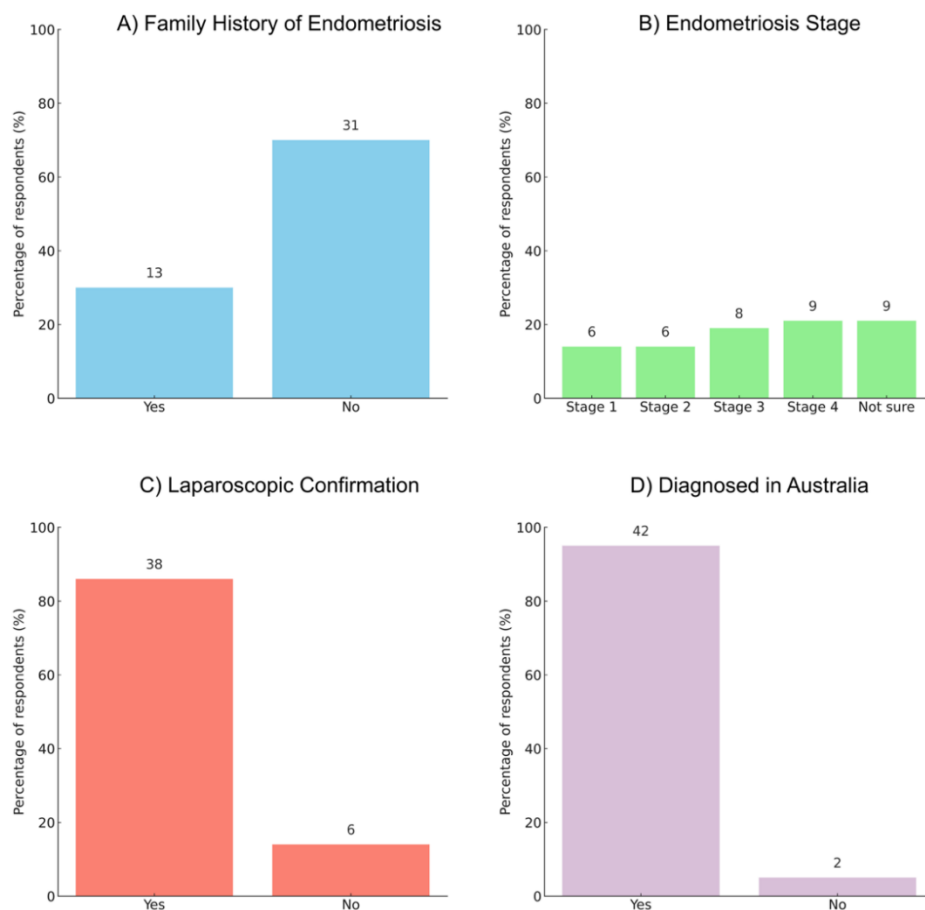


Figure 12. Clinical characteristics of respondents (n = 44) with endometriosis. Shown are respondent family history of endometriosis (panel A), their diagnosed stage of endometriosis (panel B), if their diagnosis was by laparoscopic surgery (panel C), and whether respondents were diagnosed in Australia (panel D). Numbers above each bar represents the number of respondents who selected that option.

4.3 Questionnaire Validity and Reliability

Intraclass correlation coefficients (ICC; Table 9) were calculated to examine the reliability between symptom severity items sampled at the beginning and end (Appendix B; question 2g and question 19 respectively) of the questionnaire. One respondent who was an extreme outlier for questionnaire completion duration was removed from reliability analysis because the duration (took 40 hours to complete) between the first and second set of symptom severity questions could not be ascertained. A similar approach has been taken in methodological research where extreme or influential data points are assessed, and when justified, excluded to prevent disproportionate distortion of statistical estimates and improve the accuracy of analyses (Osborne & Overbay, 2004). Removing this case ensured that test-retest estimates more accurately reflected measurement reliability within the intended sample context (Osborne & Overbay, 2004). Based on established interpretive guidelines (Koo & Li, 2016), ICC values of < 0.5 indicate poor reliability, 0.5 and 0.75 moderate reliability, 0.75 and 0.90 good reliability, and above 0.90 excellent reliability. ICCs ranged from 0.402 to 0.830, with the width of the corresponding 95% CIs ranging from 0.215 to 0.505. All the question-pairs, except for Q2g_2 and Q19_2, exhibited moderate to good reliability (Koo & Li, 2016). Dysmenorrhoea showed poor reliability and the widest 95% CI.

Bland-Altman analyses (Figure 13) were conducted to evaluate agreement between symptoms severity scores at the beginning and end of the questionnaire. Across all symptoms, mean differences were small, ranging from 0.028 to 1.150, indicating minimal but positive (i.e., Q19 on average scored slightly less than Q2g) systematic bias (Bland & Altman, 1986). Across the ten symptoms, reproducibility was generally moderate (Table 10). Fatigue, dyschezia, and dysuria demonstrated the highest agreement between the first and second ratings, showing minimal bias and the narrowest limits of agreement. In contrast, dysmenorrhoea, bloating, and headache/migraine showed the weakest agreement.

Table 9. Intraclass Correlation Coefficients for Symptom Severity Questions at the Start and End of the Questionnaire

Question Placement	Symptom	Point Estimate	95% CI		CI Range	Sample size (n=)
			Lower	Upper		
Q2g_1 - Q19_1	Chronic pelvic pain	0.591	0.356	0.755	0.399	37
Q2g_2 - Q19_2	Dysmenorrhoea	0.402	0.119	0.624	0.505	33
Q2g_3 - Q19_3	Heavy menstrual bleeding	0.752	0.586	0.858	0.272	21
Q2g_4 - Q19_4	Dyschezia	0.812	0.679	0.894	0.215	22
Q2g_5 - Q19_5	Dysuria	0.830	0.707	0.904	0.197	15
Q2g_6 - Q19_6	Dyspareunia	0.725	0.546	0.841	0.295	26
Q2g_7 - Q19_7	Fatigue	0.813	0.681	0.894	0.213	37
Q2g_8 - Q19_8	Bloating	0.520	0.264	0.708	0.444	36
Q2g_9 - Q19_9	Nausea	0.677	0.475	0.811	0.336	27
Q2g_10 - Q19_10	Headache/migraine	0.553	0.306	0.730	0.424	26

Note. 43 subjects and two measurements. ICC type ICC3,1 as referenced by Shrout & Fleiss (1979).

Figure 13. Bland-Altman Plots for Symptom Severity Questions at the Start and End of the Questionnaire

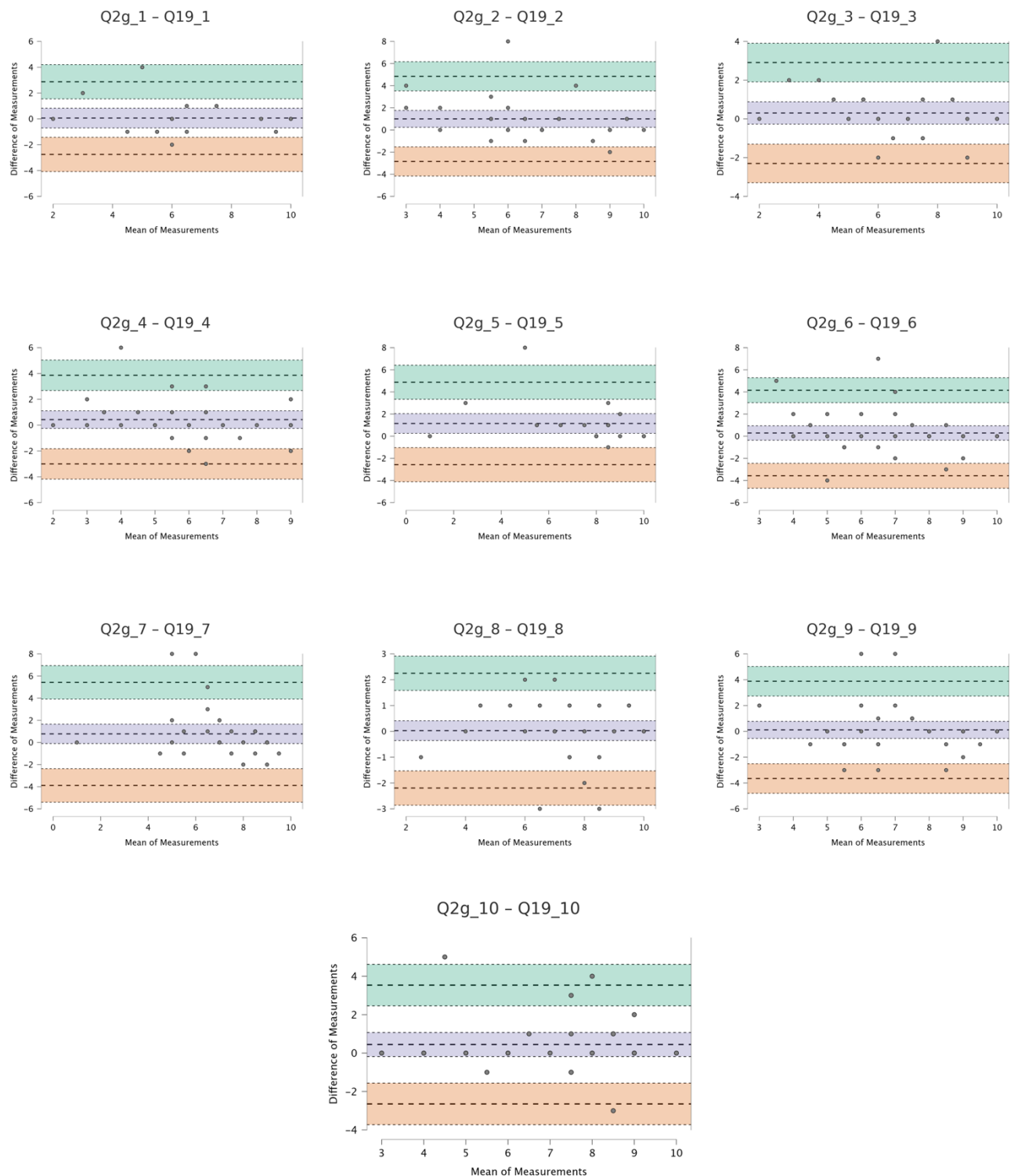


Figure 13. Bland-Altman plots for symptom severity items at the beginning and end of the questionnaire ($n = 15$ to $n = 38$ for any single symptom). The purple zone represents the mean difference, the green and orange zones represent the upper and lower CIs, respectively. Upper and lower limits are calculated by multiplying the standard deviation by 1.96.

Table 10. Bland-Altman Summary of Bias and Limits of Agreement Across Symptoms

Q2g_1 - Q19_1 (chronic pelvic pain)			
Bias & Limits	Point Value	Lower 95% CI	Upper 95% CI
Mean difference + 1.96 SD	3.881	2.737	5.024
Mean difference (bias)	0.114	-0.546	0.774
Mean difference - 1.96 SD	-3.652	-4.795	-2.509
Limit of Agreement $\pm$	3.767		
Symptom Rank (1-10)	7		
Q2g_2 - Q19_2 (dysmenorrhoea)			
Bias & Limits	Point Value	Lower 95% CI	Upper 95% CI
Mean difference + 1.96 SD	5.432	3.922	6.942
Mean difference (bias)	0.774	-0.097	1.646
Mean difference - 1.96 SD	-3.884	-5.393	-2.374
Limit of Agreement $\pm$	4.658		
Symptom Rank (1-10)	10		
Q2g_3 - Q19_3 (heavy menstrual bleeding)			
Bias & Limits	Point Value	Lower 95% CI	Upper 95% CI
Mean difference + 1.96 SD	4.873	3.333	6.413
Mean difference (bias)	1.150	0.261	2.039
Mean difference - 1.96 SD	-2.573	-4.113	-1.033
Limit of Agreement $\pm$	3.723		
Symptom Rank (1-10)	6		
Q2g_4 - Q19_4 (dyschezia)			
Bias & Limits	Point Value	Lower 95% CI	Upper 95% CI
Mean difference + 1.96 SD	2.910	1.914	3.905
Mean difference (bias)	0.304	-0.270	0.879
Mean difference - 1.96 SD	-2.301	-3.296	-1.305
Limit of Agreement $\pm$	2.606		
Symptom Rank (1-10)	2		
Q2g_5 - Q19_5 (dysuria)			
Bias & Limits	Point Value	Lower 95% CI	Upper 95% CI
Mean difference + 1.96 SD	2.877	1.552	4.203
Mean difference (bias)	0.063	-0.703	0.828
Mean difference - 1.96 SD	-2.752	-4.078	-1.427
Limit of Agreement $\pm$	2.814		
Symptom Rank (1-10)	3		
Q2g_6 - Q19_6 (dyspareunia)			
Bias & Limits	Point Value	Lower 95% CI	Upper 95% CI

Mean difference + 1.96 SD	3.536	2.455	4.616
Mean difference (bias)	0.444	-0.179	1.068
Mean difference - 1.96 SD	-2.647	-3.727	-1.566
Limit of Agreement $\pm$	3.092		
Symptom Rank (1-10)	4		
Q2g_7 - Q19_7 (fatigue)			
Bias & Limits	Point Value	Lower 95% CI	Upper 95% CI
Mean difference + 1.96 SD	2.250	1.585	2.914
Mean difference (bias)	0.028	-0.356	0.411
Mean difference - 1.96 SD	-2.194	-2.858	-1.530
Limit of Agreement $\pm$	2.222		
Symptom Rank (1-10)	1		
Q2g_8 - Q19_8 (bloating)			
Bias & Limits	Point Value	Lower 95% CI	Upper 95% CI
Mean difference + 1.96 SD	4.154	3.031	5.276
Mean difference (bias)	0.289	-0.359	0.937
Mean difference - 1.96 SD	-3.575	-4.697	-2.452
Limit of Agreement $\pm$	3.865		
Symptom Rank (1-10)	9		
Q2g_9 - Q19_9 (nausea)			
Bias & Limits	Point Value	Lower 95% CI	Upper 95% CI
Mean difference + 1.96 SD	3.862	2.686	5.039
Mean difference (bias)	0.429	-0.251	1.108
Mean difference - 1.96 SD	-3.005	-4.181	-1.828
Limit of Agreement $\pm$	3.433		
Symptom Rank (1-10)	5		
Q2g_10 - Q19_10 (headache/migraine)			
Bias & Limits	Point Value	Lower 95% CI	Upper 95% CI
Mean difference + 1.96 SD	4.847	3.529	6.165
Mean difference (bias)	1.000	0.239	1.761
Mean difference - 1.96 SD	-2.847	-4.165	-1.529
Limit of Agreement $\pm$	3.847		
Symptom Rank (1-10)	8		

Limit of agreement $\pm$ is the numerical difference between the mean difference and either the mean difference + 1.96 SD, or, mean difference – 1.96 SD. Symptom rank represents the order of the ten symptoms from best agreement (1) to worst agreement (10) based on the size of the limit of agreement $\pm$ value, relative to the 10-point VAS scale rating the symptom, with smaller values (closer to 0) considered stronger agreement than larger values (closer to 10).

Percent agreement and κ were calculated to determine the agreement between motivations for RT, and perceived effects of RT (Table 11). Percent agreement between motivator and impact items was generally high, ranging from 68% to 96%, showing that participants' reported reasons for doing resistance training generally matched the benefits they perceived. Cohen's κ values were more variable, from -0.05 to 1.00. Poor κ values (e.g., for physical strength and energy levels) occurred even with high agreement, likely because nearly all participants selected these items, which makes chance agreement very high and lowers the κ statistic (Wongpakaran et al., 2013). Almost perfect κ values (e.g., for athletic ability) indicate stronger agreement beyond chance for these items. Overall, the findings suggest that most motivators align closely with perceived benefits, but κ values should be interpreted with caution when responses are highly skewed.

To further examine construct consistency, Mann-Whitney U tests with Cliff's δ were planned to assess whether participants who endorsed a given motivator reported higher perceived impact ratings for the corresponding outcome. However, for all but one motivator-impact pairs, inferential testing was not possible because motivator endorsement and/or impact ratings showed minimal variability, resulting in undefined statistics (i.e., "not a number" outputs). This pattern reflects near-universal endorsement and consistently high perceived impacts, rather than a limitation of the analysis. A meaningful group comparisons was therefore only possible for mental health, where sufficient variability was present, respondents who endorsed mental health benefits as a motivator reported higher perceived mental health impact ratings than those who did not, however, this difference was not statistically significant, with a small effect size (Mann-Whitney U = 27.00, $p = 0.239$, Cliff's $\delta = 0.299$).

Table 11. Cohen's Kappa and Percent Agreement of Motivators and Impacts

Motivator/Impact	kappa	SE	95% CI			Percent Agreement
			Lower	Upper	CI Range	
Physical strength	0.00	2.39E ⁻⁷	-4.684E ⁻⁷	4.684E ⁻⁷	9.368E ⁻⁷	96%
Muscle mass	1.00	0.00	1.00	1.00	0.00	96%
Bone health	0.344	0.292	-0.228	0.915	1.143	89%
Athletic ability	0.868	0.129	0.616	1.00	0.384	96%
Activities of daily living	0.364	0.268	-0.161	0.889	1.05	89%
Overall health and well-being	0.00	0.00	0.00	0.00	0.00	92%
Physical appearance	-0.05	0.036	-0.12	0.02	0.14	89%
Energy levels	0.00	2.39E ⁻⁷	-4.684E ⁻⁷	4.684E ⁻⁷	9.368E ⁻⁷	96%
Stress levels	0.781	0.21	0.37	1.00	0.63	96%
Mental health	0.212	0.18	-0.14	0.565	0.705	68%
Weight management	0.781	0.21	0.37	1.00	0.63	96%

Note. n = 28 and 2 raters/measurements. Based on pairwise complete cases. CIs are asymptotic. SE = standard error

4.4 Planned Physical Activity and Resistance Training Participation

4.4.1 Self-reported Planned Physical Activity and Resistance Training Practices

36 respondents reported participating in planned PA. Respondent PA practices are shown in Figure 14. Participation was most commonly reported on three days per week (33%), and for three sessions per week (30%). Session duration was most frequently reported within the 46-60-minute range (53%). Across respondents, participation varied, with training occurring on between one and seven days per week, and one to ten sessions per week, and session durations ranging from 22 to 135 minutes. This variability is reflected in the IQRs observed for training days (IQR = 1.25), sessions (IQR = 3.00), and session duration (IQR = 15.50 minutes).

Figure 14. Planned Physical Activity Frequency and Durations

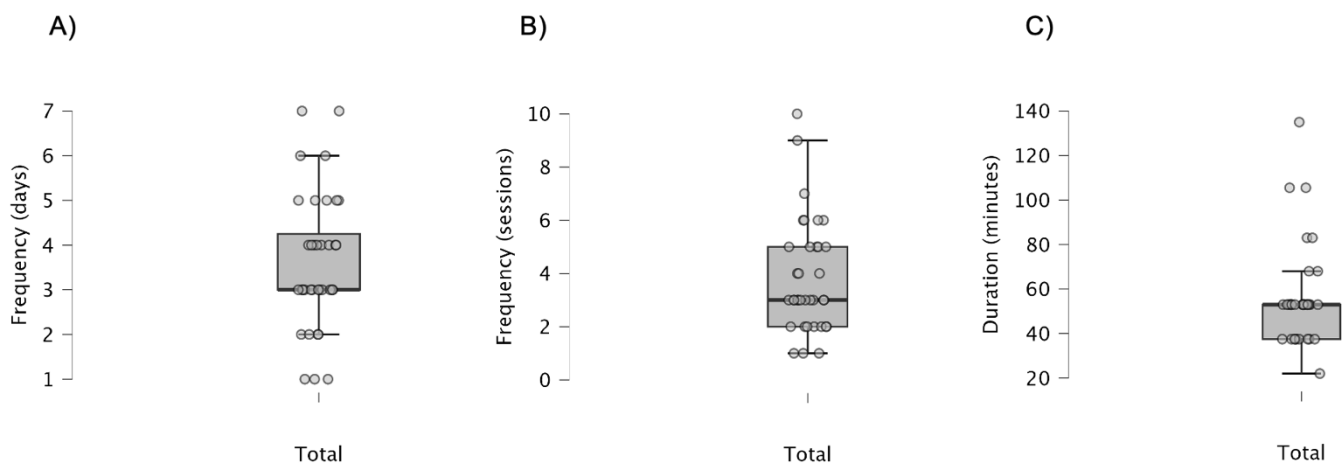


Figure 14. Frequency and durations of respondents who participate in planned PA (n = 36). Shown are the distribution of respondent training days (panel A), training sessions (panel B), and training session duration (panel C). Training session duration was collected using categorical ranges and converted to numeric midpoints for descriptive analysis to enable calculation of medians and IQRs; for the open-ended upper category (> 120 minutes), a conservative midpoint of 135 minutes was assumed.

Twenty-nine respondents reported participating in RT, and all were asked to self-report perceived training intensity (effort) regardless of whether they used formal RPE scales. Respondent RT practices are shown in Table 12. A visual check of total RT volume (frequency and duration) versus planned PA volume was performed to assess exercise reporting consistency. As expected, RT frequency and duration were less than planned PA frequency and duration, indicating consistent exercise volume reporting. Most respondents (79%) undertook either two or three RT sessions per week, and most respondents' sessions (84%) were between 30-60 minutes in duration. A small proportion of respondents (21%) typically trained with very hard to maximal effort in their sessions, but most (70%) trained with moderate to hard effort. Of those who trained to failure at any point in their RT, a mix of approaches were used, with a small number going to failure on every set of every exercise (n = 3).

Table 12. Respondent Resistance Training Frequency, Duration, and Intensity

n = number of responses (total, 29 respondents); RPE = Rate of Perceived Exertion; % =

Principle	Variable	n	%
Training Frequency (sessions/week)	1	2	7
	2	12	41
	3	11	38
	4	2	7
	5	2	7
Session Duration* (min)	15 - 29	5	17
	30 - 45	14	48
	46 - 60	13	45
	61 - 75	1	3
	76 - 90	0	0
	91 - 120	1	3
Session Intensity (RPE)*	3 - 4 (light)	4	9
	5 - 6 (moderate)	16	36
	7 - 8 (hard)	15	34
	9 (very hard)	6	14
	10 (maximal effort)	3	7
Trains to Failure	On the final set of some exercises	6	43
	On the final set of every exercise	1	7
	On some sets of some exercises	4	29
	Every set of every exercise	3	21

percent of total responses. *Note*, * = question could have more than one response per respondent.

The composition of exercises within RT sessions along with associated volume variables for 29 respondents participating in RT is presented in Table 13.

Table 13. RT Session Exercise Composition

Characteristic	Mean $\pm$ SD	Range
Exercises per session	6 $\pm$ 1	5 - 9
Compound exercises	3 $\pm$ 1	1 - 6
Sets per compound exercise	3 $\pm$ 1	1 - 4
Reps per compound exercise	8 $\pm$ 4	2 - 13
Isolation exercises	3 $\pm$ 1	1 - 5
Sets per isolation exercise	3 $\pm$ 1	1 - 4
Repetitions per isolation exercise	8 $\pm$ 4	1 - 15

4.4.2 Contextual Training Factors

Contextual training factor responses are shown in Figure 15. The most common training type was bodyweight training, followed by recreational type lifting and group classes with weights. More than a third of respondents trained at commercial gyms, and nearly one-quarter trained at home. Most respondents reported using free weights (dumbbells, barbells, kettlebells) and more than half used cable machines, pin-loaded machines and bands with their training.

Figure 15. Contextual Training Factors

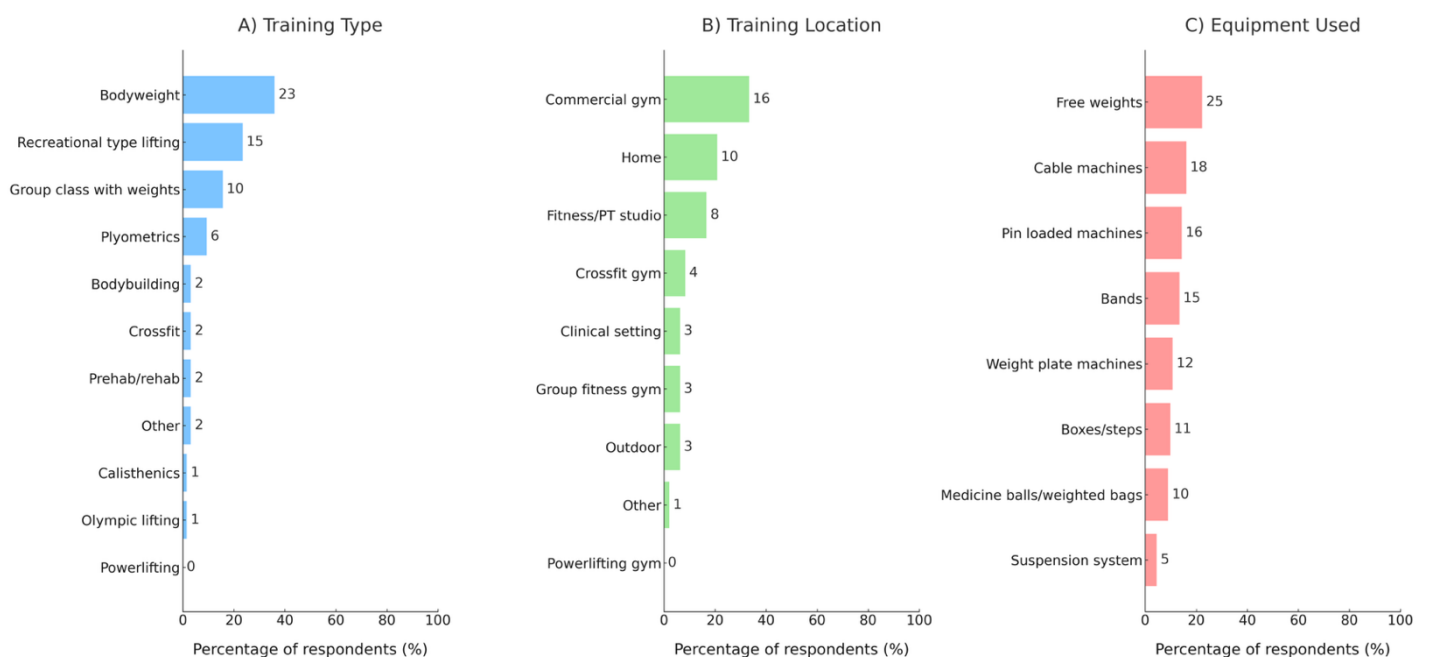


Figure 15. Contextual training factors of respondents who participate in RT. Shown are respondent training type (panel A; n = 29), training location (panel B; n = 29), and equipment used in their training sessions (panel C; n = 27). Numbers above each bar represents the number of respondents who selected that option.

Secondary training factors are shown in Figure 16. Most respondents reported training alone, although, more than half also trained with others. Approximately one-quarter of respondents have been resistance-training for 12 months or less, while 40% had been training for between 1-2 years. Four out of 29 respondents reported having a competitive training goal, of which two had a competitive training goal in Crossfit, and two were unspecified.

Figure 16. Training Context and Experience Characteristics

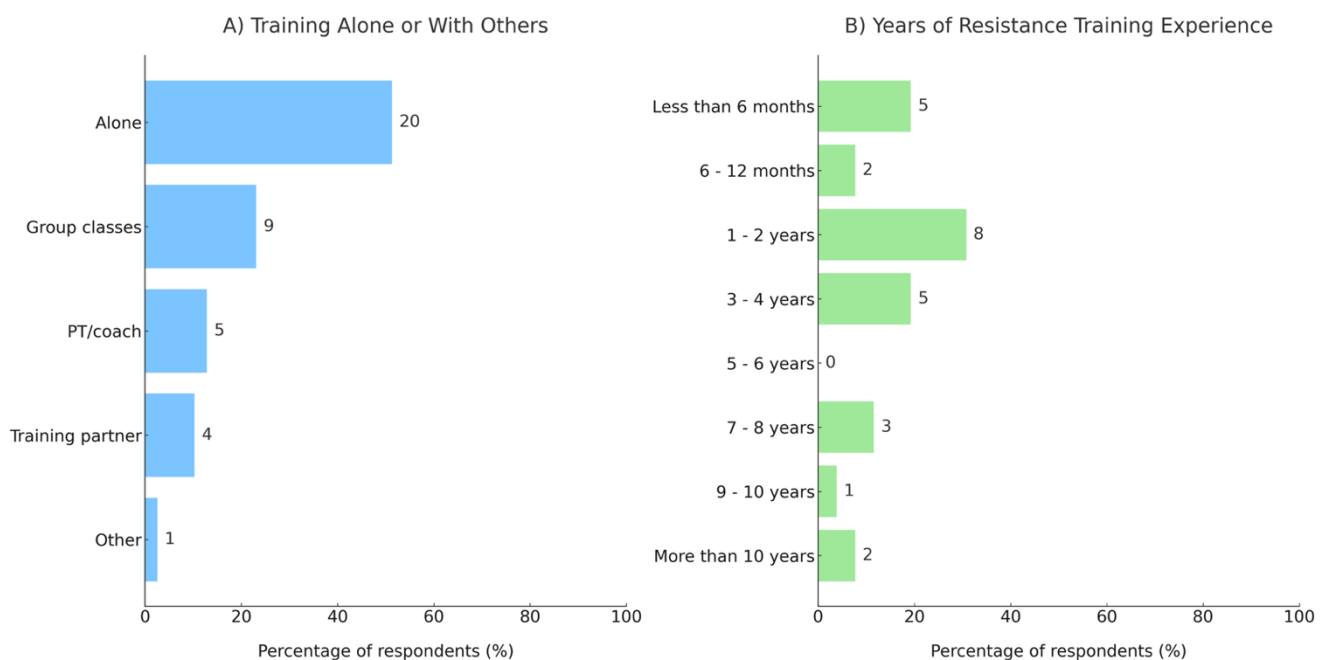


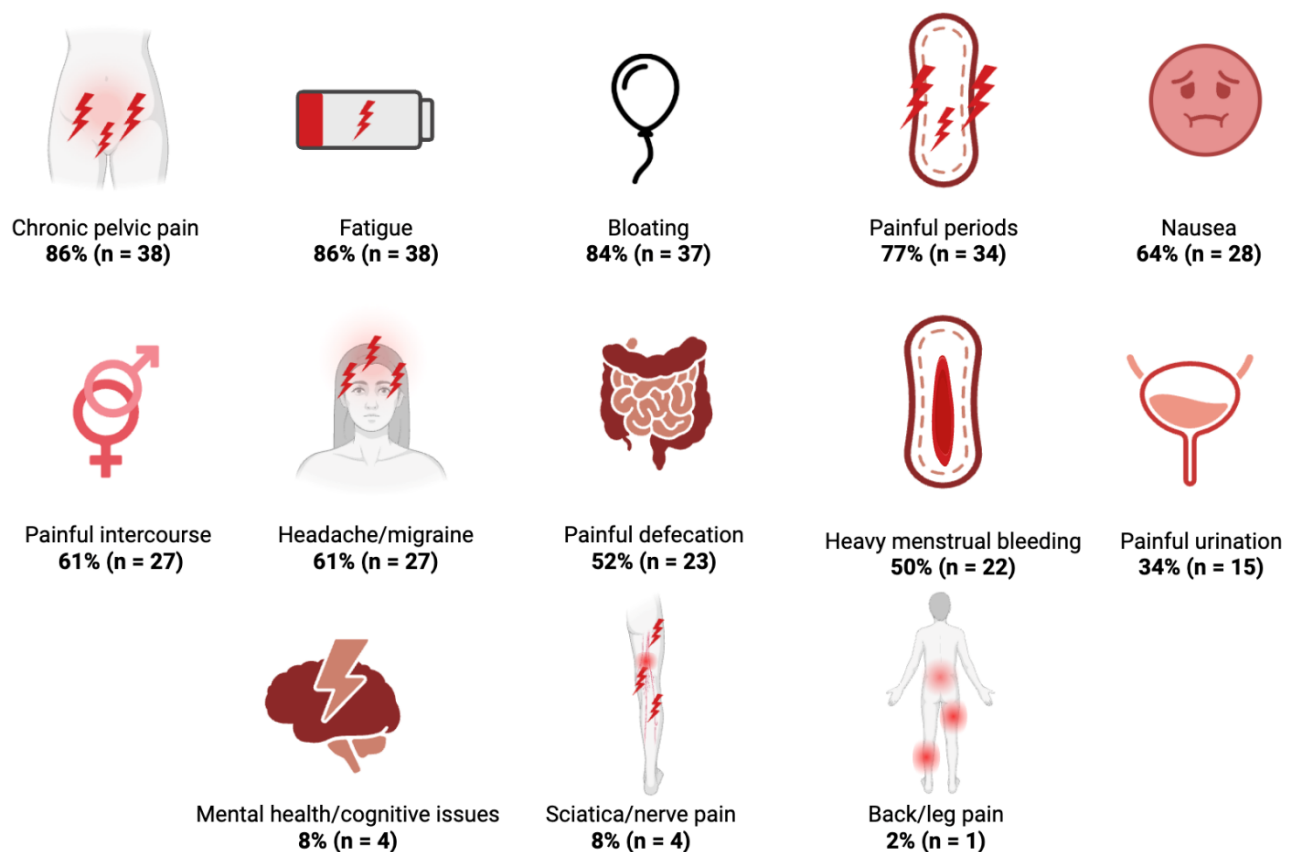
Figure 16. Contextual training factors and experience of respondents who participate in RT. Shown are respondent training context (panel A; n = 27), and years of RT experience (panel B; n = 26). Numbers above each bar represents the number of respondents who selected that option.

4.5 Symptoms and Comorbidities

4.5.1 Reported Endometriosis Symptoms

Forty-four respondents reported experiencing a range of symptoms associated with endometriosis. More than three-quarters of respondents reported experiencing chronic pelvic pain, fatigue, bloating and painful periods, and more than half also reported nausea, painful intercourse, headache/migraine, painful defecation and heavy menstrual bleeding (Figure 17). The number of symptoms experienced by respondents varied, with 2% reporting only a single symptom, 2% reporting two or three symptoms, 36% experiencing four to six symptoms, and 59% experienced seven or more endometriosis symptoms.

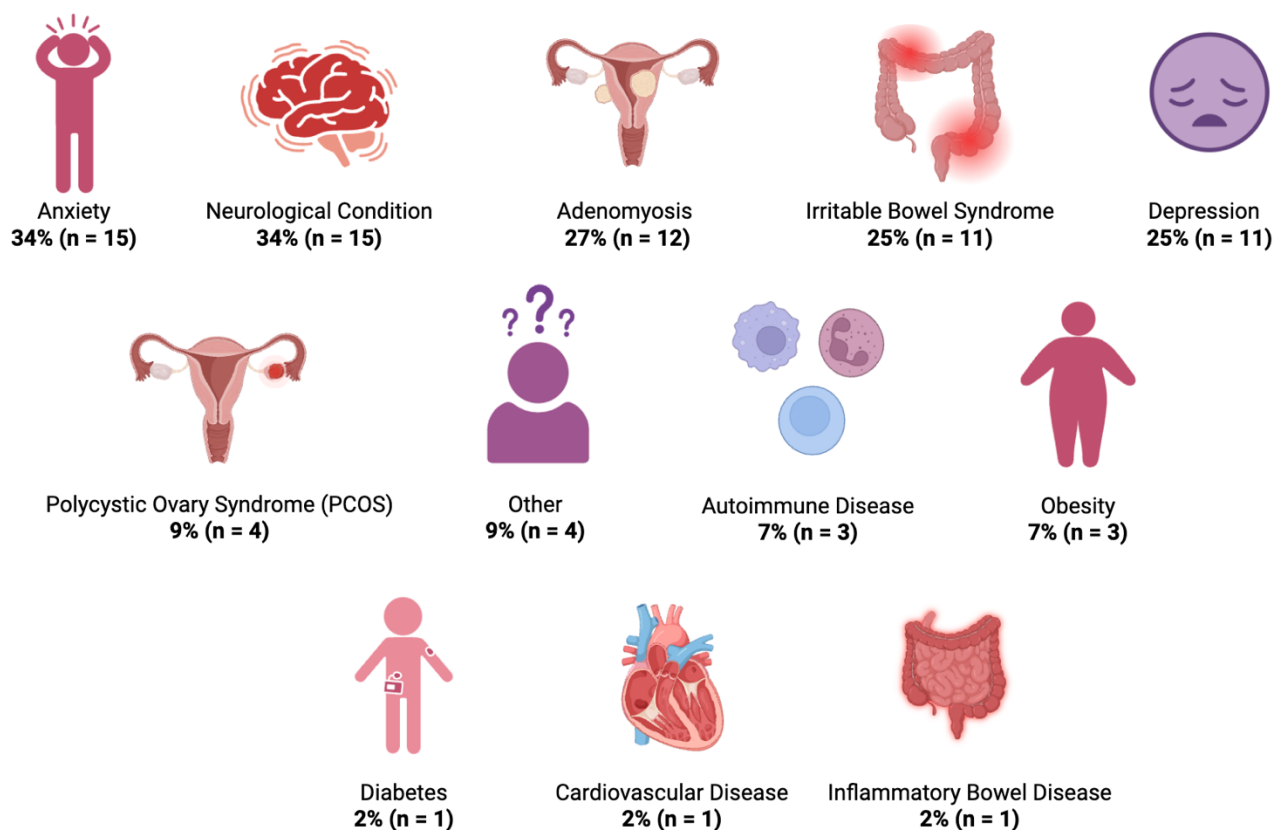
Figure 17. Frequency of Endometriosis Symptoms



4.5.2 Reported Associated Comorbidities

Comorbidities reported by respondents are summarised in Figure 18. One-quarter of respondents experienced depression and one-third experienced anxiety. One-third of respondents also reported a neurological comorbidity including migraines, attention deficit hyperactivity disorder, bipolar, post-traumatic stress and personality disorders. The proportion of obese respondents was lower than the typical Australian female population for the same age range (Australian Institute of Health and Welfare, 2024).

Figure 18. Frequency of Associated Comorbidities



4.6 Resistance Training and Symptom Management

4.6.1 Perceptions of Resistance Training for Symptom Management

44% of the respondents who participate in RT reported that RT helps manage their endometriosis symptoms 'to some extent', while 11% felt it helps 'significantly'. 26% of these respondents believed RT does not help with symptom management, and 19% were unsure.

4.6.2 Symptom-Specific Responses to Resistance Training

11% of resistance-training respondents (n = 26) reported that their symptoms typically improved immediately after participating in RT, while 8% indicated their symptoms worsened. 23% reported no change in symptoms, and 58% experienced a mixed response, with some symptoms improving and others worsening.

Following RT, some respondents (n = 15) reported improvements in endometriosis symptoms. Respondents most commonly reported improvements in chronic pelvic pain (17%), dysmenorrhoea (10%), and fatigue (10%), with smaller improvements in symptoms such as bloating (3%), nausea (3%), headaches (3%) and heavy menstrual bleeding (3%). Conversely, most respondents experienced worsening of some symptoms (n = 27), most frequently in chronic pelvic pain (21%), fatigue (17%), and nausea (14%), while other symptoms such as bloating (10%), headaches (10%) and dysmenorrhoea (7%) were less commonly affected.

4.6.3 Symptom Exacerbation Following Resistance Training

70% of respondents who participate in RT have experienced a symptom flare that they attributed to RT. When experiencing a flare, the timing of pain exacerbation in relation to RT varied; the largest proportion of respondents (39%) reported that pain began immediately or during the training session. 22% experienced pain within 30-60 minutes after RT, while 28% reported pain 12-24 hours post-session. A smaller group (11%) experience pain from several hours and up to 48 hours following RT. On the Visual Analogue Scale, a 10-point linear scale, the mean severity of symptom flares was 7 ± 1 (range: 5–10).

Resistance-training respondents reported several factors that they believed contributed to symptom flares during or after RT. The most commonly identified perceived contributors were overall session intensity (63%), and heaviness of weights lifted (58%). Other factors included the type of RT performed (37%), training to failure (26%), short rest periods between exercises (26%), the number of RT sessions performed in one week (26%) and the total number of exercises in a session (21%). In the “other” category (16%), respondents cited specific exercises, such as, hip thrusts, planks, and lateral movements, as well as factors related to core or pelvic pressure, timing of RT in relation to the menstrual cycle, and lifestyle influences including diet, sleep, and stress.

4.6.4 Symptom Severity and Resistance Training Variables

Because FITT characteristics are inherently interrelated (e.g., intensity typically co-varies with frequency and time), correlations should be interpreted contextually rather than as independent effects. Correlational analysis between symptoms and training variables was intended to provide an initial map of potential associations; however, many relationships are difficult to interpret in isolation, as the interdependence of training variables means that any single correlation likely reflects a cluster of co-occurring training variables, rather than a single isolated factor.

Visual heat-map representations of the symptom and FITT correlations are presented in Figures 19 and 20. Symptom data were drawn from Q2 rather than Q19 symptom questions (see Appendix B), as Q2 responses represents symptom reporting before any exercise-related questions, and therefore provides a more unbiased measure (Van den Bergh & Walentynowicz, 2016), and the responses of Q19 risk psychological carryover effects from preceding training questions (Tourangeau et al., 1989).

Figure 19. Spearman's Correlations between Reported Resistance Training Frequencies and Durations, and Symptom Severity Relationships

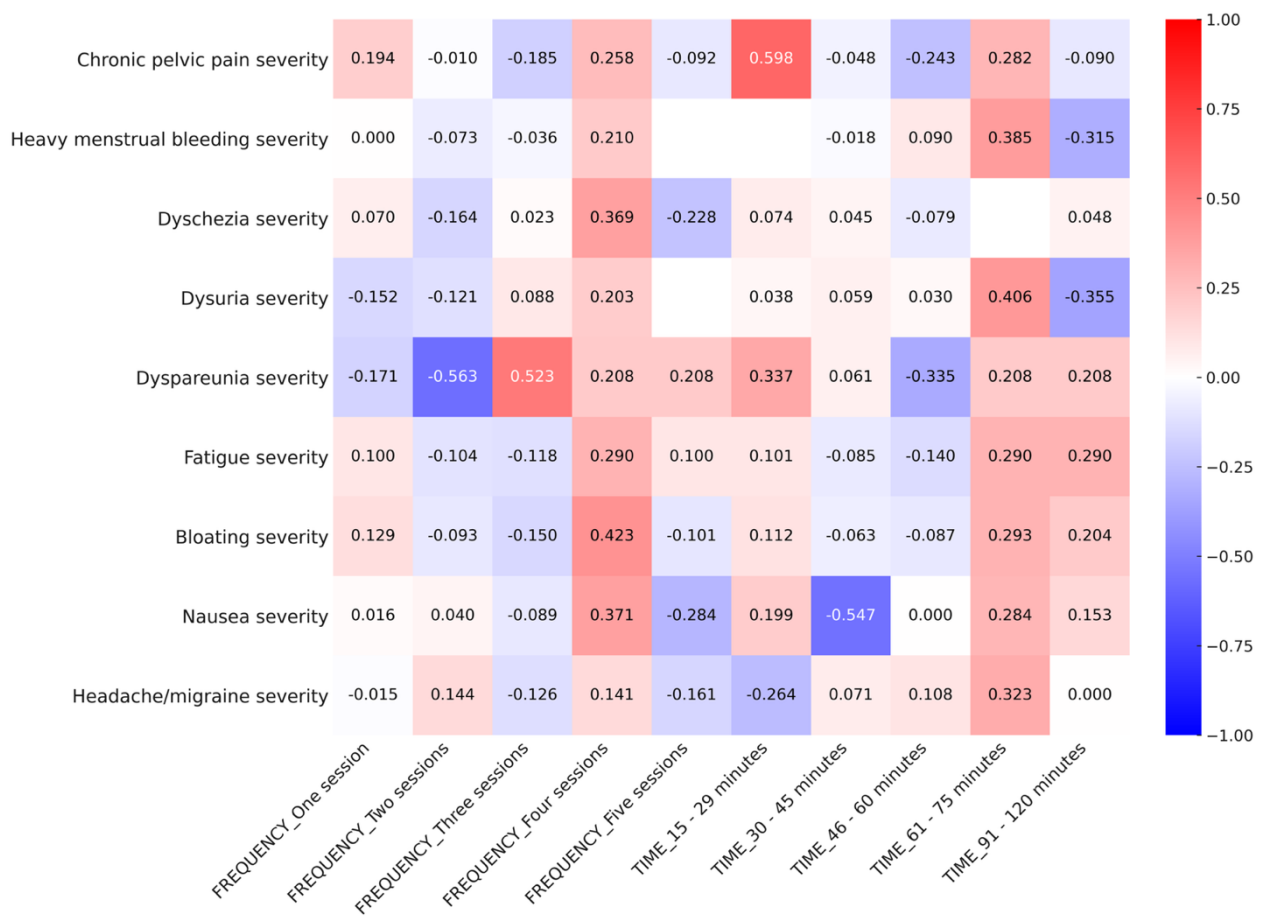


Figure 19. RT frequency and duration relationships with symptom severity (n = 28). Blank cells indicate that no Spearman correlation coefficient could be computed for that symptom–exercise type combination (e.g., insufficient cases, zero variance, or missing data).

Figure 20. Kendall's Tau-b Correlations between Reported Resistance Training Intensities and Symptom Severity Relationships

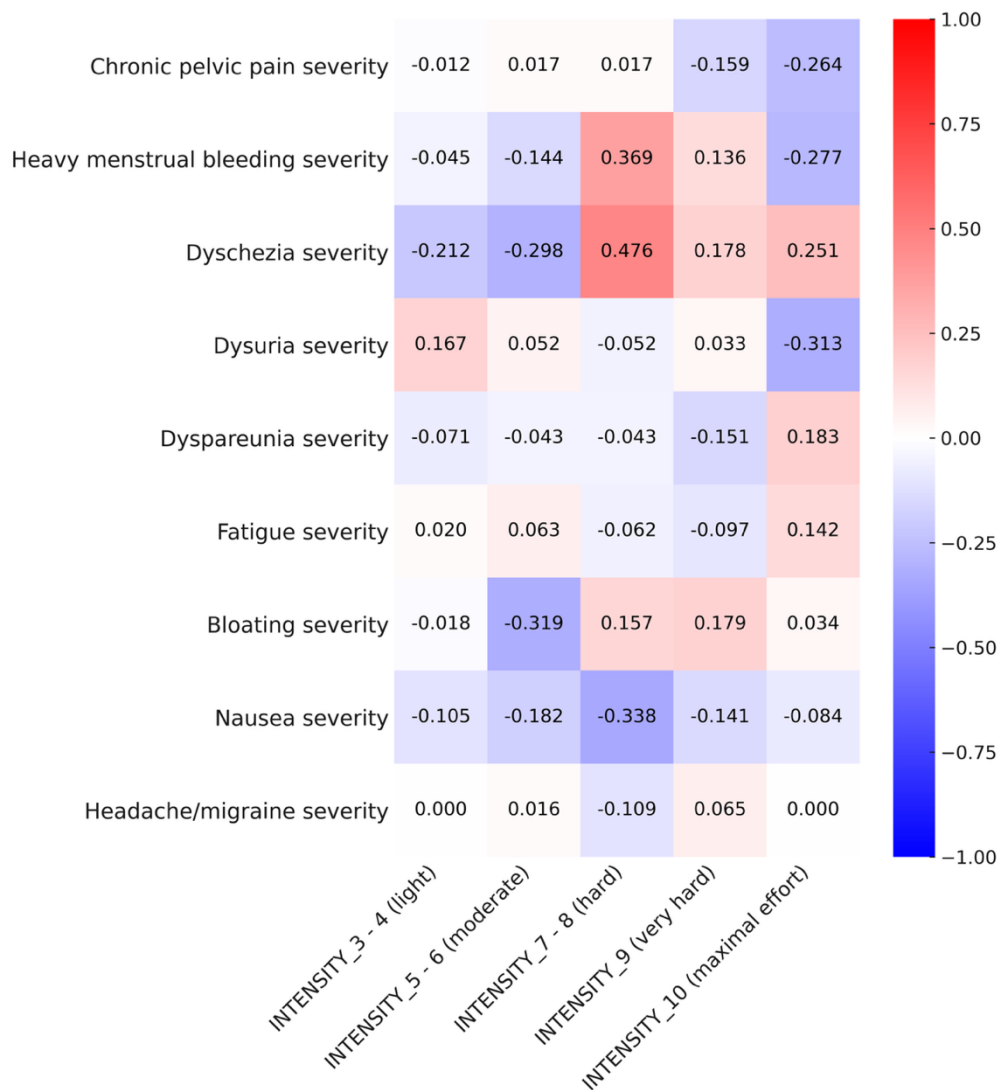


Figure 20. Kendall's tau-b relationships between RT frequency and duration with symptom severity (n = 28).

RT frequency and duration variable correlations with symptom severity (Figure 19) were generally weak or negligible (84 out of 90 correlations where $\rho \leq 0.39$). No Spearman correlations exceeded the threshold for a large effect size (where $\rho \geq 0.70$). Moderate correlations ($\rho \geq 0.40$) were observed between six different RT frequencies and durations and symptom severity comparisons. The largest Spearman correlation ($\rho = 0.598$; 95% CI, 0.28 to 0.79) was for chronic pelvic pain-15-29 minutes, followed by dyspareunia-two sessions (-0.563; -0.83 to -0.18), nausea-30-45 minutes (-0.547; -0.81 to -0.18), dyspareunia-three

sessions (0.523; 0.09 to 0.80), bloating-four sessions (0.423; 0.05 to 0.68), and dysuria-61-75 minutes (0.406; -0.26 to 0.81).

Similarly, across RT intensity variable correlations with symptom severity (Figure 20) were generally small or negligible (30 out of 45 correlations where $\tau \leq 0.20$). Five Kendall's correlations exceeded the threshold for a strong effect size (where $\tau \geq 0.30$) but 95% CIs were generally broad: the largest correlation ($\tau = 0.476$; 95% CI, 0.06 to 0.802) was for dyschezia-hard intensity, followed by heavy menstrual bleeding-hard intensity (0.369; -0.153 to 0.791), nausea-hard intensity (-0.338; -0.663 to 0.054), bloating-moderate intensity (-0.319; -0.613 to 0.013), and dysuria-maximal intensity (-0.313; -0.721 to -0.117). The remaining ten correlations between RT intensities and symptom severity were moderate ($\tau \geq 0.20$)

These findings suggest limited and highly uncertain linear associations between symptom severity and FITT-based resistance training behaviours. Given that correlational analyses typically require samples of approximately 150 participants for stable estimates, all findings should be considered preliminary and interpreted with caution (Bujang, 2024). Overall, despite variability in magnitude and precision, the direction of associations was generally consistent across outcomes, with most significant correlations clustering in a similar direction within symptom domains rather than showing opposing effects.

4.6.5 Symptom Management Strategies Post Symptom Exacerbation

When experiencing a flare-up of symptoms during an RT session ($n = 18$), respondents most commonly reduced their overall level of effort (50%) and increased rest or recovery periods between sets and/or exercises (44%). Other frequently reported strategies included reducing the weight lifted (39%), doing fewer exercises in a single session (39%), stopping their RT session altogether (39%), avoiding training to failure (28%), and changing the type of RT (17%).

Respondents ($n = 18$) reported a range of strategies to manage symptom flares occurring 48-72 hours after an RT session (Figure 21).

Figure 21. Self-Management Strategies Post Symptom Exacerbation

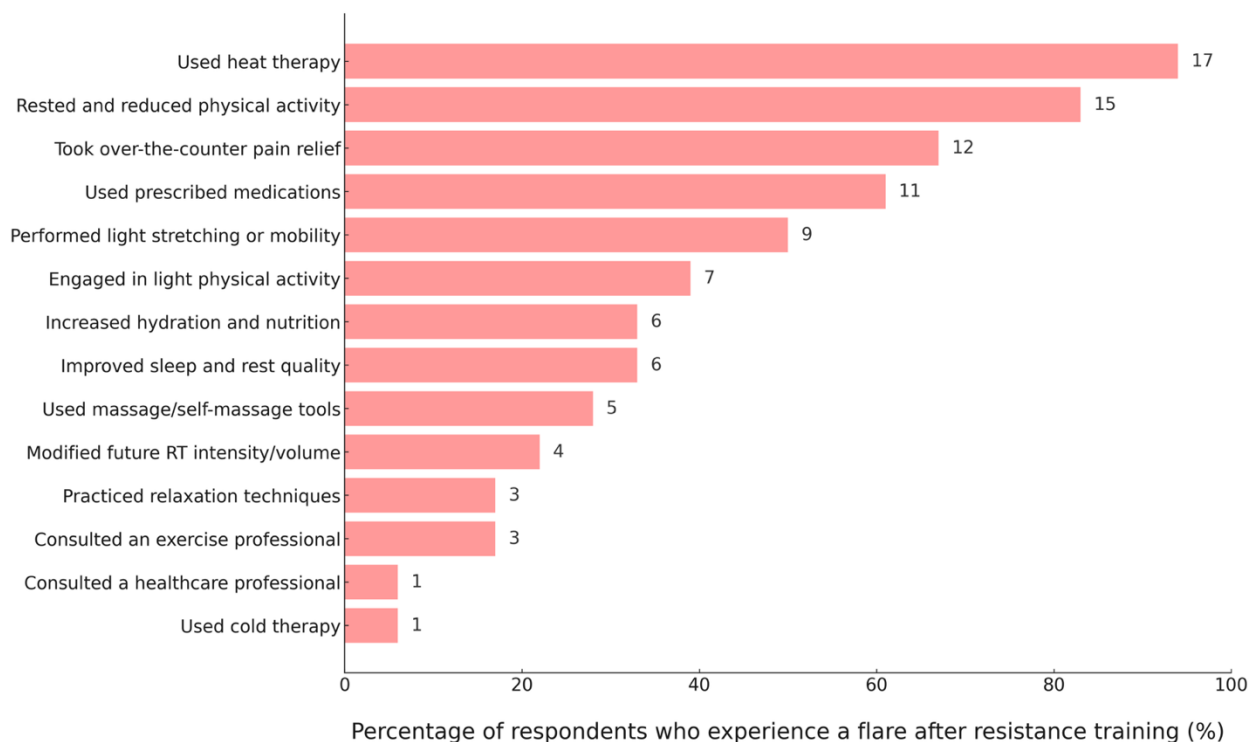


Figure 21. Shown are respondent self-management strategies who participate in RT and experience a symptom exacerbation (n = 18). Numbers above each bar represents the number of respondents who selected that option.

4.7 Confidence to Participate in Resistance Training

4.7.1 Confidence to Participate in Resistance Training Without Exacerbating Symptoms

Of respondents who participate in RT (n = 26 respondents to this section), 38% reported moderate levels of confidence in their ability to engage in RT without exacerbating their endometriosis symptoms. 27% reported feeling 'slightly confident', while 15% felt 'very confident', and 12% 'extremely confident'. In contrast, 8% of respondents reported feeling 'not confident at all' in their ability to participate in RT without exacerbating their endometriosis symptoms.

4.7.2 Confidence to Participate in Resistance Training

Of respondents who do not currently participate in RT (n = 15), 33% reported feeling 'slightly confident' in their ability to start if they wished to. 27% reported

feeling 'moderately confident', 20% reported feeling 'very confident', and 13% felt 'extremely confident'. In contrast, 7% of participants reported feeling 'not confident at all'.

4.8 Barriers to Resistance Training Engagement

4.8.1 Barriers to Resistance Training Participation

Fifteen respondents reported not participating in RT. Barriers to RT participation are summarised in Figure 22. Lack of time was reported by 60% of these respondents. Fatigue, and concerns about worsening symptoms, were barriers for 53% of these respondents, and 47% reported financial constraints or symptom exacerbation as further barriers. 40% of respondents reported a lack of professional guidance as a barrier, and 27% reported a lack of interest and motivation as a barrier to participation. 20% reported experiencing a single barrier, 33% reported two or three barriers, 33% experienced four to six, and 20% reported experiencing seven or more barriers to RT participation.

Figure 22. Frequency of Reported Barriers to Resistance Training Participation Among Non-Participants

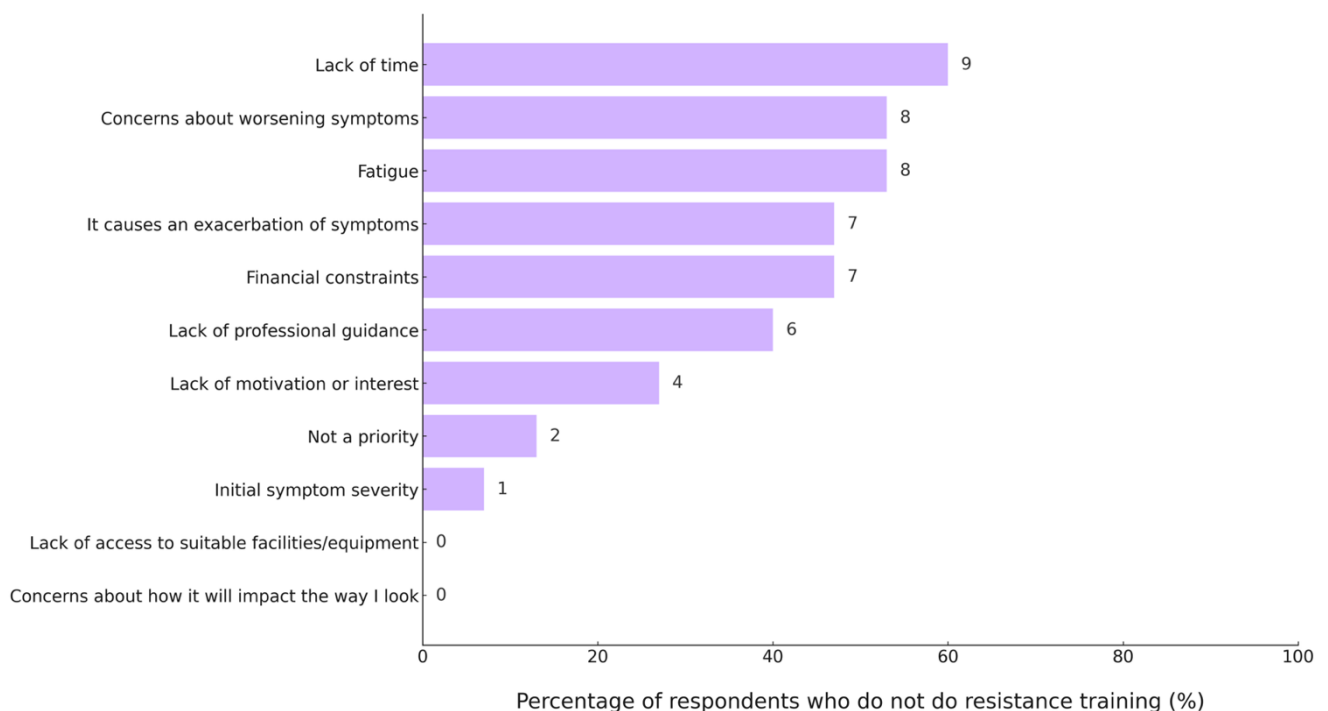


Figure 22. Shown are respondent barriers among non-RT respondents (n = 15). Numbers above each bar represents the number of respondents who selected that option.

4.8.2 Discontinuation of Resistance Training Participation

Most respondents (67%) reported having tried RT but eventually stopped. Among those who discontinued RT, worsening pain or symptoms was the primary reason, followed by financial and time constraints.

Five out of the fifteen respondents who do not participate in RT had never participated in RT. Reasons for never engaging in RT are detailed in Figure 23. Four in five respondents who had never engaged in RT feel that it would either not be beneficial to their symptoms or would exacerbate their endometriosis symptoms. Two in five respondents were unsure of where to start and how to do it.

Figure 23. Frequency of Reported Factors for Not Currently Participating in Resistance Training

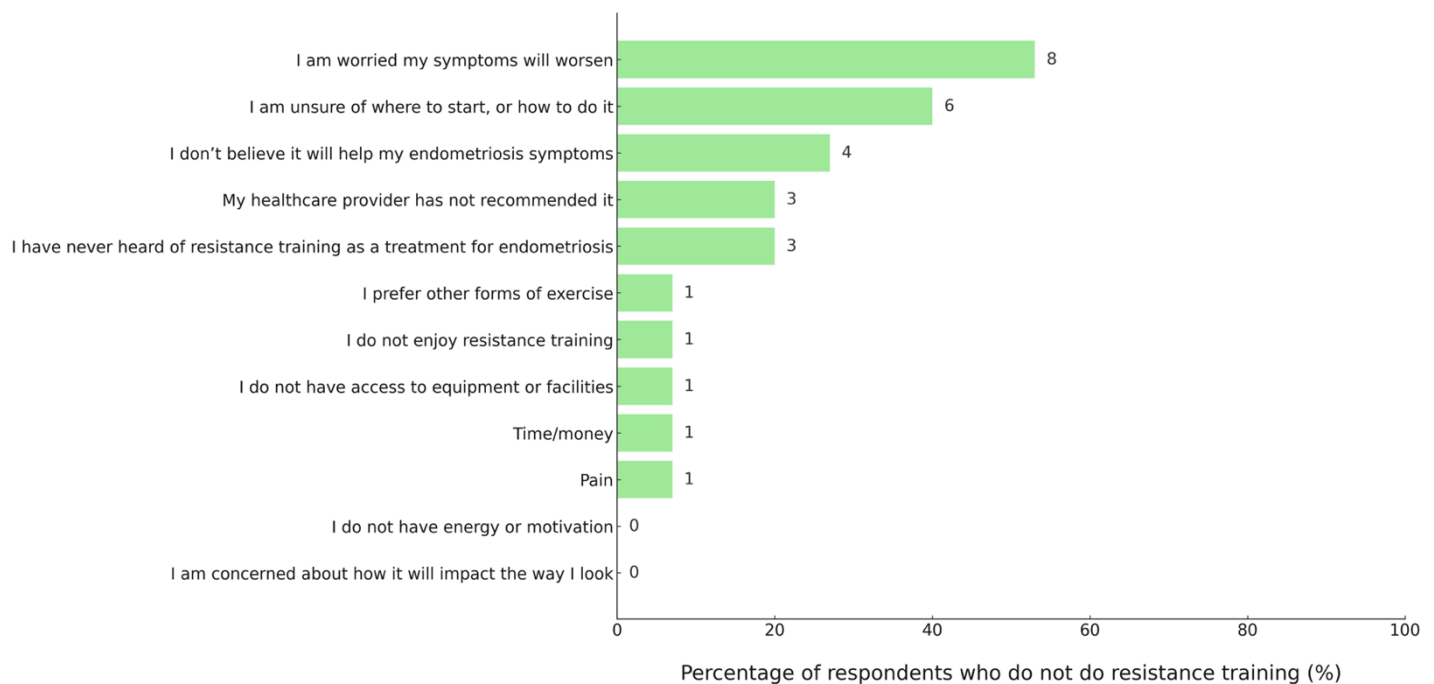


Figure 23. Shown are respondent reasons for not currently participating in RT (n = 15). Numbers above each bar represents the number of respondents who selected that option.

4.8.3 Barriers to Resistance Training Participation Across the Lifespan

An exploratory analysis of the variation in responses in different age brackets was conducted. Across the range of respondents, reported barriers to RT showed small variations between age subgroups, with several barriers appearing consistently regardless of age (Figure 24). Fatigue, and concerns about worsening symptoms were common in both the younger and older subgroups, while lack of time was most prominent in respondents aged 31 to 40 years. Only the younger respondents mentioned a lack of professional guidance. Financial constraints were most common in the oldest age group, and motivational barriers appeared only in the younger and older subgroups. The differences in barriers across the lifespan were modest, and given the small subsample sizes ($n = 8, 4,$ and 3 , for age brackets 19-30, 31-40, 41-50, respectively), they should be interpreted cautiously.

Figure 24. Barriers to Resistance Training Participation Across the Lifespan

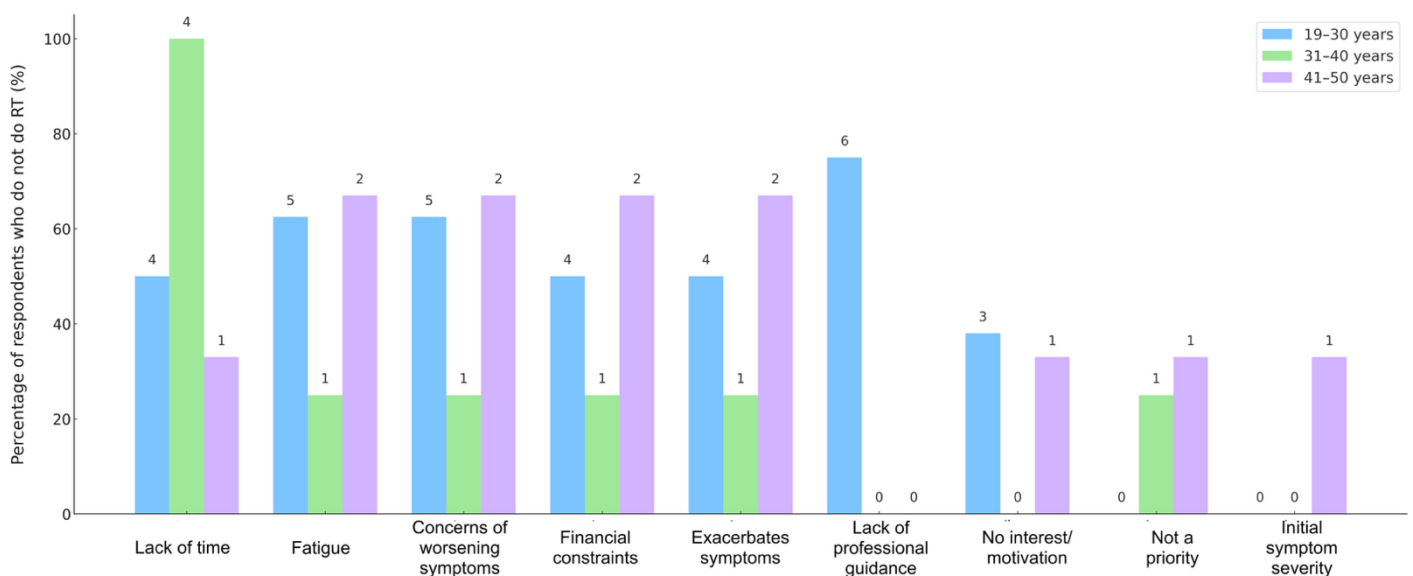


Figure 24. Shown are respondent barriers to participating in RT ($n = 15$) grouped by age. Numbers above each bar represents the number of respondents who selected that option.

4.8.4 Facilitators to Starting Resistance Training Among Non-Participants

Of the 15 respondents who had never participated in RT, 80% indicated that an exercise program specifically designed for women with endometriosis would motivate participation. 67% reported that having more information on how RT can help with endometriosis would encourage them to start. 53% stated that guidance from a qualified exercise professional or coach would be encouraging, while 40% identified access to affordable gym equipment or training facilities as a facilitating factor to participation. Additionally, 33% of respondents reported that having social support or a recommendation from a healthcare provider would encourage them to begin RT.

4.9 Facilitators and Motivators to Resistance Training Engagement

4.9.1 Facilitators and Motivators for Resistance Training Participation

Twenty-seven respondents who undertook RT responded to the facilitators and motivators section of the questionnaire. Facilitators and motivators for RT participation are presented in Figure 25. All respondents identified improving physical strength as a motivator for participating in RT. Other common motivators included enhancing overall health and fitness, improving physical appearance, and increasing muscle mass. Two-fifths of respondents reported that alleviating endometriosis symptoms motivated their engagement in RT. Only four respondents reported participating in RT following recommendation from a healthcare professional, with two receiving a recommendation from a physiotherapist, and one each from an osteopath and fitness instructor.

Figure 25. Frequency of Facilitators and Motivators for Resistance Training Participation

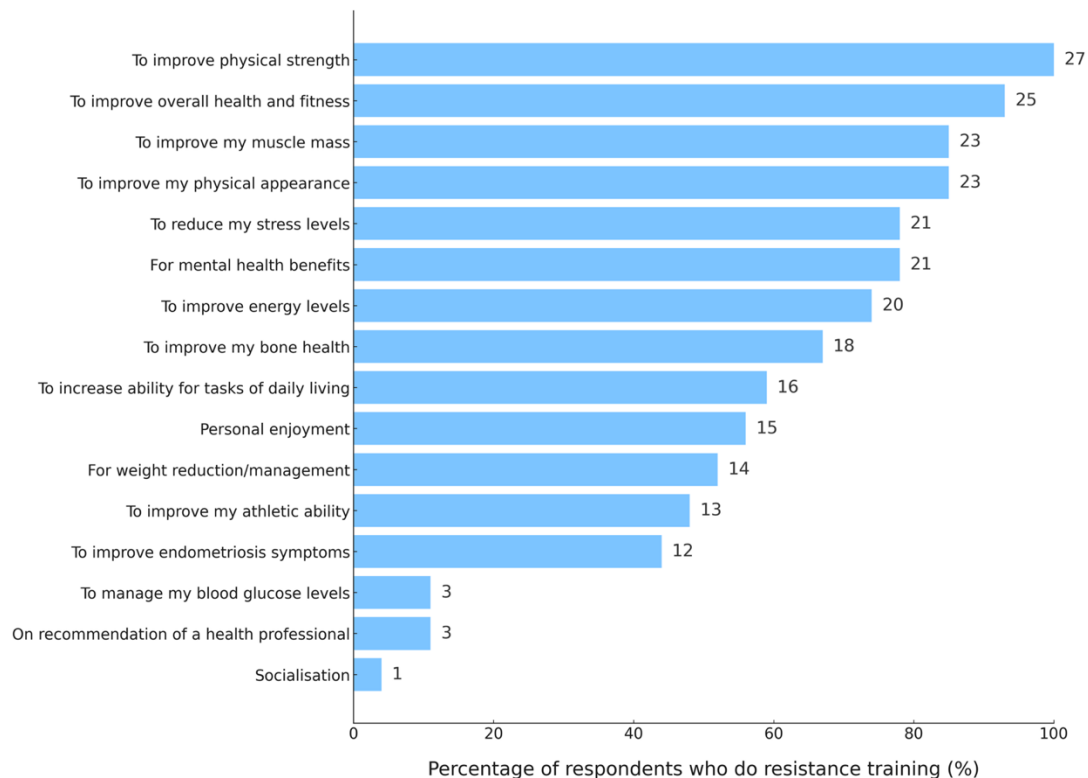


Figure 25. Shown are respondent motivators and facilitators to participating in RT (n = 27). Numbers above each bar represents the number of respondents who selected that option.

4.9.2 Facilitators to Resistance Training Participation Across the Lifespan

An exploratory analysis showed that facilitators to RT remain largely consistent across the lifespan, with little variation between age subgroups (Figure 26). There were a wide range of motivators and facilitators to participating in RT, with improved physical strength, muscle mass, and overall health and wellbeing emerged as universal motivators, alongside appearance-related benefits, mental health improvements, and stress reduction. There were few notable age-related differences; improvements in endometriosis symptoms were reported more often by those aged 31 to 40; bone health and energy improvements were more prominent in older respondents; and only the youngest age group reported recommendations from health professionals as a facilitator to RT participation. Given the very small subsample sizes (n = 14, 5, and 8, for age brackets 19-30, 31-40, 41-50, respectively), these results should be interpreted

with caution, as observed differences may reflect sampling bias rather than true distinctions in motivators across the broader population.

Figure 26. Facilitators to Resistance Training Participation Across the Lifespan

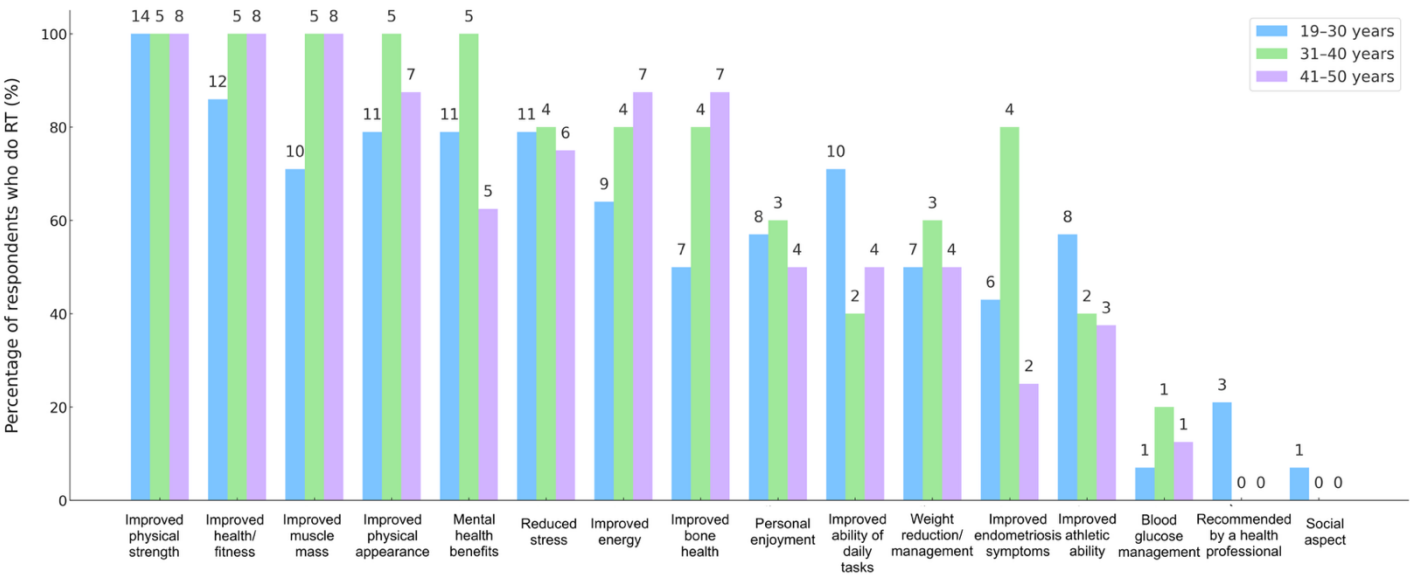


Figure 26. Shown are respondent motivators and facilitators to participating in RT (n = 27) grouped by age. Numbers above each bar represents the number of respondents who selected that option.

Chapter 5

Questionnaire Discussion

Chapter 5 Preamble

Data collection for this chapter was ceased on 09/10/2025 at which time $n = 60$ questionnaire responses had been received. This decision was made due to an unexpectedly slow response rate and the time-limited nature of recruitment within a Research Master program, alongside the need to proceed with data analysis, complete the discussion chapters, and meet thesis submission timelines. The questionnaire has, however, remained open to continue recruitment toward the target sample size required ($n = 90$) for publication based on a priori sample size calculations. As of 16/12/2025, a total of 80 responses had been collected. A close examination of the recruitment limitations and the key findings derived from the initial $n = 60$ responses is presented in the subsequent sections of this chapter.

5.1 Summary of Key Findings

This questionnaire examined real-world RT practices, perceptions, symptom responses, and participation barriers among Australian women with endometriosis. It was designed to address the evidence gaps identified in the preceding scoping review (Chapter 2), which highlighted the limited and inconsistent nature of RT research in this area. The findings of the questionnaire demonstrate considerable variability in women's RT behaviours, divided perceptions around the degree of usefulness of RT for symptom management, and challenges to resistance exercise, related to unpredictable symptoms. Furthermore, elements of the questionnaire were designed to look at the clinical stereotype of women with endometriosis, and the reliability of symptom reporting. Importantly, the questionnaire provided insight into the psychometric performance of symptom items themselves, demonstrating which symptoms are relatively stable within a single sitting and which symptoms fluctuate in ways that have implications for questionnaire validity, item construction, and interpretation of symptom–exercise relationships. Importantly, just over half of respondents perceived RT as beneficial for symptom management ($n = 15 / 27$), while just under half were unsure or believed it was not beneficial for symptom management ($n = 12 / 27$), highlighting a disconnect between the established benefits of regular RT for women, and what women

living with endometriosis are feasibly able to undertake. These findings emphasise the need for evidence-based, endometriosis-specific RT guidance that reflects women's lived experiences and their resultant capacity to resistance train.

5.2 Sociodemographic Characteristics and the Clinical Stereotype

Existing literature has identified a clinical stereotype in endometriosis research, often depicting women with the condition as “white, lean, middle class, career-driven women” (Rowlands et al., 2022). This stereotype may shape clinical understanding and research representation, potentially contributing to a narrower depiction of who is perceived to experience the condition, and how it manifests. Such bias risks excluding culturally and linguistically diverse groups, women from lower socioeconomic status, and those with differing body compositions or employment circumstances from equitable access to diagnosis, treatment, and participation in research (Rowlands et al., 2022). In this study, respondents were predominantly of white ethnic backgrounds (most commonly Australian and English/British), consistent with the current clinical stereotype. However, other sociodemographic characteristics varied notably from this clinical stereotype. The sample in this study had a mean BMI of $26.4 \text{ kg}\cdot\text{m}^{-2}$ and median BMI of $24.3 \text{ kg}\cdot\text{m}^{-2}$, corresponding to the qualitative categories of “overweight but not obese” and “normal weight” respectively (Australian Institute of Health and Welfare, 2024), rather than the stereotypical depiction of women with endometriosis as “lean”. Evidence from a large fibromyalgia cohort of 2339 patients indicates that more than 50% of patients are overweight or obese (Atzeni et al., 2021), comparable to the mean and median (which was toward the upper end of “normal weight”) in the present dataset, and suggests that chronic pain conditions are represented across a broad range of body sizes. Income patterns also differed among questionnaire respondents, with the most common income bracket reported being AUD \$0-\$18,200 per year, indicating a lower socioeconomic status than the “middle class” assumption. Respondents typically held one job, and worked an average of 29 hours per week, which does not reflect the stereotype of a high-income, full-time, “career-driven” demographic. Similar patterns are observed in fibromyalgia, where large cohort

data demonstrate reduced employment and lower income driven by symptom burden and decreased capacity for full-time work (Bennett et al., 2007; Björkegren et al., 2009).

It is plausible that at least some of the mixed findings from this sample relative to the clinical stereotype may be attributed to sampling bias related to participant recruitment and respondent completion. The questionnaire was written and distributed in English, precluding individuals of non- or limited-English speaking backgrounds from accessing the questionnaire and resulting in an under-representation of culturally and linguistically diverse community groups in the findings, potentially limiting the diversity of experiences captured. Recruitment occurred online, which may introduce further sampling bias, as responses were limited to individuals with access to digital resources and engagement with online platforms or support networks (Andrade, 2020). Additionally, the recruitment approach may have preferentially attracted individuals with greater interest in or engagement with exercise, potentially introducing self-selection bias within the sample. The primary limitation of this study related to the relatively small sample size ($n = 44$), which restricts the extent to which findings can be considered representative of the broader population of Australian women living with endometriosis. With a larger sample, greater confidence could be placed upon the stability of observed patterns and in the ability to meaningfully challenge or refine existing clinical stereotypes in this population.

Whilst the sample analysed thus far represents a smaller proportion of the overall target sample size, the findings should be interpreted as preliminary evidence, , some of the early sociodemographic findings challenge some of the current assumptions about who is affected by endometriosis in Australia. This highlights the need to maximise inclusivity in both clinical and research contexts, since sociocultural and economic factors may influence access to exercise opportunities, symptom management strategies, and engagement in RT. Future research should continue to prioritise diverse recruitment strategies alongside inclusive questionnaire-based research to ensure comprehensive population-level data are captured. Such approaches would enable accurate

subgroup analyses and comparison, providing a clearer understanding of who is impacted by endometriosis, and how exercise experiences and outcomes may differ across this population, thereby supporting the development of exercise and RT recommendations that are equitable, culturally relevant, and evidence informed. Overall, these preliminary findings warrant further exploration of the clinical stereotype of endometriosis.

5.3 Questionnaire Validity and Reliability

An important yet often overlooked component of questionnaire-based research is determining whether items are reliable and stable enough to support valid interpretation, especially when measuring temporal factors (i.e., symptoms that naturally fluctuate over time), such as pain and fatigue (Ong et al., 2006; Koo & Li, 2016; Van den Bergh & Walentynowicz, 2016; Yamada et al., 2022). Studies have examined symptom severity in chronic pain populations, however, few have looked at whether those symptoms fluctuate over the course of a single questionnaire sitting, suggesting that responses may be shaped by the respondent's immediate context and momentary symptom state. This aligns with evidence showing that symptom ratings vary over short periods and may be highly sensitive to contextual and temporal influences (Ferguson et al., 2004; Jamison et al., 2006; Stone et al., 2008). The current questionnaire enabled an assessment of symptom within-session test-retest reliability by comparing symptom severity responses at the beginning and end of the same questionnaire. Most symptoms demonstrated moderate to good reliability (ICC's ranged from 0.41 to 0.84) (Koo & Li, 2016), yet Bland-Altman analyses revealed wide LoA, indicating within-individual variability that reflects short-term symptom fluctuation.

An identified area for improvement in the questionnaire is that question-by-question timing was not collected, meaning it was unclear whether a small number of respondents completed the questionnaire in one sitting, or across multiple hours. Four respondents took extended periods to complete the questionnaire (~ 60+ minutes), and longer durations may have influenced within-session consistency. For example, one participant took 59 minutes to

complete the questionnaire and showed large shifts in symptom severity from the beginning to the end, with chronic pelvic pain, dysmenorrhoea, and heavy menstrual bleeding symptoms shifting from 7, 9, and 9 out of 10 respectively at the start of the questionnaire, to 5, 1, and 1 out of 10 by the end. However, three other respondents with durations similar or longer than this did not, suggesting there could be large individual variability in endometriosis symptoms when sampling via online questionnaire. Removing this most extreme case marginally narrowed the Bland-Altman LoA and ICC CIs, but did not change overall reliability interpretations. Therefore, there was no methodological justification for excluding this participant, and the respondent was retained in the final dataset. Future work should collect item-level timestamps and consider incorporating questionnaire duration as a covariate in linear mixed model analysis to better partition error due to true symptom instability versus prolonged questionnaire completion time.

In the present study, symptoms such as heavy menstrual bleeding, dyschezia, dysuria, dyspareunia, and fatigue showed relatively narrower LoA and CIs, suggesting more stable within-session reporting. In contrast, chronic pelvic pain, dysmenorrhoea, bloating, nausea, and headache/migraine showed poor reproducibility, but potentially impacted by smaller subgroup sample sizes (Koo & Li, 2016). Variability in symptom reporting may also arise from natural fluctuations in symptom or pain intensity (Ong et al., 2006), individual perception differences (Ong et al., 2006; Van den Bergh & Walentynowicz, 2016), underlying psychological and physical mechanisms of pain (Schneider et al., 2012), questionnaire duration or context of questionnaire completion (Stone et al., 2008) and temporal effects and variability (Ferguson et al., 2004). Given that existing endometriosis and exercise questionnaires rarely report psychometric properties of symptom ratings, these findings underscore the need for clearer temporal framing, construct stability testing, and more rigorous symptom validation work in future research.

5.4 Interpretation of Training Behaviours and Symptom Responses

5.4.1 Patterns of Planned Physical Activity Behaviours

Although similar PA-related questions have been explored in previous research, their inclusion in this study aimed to generate confirmatory data and assess alignment with existing literature. Most participants in the current study reported three PA sessions per week, each lasting 46-60 minutes. This is consistent with the findings of Brooks et al. (2024), who reported 2-3 sessions per week of 45-60 minutes. Although the overall patterns are similar, additional questionnaire items in the present study enabled more detailed response options for frequency (1-7 days per week), number of sessions (1-10), and duration ranges (e.g., 15-29 minutes, 30-45 minutes, 46-60 minutes), providing greater precision in capturing PA variability and training dosages. These more precise response brackets may help identify subtle differences that broader categories, like those used by Brooks et al. (2024) may not fully capture, even when overall trends are comparable. It is important to note that our sample may differ due to recruitment methods, including the questionnaire introduction highlighting RT participation, potentially biasing those attempting the questionnaire to more active individuals, at least from a resistance exercise perspective. Overall, the findings are broadly consistent, but suggest slight differences in reported PA patterns that may be explained by both the design of the questionnaires and sample characteristics.

5.4.2 Patterns of Resistance Training Behaviours

Research Aim 2. To explore RT frequencies, intensities, duration and types among Australian women with endometriosis.

This aim was addressed by analysing training frequency, duration, intensity, and exercise selection among survey respondents. The findings indicate that women structure their RT in ways that closely mirror general adult RT recommendations, such as those outlined by the World Health Organisation (2020) and the Australian Physical Activity Guidelines, which advises adults (including those with chronic conditions) to undertake muscle-strengthening activities at least twice weekly, alongside 105-300 minutes of moderate aerobic activity (World Health Organisation, 2020; Australian Government Department of Health and Aged Care, 2021). Comparable guidance exists for chronic pain

populations with overlapping symptom profiles, such as fibromyalgia, where the American College of Sports Medicine (2013) recommends two to three weekly RT sessions, at 40-80% of a client's estimated or measured 1RM for four to five repetitions, progressing to 60-80% of 1RM for eight to twelve repetitions.

Women in this study demonstrated considerable variation in their RT behaviours, including differences in weekly training frequency, session duration, intensity, and exercise selection. However, most respondents (79%) performed two to three weekly RT sessions, for 30 to 60 minutes (84%), at moderate-to-hard intensities (RPE 5-8; 70%). Interestingly, these training behaviours closely align not only with fibromyalgia-specific recommendations but also with general healthy adult guidelines, which may suggest that due to a lack of endometriosis-specific RT guidance, women default to more generalised exercise that mirrors recommendations.

Women in this study most commonly trained in either commercial gyms or at home, utilising bodyweight exercises, free weights, and a variety of pin- or plate-loaded machines. Understanding these contextual factors is essential for the development of feasible RT interventions that can be translated for women with lived experience of endometriosis. Given that approximately three-quarters of respondents trained in these environments and with this equipment, interventions that mirror these real-world training contexts, such as programs incorporating bodyweight exercises, free weights, cable machines, and standard commercial gym equipment, might be more acceptable and accessible to women with endometriosis who already participate in RT. Among the remaining approximately one-quarter of respondents, training contexts were highly variable; a risk with designing training interventions targeting the majority of "commercial" resistance exercisers is that this substantial subgroup is not engaged. Therefore, to better understand this substantial subgroup, it may be valuable for future research to explore their barriers to engaging with more commercial training settings, as well as their preferences for specific training types.

5.4.3 Symptom Experiences and Variability

Research Aim 2. To explore perceptions of RT as a symptom management strategy among Australian women with endometriosis.

This aim was addressed by examining reported symptoms, perceived benefits and flares related to RT, and conducting correlational analyses between FITT characteristics and symptom severity. Respondents in this study most commonly reported pain symptoms (i.e., chronic pelvic pain, painful periods, painful intercourse, headaches/migraines), fatigue, and bloating, as well as comorbidities such as depression and anxiety, which matches the current symptom profiles for women with endometriosis (van Barneveld et al., 2022; Mitchell et al., 2024). Just over half of the respondents who participate in RT viewed this exercise modality as a promising strategy for managing endometriosis symptoms, aligning with the growing interest in non-pharmacological management approaches noted within the literature (Giese et al., 2023; Afreen et al., 2024). Many women perceived RT as beneficial for improvements in chronic pelvic pain, dysmenorrhoea, and fatigue symptoms, yet others were uncertain about the effectiveness of RT as a symptom management strategy. Importantly, despite these perceived benefits, 70% of women who participate in RT reported experiencing at least one symptom flare they attributed to their training, most commonly occurring during or immediately after a session. This duality in perceptions, and variability symptom responses to RT, highlights the complexity of understanding how RT interacts with endometriosis symptoms in real-world practice. To explore this further, correlational analyses were conducted to identify whether specific RT characteristics (i.e., frequency, intensity, and time) were associated with symptom severity patterns.

Unsurprisingly, given the small sample size for correlational analysis and highly individualised symptom responses to RT, most correlations between symptom severity and FITT principles were weak or negligible. With regards to sample size, as stated earlier, correlational analyses require a minimum of 150 participants for stable estimates, therefore the results should be considered preliminary and interpreted cautiously (Bujang, 2024). An alternative analytical approach could involve linear-mixed models, incorporating the FITT principle

variables as covariates, which could provide a more nuanced understanding of how differences in RT practices contribute to variation in symptom responses. From a mechanistic perspective, symptom complexity reflects the multifactorial nature of endometriosis symptoms which emerge from interactions between inflammatory processes, hormonal fluctuations, and divergent pain sensitivity and pain processing mechanisms (Ochoa Bernal & Fazleabas, 2024) and thus symptoms may be highly variable between individuals (Mitchell et al., 2024). The magnitude of observed correlations also underscores the complexity of interpreting training principle and symptom relationships. FITT characteristics do not operate independently; athletes who train at higher intensities often train for shorter durations, select different types of exercises, or adjust weekly training frequencies (Colquhoun et al., 2018; Grgic et al., 2018), meaning these variables are interrelated. As a result, single-variable correlations are difficult to interpret on their own, because any apparent association may reflect the combined influence of multiple training behaviours rather than one isolated factor. A small number of moderate to strong associations emerged, such as shorter sessions (≤ 30 minutes) positively correlated with chronic pelvic pain, sessions lasting 30 to 45 minutes showed strong negative correlations with nausea, two weekly RT sessions showed strong negative correlations with dyspareunia severity, and hard intensities (RPE 7-8) positively correlated with dyschezia and heavy menstrual bleeding severity. The positive association between shorter RT sessions and chronic pelvic pain may reflect higher relative intensities adopted during time-constrained sessions, or exercise selection aimed at maximising training efficiency (e.g., compound movements or high impact exercises such as jumping). Such approaches may increase pelvic floor loading or discomfort in some individuals; however, these mechanisms cannot be confirmed within the present dataset. Additionally, the wide 95% CIs surrounding these estimates suggest that these patterns should be interpreted cautiously (Hazra, 2017). These results reinforce the need for future work using larger samples and more sophisticated linear mixed modelling with covariates to determine how training variables cluster together and whether specific combinations of FITT characteristics drive changes in symptom severity.

Another limitation of this analysis relates to the assessment of symptom severity, which was captured using the prompt *“How severe are your endometriosis symptoms right now?”*. While this item reflects a momentary assessment of symptom severity rather than chronic or training-related patterns, it was intentionally designed to minimise participant burden and enhance clarity with an online questionnaire format. As the timing of respondents’ most recently completed RT session was unknown, it remains unclear whether symptom rating responses reflected baseline severity, daily fluctuations, or acute post-exercise effects. Even with a larger dataset, the analysis method used may be limited by the wording of the questions, as items assessing acute training effects and chronic symptoms need to capture changes in symptoms over time relative to RT. This limitation restricts the ability to appropriately analyse and interpret relationships between RT variables and symptom outcomes.

Future questionnaire- or interview-based investigations are encouraged to incorporate more context-specific symptom measures, particularly those assessing symptoms during and immediately following RT sessions. In addition, longitudinal approaches, such as symptom diaries, may offer greater insight into temporal relationships between RT participation and symptom flares by allowing participants to record symptom severity alongside concurrent activities or training exposures. Such approaches would enable a more nuanced understanding of both acute and cumulative symptom responses to RT over time.

5.5 Symptom Exacerbation and Management Strategies

Women reported a wide range of strategies to manage RT-related symptom flare-ups, including heat therapy, prescription and over-the-counter medications, and modifying or reducing PA. These approaches are consistent with self-management patterns observed in chronic pain populations (defined as persistent pain experienced every day for over three months), where individuals commonly rely on multimodal approaches such as medications, heat therapy, and exercise to reduce pain symptoms (Blyth et al., 2005). Heat therapy is known to reduce pelvic pain and dysmenorrhoea in women with primary

dysmenorrhoea through relaxation of the abdominal wall muscles and increased pelvic blood circulation, diminishing pelvic congestion and swelling (Kirsch et al., 2024). For women who notice symptom flares in these areas following training, integrating RT with heat therapy could be a viable strategy for supporting greater adherence and satisfaction with RT. This could be a target for prospective clinical trials exploring combination therapies to help support or treat women with endometriosis. Likewise, the number of respondents reporting use of prescription and over-the-counter medications to manage flare-ups (61% and 66%, respectively) aligned with previous findings that 47% of Australian women with endometriosis use prescription pain relief, and 78% use over-the-counter medications (O'Hara et al., 2022), reflecting the reliance on pharmacological and multimodal symptom-management strategies in these women. These findings reinforce the complexity of RT participation for this population and the need for RT interventions to integrate symptom-flare awareness and pacing strategies for when to modify training sessions.

5.6 Confidence and the Theory of Planned Behaviour

The questionnaire findings also align with the TPB, which posits that health-related behaviours are shaped by attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991). Women generally reported positive attitudes towards RT, and recognised benefits for strength, muscle mass, and general health and well-being. Perceived behavioural control is a construct derived from respondents' reported beliefs regarding barriers and facilitators to RT participation. In this study, these underlying indicators suggested uncertainty regarding symptom unpredictability, fear of worsening symptoms, symptom exacerbations and uncertainties of where to start or how to do RT. This imbalance, with favourable attitudes but low perceived control, is consistent with behavioural research showing that individuals are less likely to act in a behaviour when confidence in their ability to perform the behaviour is diminished (Ajzen, 1991). Interestingly, the similarity in RT confidence between those who do and do not currently engage in RT may reflect the fluctuating and unpredictable nature of endometriosis symptoms, where prior experience does not necessarily translate into higher confidence due to ongoing uncertainty

about symptom exacerbation. It may also indicate that exercise confidence is shaped more by general self-efficacy and symptom-related fear rather than participation history alone.

The lack of clinician support and guidance further weakened perceived behavioural control, with many non-participants expressing a desire for clear, endometriosis-specific, evidence-based guidance. Within the TPB, this absence of professional support reflects weak subjective norms, as women are not receiving reinforcement from healthcare professionals that RT is appropriate, safe, or beneficial. Barriers identified in this study, including pain, fatigue, and fear of symptom exacerbation, are well-established obstacles to PA in women with endometriosis (Sachs et al., 2023; Blanco-Martínez et al., 2025).

Conceptually, these barriers undermine perceived behavioural control, decreasing women's confidence in their ability to engage in RT without negative effects. In contrast, facilitators such as tailored education, symptom-informed programming, and professional guidance, alongside practical supports (e.g., time-management strategies, social support networks, and reduced location or travel barriers) are likely to strengthen perceived control, making participation feel more achievable and safer in this population. In chronic conditions, individuals perceived a need for fitness instructors to have additional training and experience with chronic disease management and exercise prescription to facilitate participation and improve confidence in the community (Sheil et al., 2022). For example, group-based exercise classes conducted under supervision by qualified exercise instructors was viewed as being more accessible among cancer patients living with fatigue (Blaney et al., 2010). In fibromyalgia, physiotherapist support and individualisation of exercise programs enhance confidence, promote safety, and improve exercise adherence, whereas a lack of ongoing professional guidance is a key barrier in this population (Carvalho et al., 2024). These findings align with the results in the current study, whereby the absence of professional guidance was a barrier to RT, and tailored education and symptom-informed support were identified as facilitators for our cohort of women with endometriosis, highlighting the importance of professional input in promoting safe and effective exercise participation.

Overall, these findings indicate that improving women's perceived behavioural control is an important aspect of enabling RT participation in this population. Targeted educational resources, clear guidance on adapting training around symptom flares, and stronger clinician-led support are necessary components of endometriosis-specific RT guidelines. In chronic musculoskeletal pain populations, multimodal programs that combine structured exercise with education, self-management support, and behavioural adherence strategies, have demonstrated improvements in participation, and could serve as a framework for future clinical exercise trials targeting women with endometriosis (Jordan et al., 2010).

5.7 Lifespan Considerations

Research Aim 3. To examine perceptions and barriers to RT and how they may change across the lifespan of women with endometriosis.

This aim was addressed by examining patterns of barriers, motivations, and training behaviours across different age groups. Different life stages can have different effects on the ability to access and undertake exercise, and the modalities and nature of training undertaken in Australian women (Brown et al., 2009). Age-related patterns suggested that barriers and motivations shift across the lifespan, however, in the present analysis, small sample sizes limit definitive conclusions, and any analysis and interpretation is therefore exploratory and hypothesis-generating only. From our findings, younger women (aged 19 to 30) reported low confidence, lack of guidance and uncertainty around symptoms, which is consistent with the literature showing that pain unpredictability and flare-related anxiety commonly reduce PA participation in this younger population (Sachs et al., 2023; Blanco-Martínez et al., 2025). On the other hand, women from our study who were aged 31 to 40 were most affected by time constraints, which may reflect greater work and/or caregiving demands during this stage of life. This may suggest that life-stage pressures play a role in shaping RT engagement, which is consistent with broader women's PA research (Brown & Trost, 2003; Dave et al., 2015). In terms of women at typical perimenopausal or menopausal ages (ages 41 to 50), there was a tendency to

prioritise strength, bone and muscle health, and energy levels, which aligned with ageing and functional capacity targets previously reported for women within this age range (Izquierdo et al., 2021). These preliminary findings reinforce that a one-size-fits-all approach to RT is insufficient, and that effective intervention design should account for individual symptom profiles alongside broader lifespan considerations. Given these preliminary patterns, a larger sample will be collected to allow the use of an age-sensitive modelling approach (e.g., linear mixed modelling utilising age and other variables as covariates) to explore interactions between age, symptoms, comorbidities, and RT behaviours. This more robust analyses will support future publication(s) derived from a final questionnaire dataset (of at least 90 respondents).

5.8 Questionnaire Strengths and Limitations

Key strengths of this questionnaire include its Australia-wide recruitment, with participants drawn from multiple states and territories across Australia,, comprehensive evaluation of RT behaviours, and the integration of symptom profiles, barriers, facilitators, and perceptions within a single dataset. Biases related to sociodemographic characteristics were described in Section 5.2, and likely reflect the recruitment approach, which relied on English-language materials and online social media dissemination. A broader audience could have been achieved through translation into different languages and the use of alternative advertising platforms, such as messaging apps or other channels that reach diverse ethnic groups. Future research should consider these approaches to ensure underrepresented populations are included in efforts to promote exercise behaviours among women with endometriosis. Several further limitations must be acknowledged. Despite broad dissemination, the study did not reach its target of at least 90 participants within the allocated timeframe, reflecting the inherent difficulties of digital recruitment (Nayak & Narayan, 2019). Several recent online surveys investigating PA and exercise in women with endometriosis have been conducted, including Blanco-Martínez et al. (2025), Pavic et al. (2025), and Brooks et al. (2024), demonstrating that such research is feasible but that response rates can vary depending on recruitment strategies, timing, and platform engagement. Due to the current sample size (n

= 44), the statistical power of subgroup analyses is reduced, and therefore any age-related analyses conducted in the study should be interpreted cautiously. Symptom severity ratings may be influenced by recall variability (Ferguson et al., 2004), a limitation supported by reliability analysis showing inconsistent reproducibility for some symptoms, such as dysmenorrhoea. Another important limitation to address in the reliability analyses is that some participants took several hours to complete the questionnaire, potentially introducing additional measurement error. Extended completion times may increase the likelihood that symptom ratings reflected natural fluctuations rather than true test-retest stability, thereby altering within-individual variability. Future studies can address this issue by firstly encouraging participants to complete questionnaires in a single sitting without breaks at a time when there are minimal distractions, as well as utilising question timing options within online survey software and incorporating questionnaire duration as a covariate in linear mixed models examining associations between symptom severity, RT variables, and reliability indices. Including completion time or time between similar or identical constructs as a covariate would allow researchers to account for temporal drift and isolate error attributable to prolonged survey duration from error attributable to instability in symptom reporting. Although data collection is still ongoing for future publications (80 submitted questionnaires as at 16/12/2025), current response patterns offer valuable and practical insights into the feasibility of online recruitment approaches in this population group. Tracking recruitment timelines and platform-specific response rates provides meaningful benchmarks for future studies, including the planning of sample sizes, realistic recruitment timeframes, effective dissemination strategies, and expected visibility across platforms for the wider research field.

5.9 Conclusions

The results from this questionnaire provide preliminary evidence that Australian women with endometriosis engage in RT in diverse, adaptive, and highly individualised ways. Their perceptions of RT's benefits are mixed, and their experiences are often shaped by symptom unpredictability, uncertainty, and limited access to professional guidance. Educational and clinical support gaps

remain, particularly regarding evidence-based RT guidelines, and symptom-flare management. These findings reinforce the need for clear, endometriosis-specific RT guidelines developed in collaboration with women living with endometriosis. Overall, this questionnaire contributes context-specific evidence on RT engagement and lived experience in Australian women with endometriosis, providing an applied foundation to inform future research and the development of practical, condition-specific RT recommendations.

Chapter 6

General Thesis Discussion

6.1 Contextual Overview

Endometriosis is a chronic, inflammatory condition (Tragantzopoulou, 2024) affecting approximately one in nine Australian women (Rowlands et al., 2021). The condition is associated with pelvic pain, menstrual disturbances, gastrointestinal symptoms, fatigue (Mitchell et al., 2024), and substantial reductions in QoL, work participation, and daily functioning (Álvarez-Salvago et al., 2020; Armour et al., 2020; Giese et al., 2023; Mitchell et al., 2024). Women with endometriosis also experience reduced muscle strength (Silva et al., 2024) and higher rates of musculoskeletal disability (Silva de Barros et al., 2024), highlighting the need for adjunct therapies that support musculoskeletal health. Exercise is therefore often recommended as part of multidisciplinary care (Xie et al., 2025). A specific form of exercise like RT may be a potentially beneficial adjunct therapy to standard care practices due to its effect on musculoskeletal health and function (Artacho-Cordón et al., 2023; Silva et al., 2024), inflammation (Balakrishnan & Thurmond, 2022; McKnight et al., 2024), and in reducing fatigue (Salinas-Asensio et al., 2025). However, research investigating RT in women with endometriosis is limited, and existing studies are often inconsistent, lack detailed reporting of training variables, and rarely isolate RT as an independent exercise modality (see Chapter 2) (Awad et al., 2017; Poli-Neto et al., 2020; Artacho-Cordón et al., 2023; Skaug et al., 2024; Tennfjord et al., 2024; Salinas-Asensio et al., 2025). Evidence-based RT guidance for this population does not currently exist, making it crucial to understand both the existing research landscape and the real-world RT practices of women with endometriosis.

6.2 Synthesis of Thesis Aims and Findings

This thesis addressed three interconnected aims to advance understanding of RT as a potential management strategy for women with endometriosis. In Chapter 2, a scoping review of this topic was conducted which established that the current RT literature is sparse, inconsistently reporting essential training variables or symptom-management approaches (Awad et al., 2017; Poli-Neto et al., 2020; Artacho-Cordón et al., 2023; Skaug et al., 2024; Tennfjord et al., 2024; Salinas-Asensio et al., 2025). This gap highlighted the need to explore

how women with endometriosis actually engage with RT in everyday life. Thus, in Chapter 3, we developed and disseminated a customised questionnaire that was able to capture real-world insights into RT practices, perceptions and barriers. The results of this study revealed that women train in diverse and adaptive ways, often without clinical guidance. A key finding was that approximately three-quarters of respondents who engaged in RT reported performing typical gym-based training in some form. This pattern may reflect sampling bias, as participants were recruited from online support communities where gym-based exercise may be more familiar or accessible. Further, it raises questions about why women with endometriosis choose gym-based training over alternative forms, or conversely, why some engage in different types of RT. Understanding these preferences and choices could help guide the design of tailored interventions that align with women's needs, access, and perceptions, potentially enhancing adherence and effectiveness.

Another key finding of this thesis is the prominence of symptom exacerbations associated with resistance training participation. These exacerbations are infrequently reported or addressed in existing intervention studies, despite their potential to negatively impact QoL and ongoing exercise engagement. While women commonly perceive RT as a trigger for symptom flare-ups, the specific causes and mechanisms underlying these exacerbations remain unclear. Consequently, until mechanistic research elucidates the exact causes of flare-ups, future RT interventions should be designed with an awareness of potential symptom flares and include strategies to minimise known risks and their severity, as well as guidance on how such exacerbations can be monitored and managed effectively.

Preliminary findings looking at different age groups suggested there could be barriers but also opportunities to target and tailor RT to different subgroups among women with endometriosis. Although exploratory in nature, and with a small sample size, these preliminary trends suggest that RT guidance should reflect both symptom variability and lifespan contexts. These early findings indicate that barriers to RT vary across life stages among women with

endometriosis, while also highlighting opportunities for age-specific and context-sensitive intervention design. Tailoring RT approaches to these lifespan considerations may support improved adherence, uptake, and sustained engagement, with the potential to optimise training outcomes for women with endometriosis.

The observed uncertainty and inconsistency in RT engagement appear to be driven by multiple interrelated factors. Key barriers reported by women with endometriosis included lack of time, fatigue, and financial constraints. Additional barriers included concerns that exercise could worsen symptoms or trigger exacerbations, a lack of professional guidance for RT, uncertainty about how or where to start a training program, limited awareness of RT as a management strategy, and scepticism about its potential benefits for endometriosis symptoms. These findings provide insight into how limited RT guidance and education, combined with individual contexts and experiences, may contribute to varied engagement patterns. Each aim of the thesis, spanning the scoping review and questionnaire findings, provides a distinct perspective that together underscores the need for endometriosis-specific RT guidance that accounts for symptom variability, lifespan considerations, and individual barriers and facilitators.

6.3 Key Research Findings, Limitations, and Future Directions

6.3.1 Chapter 2 (Scoping Review)

Research Aim 1. To summarise reported RT prescriptions and outcomes and identify knowledge gaps to inform future trials and clinical guidance.

The scoping review revealed that RT is feasible and generally well tolerated within multimodal exercise programs for women with endometriosis. Bodyweight and low-load RT, often incorporated alongside other interventions, appear safe and potentially beneficial for maintaining muscle function and overall health. However, few studies have examined RT as a standalone intervention, and reporting of prescription variables (FITT) was inconsistent. Importantly, none of the reviewed studies systematically monitored symptom flare-ups in response to training, limiting the understanding of how RT may influence endometriosis-

specific symptoms. Notably, the predominance of bodyweight and low-load RT across the reviewed studies limits the ability to infer whether RT, as currently prescribed, provides a sufficient osteogenic or hypertrophic stimulus to support bone density retention and meaningful skeletal muscle adaptation in women with endometriosis.

As highlighted in the scoping review, it is questionable whether some interventions labelled as RT meaningfully reflect RT practice, particularly where protocols include only a single resistance exercise or minimal progression. While such approaches may technically meet a definition of resistance exercise, they likely represent a limited stimulus and may not constitute RT in a physiological effect or training-adaptation sense. This issue is further compounded by the widespread use of multimodal exercise interventions in which resistance exercises are typically programmed after aerobic or conditioning components. Exercise order is known to influence neuromuscular performance, with preceding aerobic exercise inducing variable fatigue that can impair motor unit recruitment, force production, and the capacity to train at sufficient intensities to stimulate strength and hypertrophic adaptations (Ribeiro et al., 2018). In multimodal programs where aerobic and resistance components are prescribed using different dosing frameworks, this fatigue is neither standardised nor quantified, obscuring the true contribution of the RT component, and potentially diluting its effect. This raises an important methodological question for the field: does a multimodal training intervention that includes a single resistance exercise with limited or no progressive overload meaningfully constitute RT?

When interpreting the findings of the scoping review, it is important to consider the broader musculoskeletal and hormonal context in which women with endometriosis manage their condition across the lifespan. In women without a clinical condition, age-related bone loss typically occurs at a rate of approximately 0.3-0.5% per year prior to menopause (Iwanowicz-Palus et al., 2019), accelerating to around 1-2% per year following menopause, largely due to declining oestrogen levels (Stokes et al., 2025). In the absence of sufficient mechanical loading, particularly progressive, moderate-to-heavy resistance

exercise, bone loss is likely to occur at a faster rate (Hong & Kim, 2018; Shefflette et al., 2023). For women with endometriosis, these normative ageing-related changes may be compounded by the cumulative burden of the condition itself and prolonged exposure to standard treatments such as hormonal suppression and surgery, which have been associated with adverse musculoskeletal consequences, including clinically meaningful reductions in BMD (Sauerbrun-Cutler & Alvero, 2019; Vannuccini et al., 2022). This broader context underscores the potential importance of RT not only as a symptom management strategy, but also as a preventative and protective intervention for long-term musculoskeletal health.

The evidence base as a lifestyle intervention for endometriosis is constrained by several methodological limitations. Very few studies examined RT as a standalone intervention, and those that did had small sample sizes and lacked detail in reporting intensity, volume, progression, or exercise selection (Awad et al., 2017; Poli-Neto et al., 2020; Artacho-Cordón et al., 2023; Skaug et al., 2024; Tennfjord et al., 2024; Salinas-Asensio et al., 2025). Adverse events, symptom flares, and modification strategies were not documented, making it difficult to evaluate the safety and feasibility of continued RT participation in this population (Awad et al., 2017; Poli-Neto et al., 2020; Artacho-Cordón et al., 2023; Skaug et al., 2024; Tennfjord et al., 2024; Salinas-Asensio et al., 2025). The limited presence of long-term follow-up further limits understanding of adherence and meaningful functional outcomes in women with endometriosis (Awad et al., 2017; Poli-Neto et al., 2020; Skaug et al., 2024; Tennfjord et al., 2024). In addition, group-level improvements in pain were reported without presenting individual participant data (Awad et al., 2017), limiting interpretation of whether observed benefits reflected broadly distributed responses or improvements driven by a subset of responders. This lack of transparency is particularly problematic in endometriosis research, where symptom expression and exercise tolerance are highly heterogeneous, and understanding response variability is critical for informing personalised RT prescription. These limitations highlight the need for rigorous, well-designed RT interventions that include detailed reporting of the FITT principles, symptom monitoring and adaptations, long-term follow-up and adherence rates, and patient-centred design.

Importantly, inadequate reporting and inconsistent prescription of exercise interventions is not unique to endometriosis, and has been widely documented across clinical exercise research, including in populations such as Parkinson's disease (Silva et al., 2019), oncology (Avancini et al., 2025), and musculoskeletal pain (Arora et al., 2024), where incomplete and insufficient description of exercise dose, progression, adherence, and long-term follow up has been shown to limit reproducibility and clinical translation (Slade & Keating, 2012; Silva et al., 2019; Arora et al., 2024; Avancini et al., 2025). In response to these challenges, several exercise intervention reporting tools and methodological guidelines have been developed to improve transparency, standardisation, quality, and reporting in exercise research (e.g., Consensus on Exercise Reporting Template, Template for Intervention Description and Replication, and the Tool for the assessment of Study quality and reporting in EXercise) (Hacke et al., 2018; Page et al., 2017; Smart et al., 2015), yet their uptake remains inconsistent across clinical trials. Emerging work in conditions such as fibromyalgia has also demonstrated a growing emphasis on physiologically guided, symptom-informed exercise prescription, grounded in established principles of training adaptation across multiple body systems (Brown & Nelson, 2024; Lucini et al., 2024), which may provide a useful model for improving the quality and interpretability of RT interventions in endometriosis research.

Future research should aim to isolate the effects of RT through standalone or factorial trial designs, with transparent reporting of FITT parameters, progression rules, supervision protocols, adherence, and symptom flare management. While the current evidence does not support the development of an evidence-based optimal RT prescription for women with endometriosis, preliminary findings from this thesis suggest that future trials may benefit from adopting lower-volume, symptom-informed RT approaches with flexible progression strategies. This is particularly relevant given that symptom flares, fatigue, and pain exacerbation were among the most commonly reported barriers and adverse responses associated with RT participation in the present sample. These findings suggest that higher training volumes, insufficient recovery, or poorly individualised progression may represent key aggravating

factors, although the mechanisms underlying these responses remain unclear. Future RCTs should systematically examine how variables such as frequency, intensity, exercise selection, and recovery periods influence symptom responses to better identify tolerable thresholds and effective prescription strategies. Trials should incorporate longer-term follow-up and consider stratification by treatment status, endometriosis phenotype, and life stage to identify who benefits most. Clinically relevant outcomes, including pain, fatigue, functional capacity, pelvic floor symptoms, bone health, and adverse events should be prioritised. Pragmatic delivery models, such as supervised programs transitioning to home- or hybrid-based formats, may support adherence and patient-centred care.

6.3.2 Chapters 3-5 (Questionnaire)

Research Aim 2. To explore RT frequencies, intensities, duration and types; perceptions of RT as a symptom management strategy; and barriers to regular RT engagement in Australian women.

RT has well-known benefits, when prescribed appropriately, for muscle mass, bone health, and functional capacity (Fyfe et al., 2022; Westcott, 2012). Despite these benefits, only 66% of questionnaire respondents reported engaging in RT, suggesting that some women with endometriosis may be unaware of its advantages, unable to participate in it, or perceive the potential risks or costs as outweighing the benefits.

Respondents reported mixed symptom responses, with some (n = 15) experiencing improvements in symptom severity, while most (n = 27) experienced temporary increases in symptom severity. These mixed experiences likely reflect the unpredictable nature of symptoms, variability in individual responses to training, and an absence of clear guidance on how to safely engage with RT, consistent with the literature highlighting symptoms unpredictability and anxiety as barriers to participation in exercise in this population (Sachs et al., 2023; Blanco-Martínez et al., 2025).

Although approximately three-quarters of respondents reported engaging in RT, far fewer reported training at intensities or proximity to failure consistent with established principles for optimising bone density and skeletal muscle adaptations (Refalo et al., 2023; Robinson et al., 2024). The current reported participation in RT alone may be insufficient to offset age-related, treatment-related, and condition-specific musculoskeletal risk if RT is not performed with adequate load, progression, and intent. These findings suggest that while RT is broadly accepted and perceived as beneficial, its current implementation may not be optimised to deliver the full protective benefits for bone and muscle health in women with endometriosis.

There is also potentially a disconnect between clinical research to date and what women with endometriosis are actually doing. Published RT interventions often involved structured programs that do not account for symptom variability, yet findings from this questionnaire indicate that women adjust their training continuously in response to symptom profiles and exacerbations. These adaptive strategies influence the volume, intensity, frequency, and exercise selection of their training, demonstrating a disconnect between rigid clinical protocols and women's training experiences. Symptom variability should be central to future RT research.

Across the duration and context of the questionnaire, some symptoms appear relatively stable (e.g., dyschezia), whereas others (e.g., dysmenorrhoea), may fluctuate. While this finding may be contextualised to the online questionnaire itself, it does raise that symptoms might have inherent variability over short timeframes. Furthermore, 70% of RT respondents experienced symptom flares. Similar approaches have been applied in chronic inflammatory conditions such as rheumatoid arthritis, where longitudinal physiological metrics collected via wearable devices have been shown to identify and symptomatic and inflammatory flare periods (Sharma et al., 2025). These findings demonstrate the feasibility of continuous symptom monitoring to inform personalised management strategies and support symptom-aware modifications during exercise to optimise adherence and safety. Together, these findings would

imply that researchers strongly consider incorporating symptom-monitoring and flare-modifications as core components of training interventions.

Research Aim 3. To examine perceptions and barriers to RT and how they may change across the lifespan of women with endometriosis.

While women exhibit strong motivation to improve strength, function, and overall health and well-being across all stages of the lifespan, the questionnaire findings indicate that a substantial proportion train independently, without guidance from a healthcare professional. Questionnaire responses highlighted uncertainty regarding the effectiveness of RT for symptom management, symptom exacerbations and unpredictability, and how to do RT itself, suggesting that more needs to be done, both in research and in translation of findings to clinical and community practice, to adequately support women in engaging safely and effectively with RT. Given that many women with endometriosis may not access or remain engaged in formal clinical services and often engage in RT independently, future efforts should prioritise community-based dissemination of evidence-informed RT guidance. This includes proactive outreach through established endometriosis support networks (e.g., Endometriosis Australia, EndoZone, and online social media communities), where women already seek peer support and health information. Messaging should emphasise that RT can be safe, flexible, and adaptable to symptom fluctuations when appropriately prescribed, rather than positioning RT as a rigid intervention. Professional bodies with advanced expertise in exercise prescription, such as Exercise & Sports Science Australia, are well positioned to lead the development of endometriosis-specific RT resources grounded in clinical evidence and symptom-informed principles. To maximise reach and population-level impact, these resources could further be disseminated beyond traditional clinical settings through partnerships with AUSactive and other fitness organisations, to support the upskilling of fitness professionals (e.g., personal trainers) who are likely to encounter women self-managing RT. While not all women have access to exercise professionals with clinical condition expertise (in Australia, accredited exercise physiologists, as well as osteopaths and physiotherapists), a tiered dissemination model, whereby higher-level clinical expertise informs broader education and community-facing resources,

may represent a pragmatic and scalable approach to supporting safe and effective RT participation among women with endometriosis. Although it was not explicitly asked whether respondents felt under-supported, the combination of independent training and uncertainty around engaging in RT suggests a gap in professional guidance. This is compounded by the lack of established RT guidelines for women with endometriosis, which contrasts with conditions such as fibromyalgia, where structured resistance exercise recommendations and clinician-led programs are more common (American College of Sports Medicine, 2013). These findings emphasise the need for more evidence-informed RT guidance and clinician involvement (e.g., medical professionals, physiotherapists, exercise physiologists) to support safe and effective training practices for women with endometriosis.

Several methodological and contextual limitations should be considered. The questionnaire was cross-sectional, capturing a single point in time, rather than longitudinal changes in training behaviours or symptom responses. Timing of the last RT session was also unknown, limiting interpretation of acute versus chronic effects. Sample sizes were relatively small ($n = 14, 5, \text{ and } 8$, for age brackets 19-30, 31-40, 41-50, respectively) for lifespan analyses, restricting definitive conclusions about age-related patterns in barriers, motivators, training responses, or symptom experiences. Furthermore, symptom severity was self-reported using a single-item measure, which does not capture temporal dynamics or nuanced symptom changes during or after RT. The reliance on self-reporting may also introduce recall or social desirability bias (Andrade, 2020).

This study highlights several practical considerations for clinicians, exercise professionals, and researchers seeking to improve RT participation and outcomes among women living with endometriosis. High rates of symptom fluctuation, flare-ups, and uncertainties surrounding safe RT practices indicate the need for clearer, condition-specific, evidence-based guidance. These findings suggest that improving outcomes in this population requires not only more thorough exercise prescription, but also impactful end-user-informed research practices. From a clinical perspective, the findings indicate that RT

interventions with endometriosis must be flexible, tailored, and symptom aware. Strategies such as pacing, load progression, pelvic-floor-safe exercise selection, and ongoing symptom monitoring, which may support safer and more consistent exercise and RT participation in this population. Current RT practices in this population are generalised and potentially extrapolated from general population recommendations, that inadequately address the daily variability and unpredictability of endometriosis symptoms. Developing endometriosis-specific RT recommendations, including minimum effective dose thresholds, flare-up modification strategies, and guidance surrounding when and how to progress training, may reduce uncertainty and disengagement, supporting safer and more consistent participation in RT.

The findings also highlight a responsibility for researchers to reevaluate how RT interventions are designed if meaningful impact is to be achieved. If RT is to be positioned as a viable symptom-management and health-promoting strategy, interventions should be co-designed with women living with endometriosis, including those who currently engage in RT, and those who do not. Engaging directly with women to understand perceived feasibility, barriers, facilitators, and preferences is essential to ensure that proposed interventions are realistic, and achievable. Without this step, physiologically sound interventions risk poor uptake and adherence in this group.

6.4 Opportunities and Future Directions to Enhance Clinical RT Research for Women with Endometriosis

The present findings point to several pathways through which future research may generate impact. First, preliminary insights into why some women do not engage in RT provide a clear opportunity to target modifiable barriers and inform intervention design aimed at increasing RT participation. Second, among women who already engage in RT, the findings suggest considerable uncertainty regarding how training should be adapted for endometriosis-specific symptoms. This highlights a need to build an evidence base that clarifies not only the potential benefits of RT, but also how training variables can be manipulated to optimise desired adaptations. The frequent use of multimodal

exercise interventions in endometriosis research also highlights the importance of program design when interpreting RT outcomes. If resistance exercises are consistently positioned after fatiguing aerobic or flexibility components, the resulting pre-fatigue may systematically constrain training intensity and adaptation, potentially contributing to the modest and inconsistent RT effects reported in the literature. Importantly, what constitutes as “optimal” training for health may differ from both general population guidelines and from individual goals and motivations. As such, future guidelines must balance evidence-based health outcomes with what women with endometriosis want from training, supported by targeted education around why certain training approaches may be beneficial, and why it is important to achieve optimal health outcomes in this population.

Additional implications include the need to better understand differences in RT practices across training contexts (e.g., commercial gym settings versus other training environments), as well as plausible age-related differences in barriers, motivators, training responses, and symptom experiences. While preliminary trends observed in the current study suggest age-related variation, larger samples are required to enable robust modelling approaches, such as linear models with age (and/or other relevant variables) as a covariate.

A critical gap identified across both the scoping review and questionnaire findings is the absence of research examining the effects of exercise, and RT specifically, on skeletal muscle quality in women with endometriosis. To date, no studies have investigated exercise-induced changes in muscle cross-sectional area, muscle strength or power, or intramuscular fat infiltration in this population, despite the central role of skeletal muscle in functional capacity, metabolic health, and QoL (Wolfe, 2006). Future RT trials should incorporate objective assessments of muscle morphology and function alongside symptom and patient-reported outcomes to better understand the mechanisms through which RT may offer both symptomatic and long-term health benefits in women with endometriosis.

From a research design perspective, improving the quality and impact of RT research in endometriosis also requires more transparent reporting of training prescription, progression, and adherence. Future studies should prioritise longitudinal and intervention studies to clarify causal relationships between RT and symptom outcomes, while explicitly reporting FITT components and how these are adapted in response to symptoms and flare-ups, and to test RT protocols that optimise training outcomes, feasibility and adherence.

As recruitment of the current questionnaire continues, subsequent analyses will be conducted for future publication, exploring temporal and contextual data, including time of day of questionnaire completion, weekday versus weekend completion, and questionnaire durations, given that attention and timing affect pain perception (Ferguson et al., 2004; Stone et al., 2008). A larger sample will also allow for more nuanced modelling using linear mixed models and structural equation modelling, incorporating sociodemographic moderators such as income and work hours, to better explain variability in symptoms, barriers, and training behaviours across the lifespan.

Across the broader evidence base, the findings of this thesis highlight a fragmented understanding of RT in women with endometriosis, particularly in relation to how physiological outcomes, exercise prescription, and lived experience interact. Key gaps include the limited availability of RT-specific evidence, inconsistent reporting of training variables (including progression, intensity, and adherence), and a lack of research situated within the Australian context. Collectively, these gaps a broader limitation in how RT research in this population has been conceptualised and translated into clinical practice. This thesis contributes a detailed, real-world examination of RT engagement in Australian women with endometriosis, focusing on training practices, perceived impacts, and behavioural influences on participation. In doing so, it provides contextually grounded evidence on how RT is undertaken outside of controlled exercise trials, including barriers and facilitators across the lifespan. Overall, this work contributes to the applied understanding of RT behaviour and experience in this population, with implications for future intervention design and clinical translation.

Taken together, these findings suggest that generating meaningful impact requires a coordinated and iterative body of research that integrates end-user engagement, transparent reporting of exercise prescription variables, and flexible, symptom-responsive training principles. To support this process, and to guide future research, a framework for generating impactful resistance exercise research for women with endometriosis is proposed.

Figure 27 presents a framework for generating impactful resistance exercise research for women with endometriosis. This framework synthesises findings from the current questionnaire, evidence from the accompanying scoping review, and broader literature on clinical exercise guideline development in chronic conditions. It is intended to serve as a foundational structure upon which future researchers can build, refine, and extend a cohesive body of work at developing safe and effective RT guidelines for women with endometriosis.

Figure 27. Framework for Generating Impactful Resistance Exercise Research for Women with Endometriosis

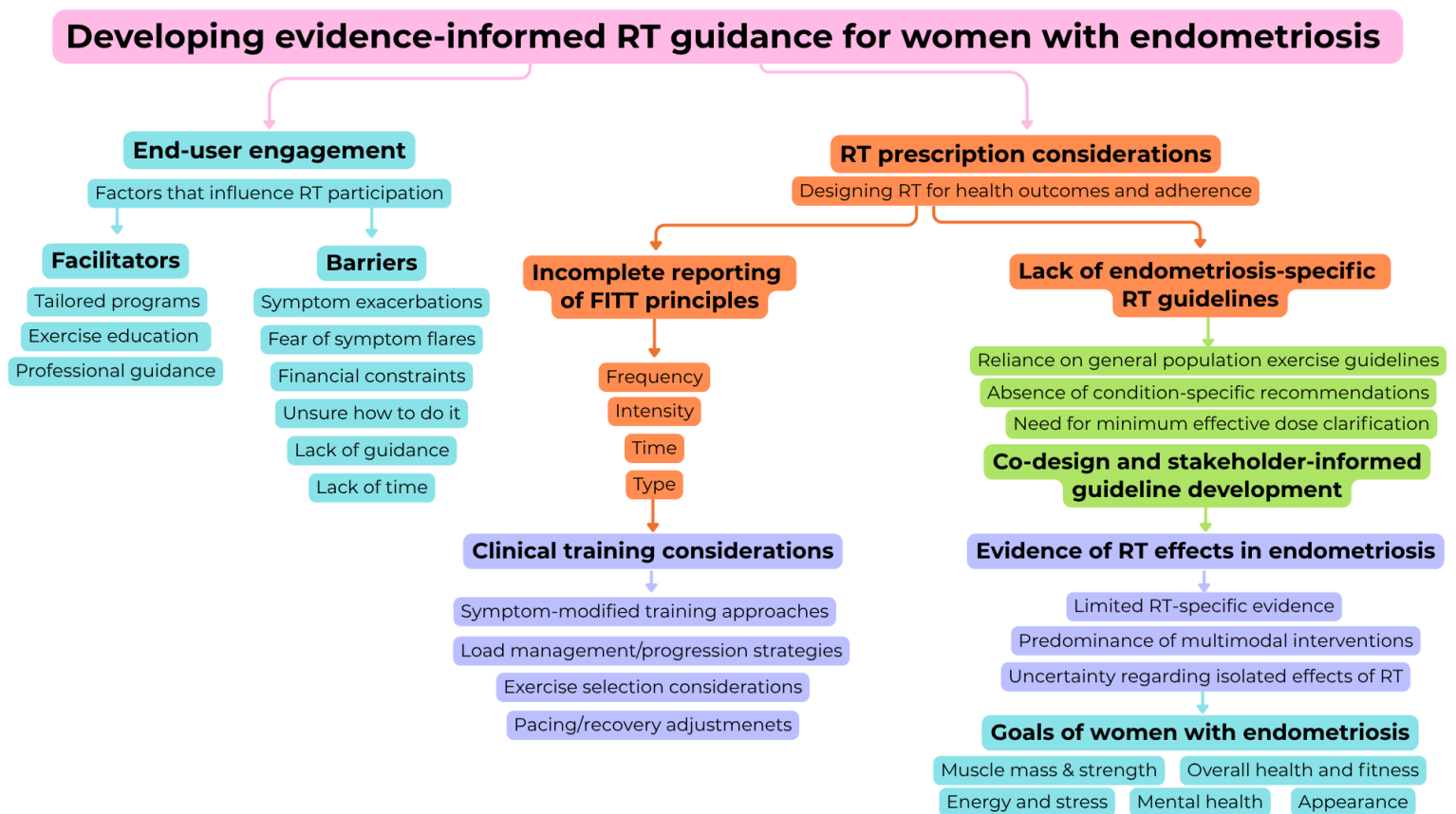


Figure 27. Colour-coding within the framework indicates the primary source of evidence informing each component: questionnaire findings (blue), scoping review findings (orange), convergence of both data sources (purple), and principles adapted from resistance training research in other chronic conditions (green).

6.5 General Conclusions

Together, the scoping review and questionnaire provide an integrated understanding of RT research and real-world RT behaviours among women with endometriosis. Given the variability in experience and engagement with RT among women with endometriosis, the thesis findings highlight opportunities for future researchers to engage with women with endometriosis to better understand barriers and facilitators to RT participation, and to inform RT interventions aimed at optimising prescription and improving engagement. This, in turn, may contribute to the longer-term development of endometriosis-specific exercises guidelines, pending further efficacy and intervention-based research. This thesis offers preliminary insights into the barriers, perceptions, and symptom considerations relevant to RT among women with endometriosis. These findings contribute to the existing literature and may support the future development of safe, evidence-informed RT guidance to better support women with endometriosis in engaging in and benefiting from RT across the lifespan.

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Appendix A

Full Search Strategies

Database	Search Date	Search Strategy
PubMed	18/08/2025	((((("resist"[All Fields] OR "resistance"[All Fields] OR "resistances"[All Fields] OR "resistant"[All Fields] OR "resistants"[All Fields] OR "resisted"[All Fields] OR "resistence"[All Fields] OR "resistences"[All Fields] OR "resistent"[All Fields] OR "resistibility"[All Fields] OR "resisting"[All Fields] OR "resistive"[All Fields] OR "resistively"[All Fields] OR "resistivities"[All Fields] OR "resistivity"[All Fields] OR "resists"[All Fields]) AND ("exercise"[MeSH Terms] OR "exercise"[All Fields] OR "exercises"[All Fields] OR "exercise therapy"[MeSH Terms] OR ("exercise"[All Fields] AND "therapy"[All Fields]) OR "exercise therapy"[All Fields] OR "exercising"[All Fields] OR "exercise s"[All Fields] OR "exercised"[All Fields] OR "exerciser"[All Fields] OR "exercisers"[All Fields])) OR ("resistance training"[MeSH Terms] OR ("resistance"[All Fields] AND "training"[All Fields]) OR "resistance training"[All Fields] OR ("strength"[All Fields] AND

		"training"[All Fields]) OR "strength training"[All Fields]) OR ("rehabilitant"[All Fields] OR "rehabilitants"[All Fields] OR "rehabilitate"[All Fields] OR "rehabilitated"[All Fields] OR "rehabilitates"[All Fields] OR "rehabilitating"[All Fields] OR "rehabilitation"[MeSH Terms] OR "rehabilitation"[All Fields] OR "rehabilitations"[All Fields] OR "rehabilitative"[All Fields] OR "rehabilitation"[MeSH Subheading] OR "rehabilitation s"[All Fields] OR "rehabilitational"[All Fields] OR "rehabilitator"[All Fields] OR "rehabilitators"[All Fields]) OR ("resist"[All Fields] OR "resistance"[All Fields] OR "resistances"[All Fields] OR "resistant"[All Fields] OR "resistants"[All Fields] OR "resisted"[All Fields] OR "resistance"[All Fields] OR "resistences"[All Fields] OR "resistent"[All Fields] OR "resistibility"[All Fields] OR "resisting"[All Fields] OR "resistive"[All Fields] OR "resistively"[All Fields] OR "resistivities"[All Fields] OR "resistivity"[All Fields] OR "resists"[All Fields]) OR ("strength"[All Fields] OR "strengths"[All Fields]) OR ("functional"[All Fields] OR "functional s"[All Fields] OR "functionalities"[All Fields] OR "functionality"[All Fields] OR
--	--	--

		"functionalization"[All Fields] OR "functionalizations"[All Fields] OR "functionalize"[All Fields] OR "functionalized"[All Fields] OR "functionalizes"[All Fields] OR "functionalizing"[All Fields] OR "functionally"[All Fields] OR "functionals"[All Fields] OR "functioned"[All Fields] OR "functioning"[All Fields] OR "functionings"[All Fields] OR "functions"[All Fields] OR "physiology"[MeSH Subheading] OR "physiology"[All Fields] OR "function"[All Fields] OR "physiology"[MeSH Terms])) AND ("endometriosis"[MeSH Terms] OR "endometriosis"[All Fields] OR "endometrioses"[All Fields])) AND (clinicalstudy[Filter] OR clinicaltrial[Filter] OR controlledclinicaltrial[Filter] OR observationalstudy[Filter] OR pragmaticclinicaltrial[Filter] OR randomizedcontrolledtrial[Filter])
CINHAL	18/08/2025	(TI endometriosis OR AB endometriosis OR TI endometrioses OR AB endometrioses) AND (TI "resistance training" OR AB "resistance training" OR TI "strength training" OR AB "strength training" OR TI exercise OR AB exercise OR TI "therapeutic exercise" OR AB "therapeutic exercise" OR TI "pelvic floor training" OR AB

		"pelvic floor training") AND (TI functional OR AB functional OR TI function OR AB function OR TI functioning OR AB functioning OR TI physiology OR AB physiology OR TI "quality of life" OR AB "quality of life" OR TI pain OR AB pain OR TI "pelvic floor" OR AB "pelvic floor")
Cochrane	18/08/2025	(endometriosis OR endometrioses) AND ("resistance training" OR "strength training" OR "weight training" OR exercise OR "physical activity" OR "therapeutic exercise" OR "pelvic floor training") AND (functional OR function OR functioning OR physiology OR "quality of life" OR pain OR "pelvic floor")
Scopus	18/08/2025	(TITLE-ABS-KEY(endometriosis OR endometrioses)) AND (TITLE-ABS-KEY("resistance training" OR "strength training" OR "weight training" OR exercise OR "physical activity" OR "therapeutic exercise" OR "pelvic floor training")) AND (TITLE-ABS-KEY(functional OR function OR functioning OR physiology OR "quality of life" OR pain OR "pelvic floor"))

EBSCO (CINHAL, Medline, PsychInfo, PsychTherapy, SPORTDiscus)	18/08/2025	(TI endometriosis OR AB endometriosis OR TI endometrioses OR AB endometrioses) AND (TI "resistance training" OR AB "resistance training" OR TI "strength training" OR AB "strength training" OR TI exercise OR AB exercise OR TI "therapeutic exercise" OR AB "therapeutic exercise" OR TI "pelvic floor training" OR AB "pelvic floor training") AND (TI functional OR AB functional OR TI function OR AB function OR TI functioning OR AB functioning OR TI physiology OR AB physiology OR TI "quality of life" OR AB "quality of life" OR TI pain OR AB pain OR TI "pelvic floor" OR AB "pelvic floor")
Web of Science	18/08/2025	('endometriosis'/exp OR endometriosis OR endometrioses) AND ('resistance training' OR 'strength training' OR 'weight training' OR exercise OR 'physical activity' OR 'therapeutic exercise' OR 'pelvic floor training') AND (functional OR function OR functioning OR physiology OR 'quality of life' OR pain OR 'pelvic floor')

Appendix B

Endometriosis and Resistance Training Survey

Survey Flow

Block: Participant Information & Informed Consent (1 Question)
Standard: Default Question Block (27 Questions)
Standard: Physical Activity & Resistance Training (39 Questions)
Standard: Facilitators, Barriers & Perceptions (28 Questions)

Page Break

Informed Consent

Thank you for your interest in this Victoria University Questionnaire about Endometriosis and Resistance Training.

As an Australian living with endometriosis, you are invited to participate in a research project titled “Resistance training and endometriosis: an online questionnaire to understand exercise practices, perceptions and impacts among Australian women living with endometriosis.”

This project is being conducted at Victoria University by Dr André Nelson, Dr Dale Harris, and Miss Dasha Banjanin, from the Institute for Health and Sport (IHES) at Victoria University, Melbourne, Australia.

Project explanation

This research is being conducted to investigate the resistance training practices, perceptions and impacts among Australian women living with endometriosis. This questionnaire is anonymous, and any personal information provided will remain anonymous and not be re-identifiable.

In this questionnaire, you will be asked to answer various questions regarding your physical activity and resistance training habits. **Resistance training is a type of exercise that involves using some form of resistance, such as weights, bands, or your own bodyweight, to improve muscle strength, size and endurance.** You will also be asked about your experiences with resistance training in the context of endometriosis, including any benefits or challenges you may have encountered. You will also be asked some general demographic questions to help us understand more about the characteristics of Australians living with endometriosis.

Your participation in this research will help contribute to a deeper understanding of resistance training habits and barriers faced by Australians living with endometriosis, which may inform future management strategies.

What are the potential risks of my participating in this project?

For some people, answering questions in survey research can present as a cause of distress. If you require support for any distress incurred from your participation in the current research project, please contact Beyond Blue on 1300 22 4636, or visit beyondblue.org.au, or consult with your health professional. **Your participation in this research is voluntary, and you can cease the survey at any time.**

Are there any requirements to participate in this research?

To participate in this study, you must be an Australian citizen or permanent resident and proficient in English, be at least 18 years old, and have a clinical

diagnosis of endometriosis via laparoscopic surgery, MRI, or ultrasound imaging. If you do not meet these criteria, you are not eligible to participate.

What will I gain from participating in this research?

This study will potentially shape future exercise programs for women suffering from endometriosis.

How will the information I give be used?

All information obtained from this research project will remain confidential and will only be used for research purposes. The data collected during this study will be used in conference presentations and peer-reviewed scientific papers. This questionnaire collects only anonymous data and thus no personal details will be revealed.

Who is conducting the study?

If you would like further information regarding this study, please feel free to contact:

Student Researcher

Miss Dasha Banjanin, dasha.banjanin@live.vu.edu.au

Chief Investigators

Dr André Nelson, Andre.Nelson@vu.edu.au

Dr Dale Harris, Dale.Harris@vu.edu.au

If you have any queries or complaints about the questionnaire, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001, email researchethics@vu.edu.au or phone (03) 9919 4781.

The survey will take approximately 12-15 minutes to complete. Data collection in this survey is fully confidential and will be used for research purposes only. The intent of this research is to contribute to the knowledge of resistance exercise training for Australians with endometriosis. For a copy of your information and consent sheet, please download [here](#).

Do you consent to participate in this survey investigating the resistance training practices, perceptions and impacts among Australian women living with endometriosis?

☐ Yes (1)

☐ No (2)

Skip To: End of Survey If Thank you for your interest in this Victoria University Questionnaire about Endometriosis and Res... = No

End of Block: Participant Information & Informed Consent

Start of Block: Default Question Block

The following section collects demographic data, which are attributes of participants undertaking the survey. The research team will use this demographic data to summarise who participated, and identify potential trends and patterns among responses that may be related to these attributes. It includes questions about your endometriosis, where you live, your ancestry, and your work.

Page Break



Q1 Please provide your date of birth (this will be used to calculate your age at time of taking survey).

Day (2)	▼ 1 (1) ... (108)
Month (1)	▼ 1 (1) ... (108)
Year (3)	▼ 1 (1) ... (108)

Page Break

Q2a Have you been diagnosed with endometriosis by laparoscopic surgery?

☐ Yes (1)

☐ No (2)

Q2b Were you diagnosed in Australia?

☐ Yes (1)

☐ No (2)

Display this question:

If Have you been diagnosed with endometriosis by laparoscopic surgery? = No

Q2c Was your diagnosis made by a surgeon?

☐ Yes (1)

☐ No (2)

Display this question:

If Was your diagnosis made by a surgeon? = No

Q2d What was the profession/qualification of the person who diagnosed your endometriosis?

☐ Endometriosis specialist (4)

☐ Other (please specify) (5)

☐ Fertility specialist (6)

Display this question:

If Have you been diagnosed with endometriosis by laparoscopic surgery? = Yes

Q2e Which stage of endometriosis have you been diagnosed with?

- ☐ Stage 1 (1)
 - ☐ Stage 2 (2)
 - ☐ Stage 3 (3)
 - ☐ Stage 4 (4)
 - ☐ I am not sure (5)
-

Q2f What are your endometriosis symptoms? (Check all that apply)

- ☐ Chronic pelvic pain (pain below your belly button that is not associated with menstrual bleeding) (1)
 - ☐ Dysmenorrhea (menstrual pain) (2)
 - ☐ Heavy menstrual bleeding (11)
 - ☐ Dyschezia (painful defecation) (3)
 - ☐ Dysuria (painful urination) (7)
 - ☐ Dyspareunia (painful intercourse) (4)
 - ☐ Fatigue (5)
 - ☐ Bloating (8)
 - ☐ Nausea (9)
 - ☐ Headache/migraine (10)
 - ☐ Other (please specify) (6)
-

Carry Forward Selected Choices from "What are your endometriosis symptoms? (Check all that apply)"



Q2g How severe are your endometriosis symptoms right now, or when they most recently occurred, on a scale from 1-10, with 10 being most severe?

	1 (11)	2 (12)	3 (13)	4 (14)	5 (15)	6 (16)	7 (17)	8 (18)	9 (19)	10 (20)
Chronic pelvic pain (pain below your belly button that is not associated with menstrual bleeding) (x1)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dysmenorrhea (menstrual pain) (x2)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Heavy menstrual bleeding (x11)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dyschezia (painful defecation) (x3)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dysuria (painful urination) (x7)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dyspareunia (painful intercourse) (x4)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fatigue (x5)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bloating (x8)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Nausea (x9)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Headache/migraine (x10)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other (please specify) (x6)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q2h At what age (in years) were you diagnosed with endometriosis?

Q2i Do you have a family history (biological family) of endometriosis?

☐ Yes (1)

☐ No (2)

Display this question:

If Do you have a family history (biological family) of endometriosis? = Yes

Q2j Please state which relation/s have endometriosis (select all that apply)

☐

Maternal grandmother (1)

☐

Paternal grandmother (2)

☐

Mother (3)

☐

Sister (if yes, please state how many sisters) (4)

☐

Daughter (if yes, please state how many daughters) (5)

☐

I am unsure (6)

Page Break

We are collecting the following information in order to calculate your body mass index.

Q3a Please state your current weight (to the nearest kilogram)

Q3b Please state your current height in centimetres (to the nearest centimetre)

Page Break

Q4a What state/territory do you live in?

- ☐ New South Wales (1)
- ☐ Victoria (2)
- ☐ Queensland (3)
- ☐ Western Australia (4)
- ☐ South Australia (5)
- ☐ Tasmania (6)
- ☐ Northern Territory (7)
- ☐ Canberra/ACT (8)

Q4b Please enter the postcode of the suburb you live in

Page Break

Q5a Please state your country of birth



Q5b What ancestry do you predominantly identify with? (you may select up to two)

- ☐ English/British (1)
 - ☐ Australian (2)
 - ☐ Irish (3)
 - ☐ Scottish (4)
 - ☐ Chinese (5)
 - ☐ Italian (6)
 - ☐ German (7)
 - ☐ Indian (8)
 - ☐ Aboriginal or Torres Strait Islander (9)
 - ☐ Greek (10)
 - ☐ Filipino (11)
 - ☐ Dutch (12)
 - ☐ Vietnamese (13)
 - ☐ Lebanese (14)
 - ☐ Polish (15)
 - ☐ Other 1 (please specify) (16)
-

☐

Other 2 (please specify) (17)

Page Break

The following questions are about your employment status. We are interested in the impact of your condition on working.

Q6a Are you currently employed?

☐ Yes (1)

☐ No (2)

Skip To: Q7a If Are you currently employed? = No

Q6b Do you work at one workplace/job, or more than one workplace/job?

☐ 1 (1)

☐ 2 (2)

☐ 3 (3)

☐ 4 or more (4)

Q6c What is the total number of work hours (all jobs) you are paid for per week?
If your typical paid hours vary per week, please provide an estimate of the total hours you work per week, on average

Q6d What is your current annual income?

▼ \$1-\$18,200 (1) ... I prefer not to say (15)

Q6e What is your current primary occupation? (defined as the occupation that contributes most to your annual income)

Page Break

Q7a Do you have any other diagnosed health conditions in addition to endometriosis? For instance, migraines.

☐ Yes (1)

☐ No (2)

Display this question:

If Do you have any other diagnosed health conditions in addition to endometriosis? For instance, mig... = Yes

Q7b Please select the conditions you have been diagnosed with (select all that apply)

- ☐ Polycystic Ovary Syndrome (PCOS) (9)
 - ☐ Adenomyosis (10)
 - ☐ Irritable Bowel Syndrome (IBS) (13)
 - ☐ Inflammatory Bowel Disease (IBD) (14)
 - ☐ Anxiety (11)
 - ☐ Depression (12)
 - ☐ Osteoporosis (1)
 - ☐ Sarcopenia (2)
 - ☐ Obesity (3)
 - ☐ Diabetes (4)
 - ☐ Cardiovascular disease (5)
 - ☐ Autoimmune disease (please specify) (8)
-
- ☐ Neurological condition (please specify) (6)
-
- ☐ Other (please specify) (7)
-

End of Block: Default Question Block

Start of Block: Physical Activity & Resistance Training

This section involves questions around **physical activity** and **exercise**.

Understanding how women with endometriosis engage in exercise is essential because movement can play a key role in managing chronic health conditions (Burke, 2022). While physical activity recommendations exist, they remain general and lack specific guidance for women with endometriosis (Sachs et al., 2023; Silva et al., 2024). In this section, we will ask questions about your exercise, to find out how active women with endometriosis are and whether their exercise routines help manage their symptoms.

Page Break

To better understand your resistance training habits, we also need to capture your overall physical activity patterns. This will help us interpret your resistance training practices in the context of your broader exercise routine.

Page Break

Physical activity is defined as any body movement produced by the skeletal muscles that expend energy. In daily life, this may include occupational, household, sport and conditioning activities (Caspersen, Powell & Christenson, 1985).

Planned physical activity, also referred to as **exercise**, is a structured and repetitive type of physical activity, to improve or maintain physical fitness (Caspersen, Powell & Christenson, 1985). This may include activities like going to the gym, running on a regular basis, participating in a group fitness class, or sports training sessions. Please read the following questions carefully.

Q8a Do you participate in **planned** physical activity (exercise)?

☐ Yes (1)

☐ No (2)

Skip To: QID30 If Do you participate in planned physical activity (exercise)? = No

Q8b Does exercise help your endometriosis symptoms?

☐ Yes (1)

☐ No (2)

Display this question:

If Does exercise help your endometriosis symptoms? = Yes

Carry Forward Selected Choices from "What are your endometriosis symptoms? (Check all that apply)"



Q8c Which symptoms does exercise help?

- ☐ Chronic pelvic pain (pain below your belly button that is not associated with menstrual bleeding) (1)
 - ☐ Dysmenorrhea (menstrual pain) (2)
 - ☐ Heavy menstrual bleeding (3)
 - ☐ Dyschezia (painful defecation) (4)
 - ☐ Dysuria (painful urination) (5)
 - ☐ Dyspareunia (painful intercourse) (6)
 - ☐ Fatigue (7)
 - ☐ Bloating (8)
 - ☐ Nausea (9)
 - ☐ Headache/migraine (10)
 - ☐ Other (please specify) (11)
-

Page Break

Q8d What type of exercise do you do? (select all that apply)

- ☐ Walking (1)
 - ☐ Running (2)
 - ☐ Yoga (3)
 - ☐ Pilates (4)
 - ☐ Resistance/weight training (including F45, Crossfit) (5)
 - ☐ Gym-based group fitness classes (e.g. pump, spin, aerobics) (9)
 - ☐ Zumba/dancing (6)
 - ☐ Team sports (enter all sports you play) (7)
-
- ☐ Other (please specify) (8)
-

Page Break

Q8e How many days of the week do you participate in **planned physical activity (exercise)**?

- ☐ One day (1)
 - ☐ Two days (2)
 - ☐ Three days (3)
 - ☐ Four days (4)
 - ☐ Five days (5)
 - ☐ Six days (6)
 - ☐ Seven days (7)
-

Q8f How many **physical activity (exercise)** sessions do you do across the week? For example, 1 class is 1 session.

- ☐ One session (1)
 - ☐ Two sessions (2)
 - ☐ Three sessions (3)
 - ☐ Four sessions (4)
 - ☐ Five sessions (5)
 - ☐ Six sessions (6)
 - ☐ Seven sessions (7)
 - ☐ Eight sessions (8)
 - ☐ Nine sessions (9)
 - ☐ Ten sessions (10)
 - ☐ More than ten sessions (11)
-

Q8g How long do you exercise for? (in a typical session)

- ☐ Less than 15 minutes (8)
- ☐ 15 - 29 minutes (1)
- ☐ 30 - 45 minutes (2)
- ☐ 46 - 60 minutes (3)
- ☐ 61 - 75 minutes (4)
- ☐ 76 - 90 minutes (5)
- ☐ 91 - 120 minutes (6)
- ☐ More than 120 minutes (7)

Page Break

This section involves questions around **resistance training**.

Resistance training has been widely studied for managing various chronic health conditions, but little is known about its role in managing endometriosis (McKnight et al., 2024). Through the questions in this section, we aim to learn about the types, frequency, intensity, and duration of resistance training women with endometriosis are currently doing.

Page Break

Resistance training is broadly defined as a modality of exercise that increases muscular function, including strength, hypertrophy (muscle size), power, speed, endurance, balance and coordination (Kraemer & Ratamess, 2004). Please read the following questions carefully.

Q9a Do you participate in **resistance training**?

☐ Yes (1)

☐ No (2)

Skip To: End of Block If Do you participate in resistance training? = No

Page Break

Q9b What types of resistance training do you do? (select all that apply)

- ☐ Bodyweight (1)
 - ☐ Bodybuilding (2)
 - ☐ Calisthenics (3)
 - ☐ Crossfit (4)
 - ☐ Olympic lifting (5)
 - ☐ Powerlifting (6)
 - ☐ Plyometrics (box jumps, med-ball throws, jump squats) (7)
 - ☐ Prehab/rehab (8)
 - ☐ Group class with weights (9)
 - ☐ Recreational type lifting (10)
 - ☐ Other (please specify) (11)
-

Page Break

Q9c Where do you participate in resistance training? (select all that apply)

☐

Commercial gym (e.g. Anytime Fitness)



Photo Reference. Assorted gym equipment inside the gym, by M. Bertulfo, 2019, Unsplash (<https://unsplash.com/photos/assorted-gym-equipment-inside-the-gym-XKimW0pke6w>). Unsplash license. (1)

☐

Crossfit gym (e.g. CrossFit CBD)



Photo reference. From A man sitting on a bench in front of a blackboard, by R. Henri, 2021, Unsplash (<https://unsplash.com/photos/a-man-sitting-on-a-bench-in-front-of-a-blackboard-W2A-45cTqvo>). Unsplash license. (2)

☐

Powerlifting gym (e.g. Melbourne West Barbell Club)

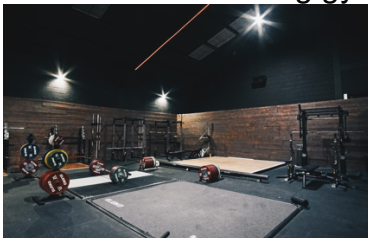


Photo reference. From A gym with a lot of equipment in it, by R. Barret, 2023, Unsplash (<https://unsplash.com/photos/a-gym-with-a-lot-of-equipment-in-it-wZlsHihO2g4>). Unsplash license. (3)

☐

Clinical setting (e.g. physiotherapy, osteopathy/exercise physiology)



Photo reference. From A room with shelves and equipment, by B. Enwald, 2023, Unsplash (https://unsplash.com/photos/a-room-with-shelves-and-equipment-si6X_0QdmHk). Unsplash license. (4)



Fitness/PT studio (e.g. independent bespoke fitness facility)



Photo reference. From A woman in black tank top and black pants exercising, by S. Khamseh, 2020, Unsplash

(<https://unsplash.com/photos/woman-in-black-tank-top-and-black-pants-exercising-0sa8D74iodl>). Unsplash license. (5)



Group fitness gym (e.g. F45)



Photo reference. From *People doing exercise inside gym*, by Photo Genius, 2019, Unsplash (https://unsplash.com/photos/people-doing-exercise-inside-gym-3eqaaqdL_IM). Unsplash license. (6)



Home



Photo reference. From *Black and gray exercise equipment*, by B. Wangenheim, 2021, Unsplash (<https://unsplash.com/photos/black-and-gray-exercise-equipment-175WMFRMoOA>). Unsplash license. (7)



Outdoor (e.g. fitness trail or park)



Photo reference. From *Black metal framed glass top table*, by G. Vallet, 2020, Unsplash (<https://unsplash.com/photos/black-metal-framed-glass-top-table-mix0aLPwtq0>) Unsplash license. (8)

☐

Other (please specify) (9)

Page Break

Q10a How many days of the week do you participate in **resistance training**?

- ☐ One day (1)
- ☐ Two days (2)
- ☐ Three days (3)
- ☐ Four days (4)
- ☐ Five days (5)
- ☐ Six days (6)
- ☐ Seven days (7)

Page Break

Q10b How many **resistance training** sessions do you do across the week?

- ☐ One session (1)
- ☐ Two sessions (2)
- ☐ Three sessions (3)
- ☐ Four sessions (4)
- ☐ Five sessions (5)
- ☐ Six sessions (6)
- ☐ Seven sessions (7)
- ☐ Eight sessions (8)
- ☐ Nine sessions (9)
- ☐ Ten sessions (10)
- ☐ More than ten sessions (11)

Page Break

Q10c How long do you exercise for in a typical **resistance training** session? If your sessions vary, select all that apply.

- ☐ Less than 15 minutes (8)
- ☐ 15 - 29 minutes (1)
- ☐ 30 - 45 minutes (2)
- ☐ 46 - 60 minutes (3)
- ☐ 61 - 75 minutes (4)
- ☐ 76 - 90 minutes (5)
- ☐ 91 - 120 minutes (6)
- ☐ More than 120 minutes (7)

Page Break

Q10d How many exercises do you typically perform in your **resistance training** sessions?

- ☐ 1 (1)
- ☐ 2 (2)
- ☐ 3 (3)
- ☐ 4 (4)
- ☐ 5 (5)
- ☐ 6 (6)
- ☐ 7 (7)
- ☐ 8 (8)
- ☐ 9 (9)
- ☐ 10 or more (10)

Page Break

Compound exercises, also referred to as multi-joint exercises, involve the movement of multiple muscle groups, and are generally performed using free weights or machines. Some of these exercises include: the squat, deadlift, bench press, push-ups and pull-ups (Geanta & Herlo, 2020).

Q10e Do you perform any compound exercises in your sessions?

☐ Yes (1)

☐ No (2)

Skip To: Q10i If Do you perform any compound exercises in your sessions? = No

Q10f How many **compound exercises** do you typically perform in your resistance training sessions?

☐ 1 (1)

☐ 2 (2)

☐ 3 (3)

☐ 4 (4)

☐ 5 (5)

☐ 6 (6)

☐ 7 (7)

☐ 8 (11)

☐ 9 (12)

☐ 10 or more (13)

Page Break

Q10g How many sets per **compound exercise** do you perform? Select all that apply; for instance, if you usually perform 4-5 sets, select the 4, and 5 options.

- ☐ 1 (1)
- ☐ 2 (2)
- ☐ 3 (3)
- ☐ 4 (4)
- ☐ 5 (5)
- ☐ 6 (6)
- ☐ 7 or more (7)

Q10h How many repetitions per set do you typically perform for your **compound exercises**? Select all that apply; for instance, if you usually perform 8-12 repetitions, select the 8, 9, 10, 11 and 12 options.

- ☐ 1 (1)
- ☐ 2 (2)
- ☐ 3 (3)
- ☐ 4 (4)
- ☐ 5 (5)
- ☐ 6 (6)
- ☐ 7 (7)
- ☐ 8 (8)
- ☐ 9 (9)
- ☐ 10 (10)
- ☐ 11 (11)
- ☐ 12 (12)
- ☐ 13 (13)
- ☐ 14 (14)
- ☐ 15 (15)
- ☐ 16 or more (16)

Page Break

Isolation exercises, also referred to as single-joint exercises, involve the movement of a single muscle group, and are generally performed using weight machines and free weights. Some of these exercises include: the leg curl, leg extension, bicep curl, tricep extension and calf raise (Geanta & Herlo, 2020).

Q10i Do you perform any isolation exercises in your sessions?

☐ Yes (1)

☐ No (2)

Q10j How many **isolation exercises** do you typically perform in your resistance training sessions?

☐ 1 (1)

☐ 2 (2)

☐ 3 (3)

☐ 4 (4)

☐ 5 (5)

☐ 6 (6)

☐ 7 (7)

☐ 8 (8)

☐ 9 (9)

☐ 10 or more (10)

Page Break

Q10k How many sets per **isolation exercise** do you perform? Select all that apply; for instance, if you usually perform 4-5 sets, select the 4, and 5 options.

☐ 1 (1)

☐ 2 (2)

☐ 3 (3)

☐ 4 (4)

☐ 5 (5)

☐ 6 (6)

☐ 7 or more (7)

Q10I How many repetitions per set do you typically perform for your **isolation exercises**? Select all that apply; for instance, if you usually perform 8-12 repetitions, select the 8, 9, 10, 11 and 12 options.

- ☐ 1 (1)
- ☐ 2 (2)
- ☐ 3 (3)
- ☐ 4 (4)
- ☐ 5 (5)
- ☐ 6 (6)
- ☐ 7 (7)
- ☐ 8 (8)
- ☐ 9 (9)
- ☐ 10 (10)
- ☐ 11 (11)
- ☐ 12 (12)
- ☐ 13 (13)
- ☐ 14 (14)
- ☐ 15 (15)
- ☐ 16 or more (16)

The **Rating of Perceived Exertion (RPE) scale** provides a measure of “how hard it feels that the body is working” during exercise based on the physical sensations experienced, including an increase in; heart rate, breathing rate, sweating and/or muscle fatigue (Williams, 2017).

Q11a Have you ever used a scale/rating, of perceived exertion for your resistance training **sessions** to measure how physically demanding the overall session was?

☐ Yes (1)

☐ No (2)

Page Break

Q11b Using the below Rate of Perceived Exertion (RPE) scale, how physically demanding are your resistance training sessions? If your sessions vary, select all that apply.

- ☐ 0 (no effort) (1)
- ☐ 1 - 2 (very light) (2)
- ☐ 3 - 4 (light) (3)
- ☐ 5 - 6 (moderate) (4)
- ☐ 7 - 8 (hard) (5)
- ☐ 9 (very hard) (6)
- ☐ 10 (maximal effort) (7)

Page Break

Training to failure means performing an exercise until you reach the **maximum number of repetitions** you can do in a set, where your muscles can no longer generate enough force to lift the weight. At this point, called muscular failure, you are physically **unable to complete another repetition with proper form** (Grgic et al., 2022; Schoenfeld, 2010).

Q11c Do you ever train to failure during your sets?

- ☐ Yes (1)
 - ☐ No (2)
-

Display this question:

If Do you ever train to failure during your sets? = Yes

Q11d How often?

- ☐ On the final set of some exercises (1)
 - ☐ On the final set of every exercise (2)
 - ☐ On some sets of some exercises (3)
 - ☐ On some sets of every exercise (4)
 - ☐ Every set of every exercise (5)
-

Page Break

Q12a What types of equipment do you use in your resistance training sessions?
(select all that apply)

☐

Bands



Photo reference. From *Group of women doing yoga*, by B. Mars, 2018, Unsplash (<https://unsplash.com/photos/group-of-women-doing-yoga-oLStrTTMz2s>). Unsplash license. (1)

☐

Free weights (dumbbells, barbells, kettlebells)



Photo reference. From *A black and white photo of a bunch of batteries*, by R. Barrett, 2023, Unsplash (<https://unsplash.com/photos/a-black-and-white-photo-of-a-bunch-of-batteries-0OpVPmVS2vg>). Unsplash license. (2)

☐

Cable machines



Photo reference. From *Man in black tank top and gray shorts holding black smartphone*, by Total Shape, 2020, Unsplash

(<https://unsplash.com/photos/man-in-black-tank-top-and-gray-shorts-holding-black-smartphone-wXBK9JrM0iU>). Unsplash license. (3)



Pin loaded machines (with a weight stack)



Photo reference. From *Gym interior*, by K. Sandhu, 2018, Unsplash (<https://unsplash.com/photos/gym-interior-85EF54QhBs4>) Unsplash license. (4)



Weight plate machines (where you add plates)



Photo reference. From *A woman sitting on a bench in a gym*, by N. Johnston, 2023, Unsplash (<https://unsplash.com/photos/a-woman-sitting-on-a-bench-in-a-gym-SMSpk9fprcU>) Unsplash license. (5)



Suspension system (e.g. TRX)

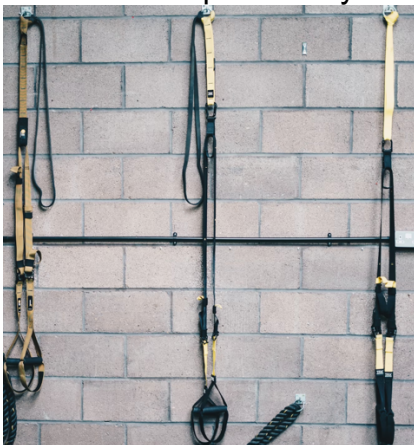


Photo reference. From *Black and white rope on brown brick wall*, by R. Barrett, 2020, Unsplash (<https://unsplash.com/photos/black-and-white-rope-on-brown-brick-wall-e1vAwZzbe5I>). Unsplash license. (6)



Medicine balls/weighted bags



Photo reference. From *A group of balls sitting on top of a gym floor*, by R. Barrett, 2022, Unsplash (<https://unsplash.com/photos/a-group-of-balls-sitting-on-top-of-a-gym-floor-gwsHSNTToGAc>). Unsplash license. (7)



Boxes/steps



Photo reference. From *Men's black leggings*, by M. Holmes, 2018, Unsplash (https://unsplash.com/photos/mens-black-leggings-wy_L8W0zcpl). Unsplash license. (8)

Page Break

Q12b Do you do your resistance training alone or with others? (select all that apply)

☐

Alone (1)

☐

PT/coach (2)

☐

Group classes (3)

☐

Training partner (4)

☐

Other (please specify) (5)

Q12c Do you plan on competing in your resistance-training sport of choice? As an example, you may currently be training for an upcoming Powerlifting or CrossFit competition.

☐ Yes (10)

☐ No (11)

Q12d How long have you been participating in **resistance training**?

- ☐ Less than 6 months (1)
- ☐ 6 - 12 months (2)
- ☐ 1 - 2 years (3)
- ☐ 3 - 4 years (4)
- ☐ 5 - 6 years (5)
- ☐ 7 - 8 years (6)
- ☐ 9 - 10 years (7)
- ☐ More than 10 years (8)

Page Break

The following section involves questions around **barriers** and **facilitators** to participating in resistance training. We are also interested in understanding what helps or stops Australian women with endometriosis from doing resistance training.

These questions aim to explore women's perceptions of resistance training as a potential management strategy for endometriosis, while also investigating whether it has helped alleviate their symptoms and how it has provided relief (or, if it has been detrimental to their symptoms).

Display this question:

If Do you participate in resistance training? = No

Q13a If you do not participate in resistance training, what are your reasons?
(select all that apply)

- ☐ Lack of time (1)
 - ☐ Lack of motivation or interest (2)
 - ☐ Lack of professional guidance (3)
 - ☐ Lack of access to suitable facilities/equipment (4)
 - ☐ Concerns about worsening symptoms (5)
 - ☐ It causes an exacerbation of symptoms (6)
 - ☐ Fatigue (7)
 - ☐ Financial constraints (8)
 - ☐ Not a priority (9)
 - ☐ Concerns about how it will impact the way I look (10)
 - ☐ Other (please specify) (11)
-

Display this question:

If Do you participate in resistance training? = No

13b Have you ever tried resistance training, and then stopped?

- ☐ Yes (1)
- ☐ No (2)
- ☐ I have never tried resistance training (3)

Display this question:

If Have you ever tried resistance training, and then stopped? = Yes

Q13c If you stopped participating in resistance training, what was the primary reason?

Display this question:

If Do you participate in resistance training? = No

Q13d What are the main reasons you have not participated in resistance training? (select all that apply)

- ☐ I don't believe it will help my endometriosis symptoms (1)
 - ☐ I am unsure of where to start, or how to do it (2)
 - ☐ I prefer other forms of exercise (3)
 - ☐ My healthcare provider has not recommended it (4)
 - ☐ I am worried my symptoms will worsen (5)
 - ☐ I do not enjoy resistance training (6)
 - ☐ I do not have the energy or motivation (7)
 - ☐ I do not have access to equipment or facilities (8)
 - ☐ I have never heard of resistance training as a treatment for endometriosis (9)
 - ☐ I am concerned about how it will impact the way I look (10)
 - ☐ Other (please specify) (11)
-

Display this question:

If Do you participate in resistance training? = No

Q13e How confident are you that you could start participating in resistance training if you wanted to?

- ☐ Not confident at all (1)
- ☐ Slightly confident (2)
- ☐ Moderately confident (3)
- ☐ Very confident (4)
- ☐ Extremely confident (5)

Display this question:

If Do you participate in resistance training? = No

Q13f If you were to consider participating in resistance training, what would help get you started? (select all that apply)

- ☐ A recommendation from a healthcare provider (1)
- ☐ More information about how resistance training can help with endometriosis (2)
- ☐ Access to a gym or affordable equipment (3)
- ☐ An exercise program designed specifically for women with endometriosis (4)
- ☐ Social support or a workout partner (5)
- ☐ A personal trainer or coach to guide me (6)
- ☐ Other (please specify) (7)

Skip To: Q19 If Condition: Selected Count Is Greater Than or Equal to 1. Skip To: How severe are your endometriosis sym....

.....
Page Break

Q14a What motivates you to participate in resistance training? (select all that apply)

- ☐ To improve endometriosis symptoms (1)
- ☐ To improve physical strength (2)
- ☐ To improve my muscle mass (10)
- ☐ To improve my bone health (14)
- ☐ To improve my athletic ability (15)
- ☐ To increase my ability to perform tasks of daily living (e.g. walking) (12)
- ☐ To improve overall health and fitness (3)
- ☐ To improve my physical appearance (11)
- ☐ To improve energy levels (4)
- ☐ To reduce my stress levels (13)
- ☐ For mental health benefits (6)
- ☐ Personal enjoyment (7)
- ☐ For weight reduction or management (5)
- ☐ To manage my blood glucose levels (16)
- ☐ On the recommendation of a health professional (8)
- ☐ To improve the symptoms of another condition I have (please specify the condition) (17)

☐

Other (please specify) (9)

Display this question:

If What motivates you to participate in resistance training? (select all that apply) = On the recommendation of a health professional

Q14b Who advises your resistance training? (select all that apply)

☐

Doctor (1)

☐

Exercise physiologist (2)

☐

Exercise scientist (3)

☐

Physiotherapist (4)

☐

Personal trainer (5)

☐

Online resources (6)

☐

Osteopath (7)

☐

Other (please specify) (8)

Page Break

Q15 Do you believe resistance training helps manage your endometriosis symptoms?

- ☐ Yes, significantly (1)
- ☐ Yes, to some extent (2)
- ☐ No (3)
- ☐ Not sure (4)

Page Break

Q16a How does resistance training contribute (positively or negatively) to managing your health, well-being and physical performance as someone living with endometriosis? (select all that apply)

- ☐ It impacts my physical strength (2)
 - ☐ It impacts my muscle mass (10)
 - ☐ It impacts my bone health (14)
 - ☐ It impacts my athletic ability (15)
 - ☐ It impacts my ability to perform tasks of daily living (e.g. walking) (12)
 - ☐ It impacts my overall health and fitness (3)
 - ☐ It impacts my physical appearance (11)
 - ☐ It impacts my energy levels (4)
 - ☐ It impacts my stress levels (13)
 - ☐ It impacts my mental health (6)
 - ☐ It impacts my weight (5)
 - ☐ It impacts my blood glucose levels (16)
 - ☐ It impacts the symptoms of another condition I have (please specify the condition) (17)
-
- ☐ Other (please specify) (9)
-

Carry Forward Selected Choices from "How does resistance training contribute (positively or negatively) to managing your health, well-being and physical performance as someone living with endometriosis? (select all that apply)"



Q16b On a scale of 1-5, how do you rate the impact of resistance training on the following aspects of your life?

	1 (large worsening) (1)	2 (small- to- moderate worsening) (2)	3 (no change) (3)	4 (small-to- moderate improvement) (4)	5 (large improvement) (5)
It impacts my physical strength (x2)	☐	☐	☐	☐	☐
It impacts my muscle mass (x10)	☐	☐	☐	☐	☐
It impacts my bone health (x14)	☐	☐	☐	☐	☐
It impacts my athletic ability (x15)	☐	☐	☐	☐	☐
It impacts my ability to perform tasks of daily living (e.g. walking) (x12)	☐	☐	☐	☐	☐
It impacts my overall health and fitness (x3)	☐	☐	☐	☐	☐
It impacts my physical appearanc e (x11)	☐	☐	☐	☐	☐
It impacts my energy levels (x4)	☐	☐	☐	☐	☐

It impacts
my stress
levels
(x13)

☐☐☐☐☐

It impacts
my mental
health (x6)

☐☐☐☐☐

It impacts
my weight
(x5)

☐☐☐☐☐

It impacts
my blood
glucose
levels
(x16)

☐☐☐☐☐

It impacts
the
symptoms
of another
condition I
have
(please
specify the
condition)
(x17)

☐☐☐☐☐

Other
(please
specify)
(x9)

☐☐☐☐☐

Q16c How confident do you feel in your ability to engage in resistance training without worsening your endometriosis symptoms?

- ☐ Not confident at all (1)
- ☐ Slightly confident (2)
- ☐ Moderately confident (3)
- ☐ Very confident (4)
- ☐ Extremely confident (5)

Page Break

Q17a Have you noticed an improvement in your endometriosis symptoms as a result of participating in resistance training?

☐ Yes (1)

☐ No (2)

☐ I'm not sure (3)

Display this question:

If Have you noticed an improvement in your endometriosis symptoms as a result of participating in re... = Yes

Carry Forward Selected Choices from "What are your endometriosis symptoms? (Check all that apply)"



Q17b Which symptoms have improved as a result of resistance training? (select all that apply)

- ☐ Chronic pelvic pain (pain below your belly button that is not associated with menstrual bleeding) (1)
 - ☐ Dysmenorrhea (menstrual pain) (2)
 - ☐ Heavy menstrual bleeding (3)
 - ☐ Dyschezia (painful defecation) (4)
 - ☐ Dysuria (painful urination) (5)
 - ☐ Dyspareunia (painful intercourse) (6)
 - ☐ Fatigue (7)
 - ☐ Bloating (8)
 - ☐ Nausea (9)
 - ☐ Headache/migraine (10)
 - ☐ Other (please specify) (11)
-

Display this question:

If Have you noticed an improvement in your endometriosis symptoms as a result of participating in re... = No

Carry Forward Selected Choices from "What are your endometriosis symptoms? (Check all that apply)"



Q17c Select the symptoms that you feel worsen after participating in resistance training. (select all that apply)

- ☐ Chronic pelvic pain (pain below your belly button that is not associated with menstrual bleeding) (1)
 - ☐ Dysmenorrhea (menstrual pain) (2)
 - ☐ Heavy menstrual bleeding (3)
 - ☐ Dyschezia (painful defecation) (4)
 - ☐ Dysuria (painful urination) (5)
 - ☐ Dyspareunia (painful intercourse) (6)
 - ☐ Fatigue (7)
 - ☐ Bloating (8)
 - ☐ Nausea (9)
 - ☐ Headache/migraine (10)
 - ☐ Other (please specify) (11)
-

Q17d How do your endometriosis symptoms feel directly after participating in resistance training?

- ☐ Better (1)
- ☐ Worse (2)
- ☐ No change (3)
- ☐ Some better, some worse (4)

Page Break

The following questions refer to **symptom “flare-ups”**. Symptom flare-ups are episodes of intense pain and exacerbations of endometriosis symptoms (Sinclair et al., 2021). These can include an increase in pelvic pain, painful urination and bowel movements, bloating, and fatigue (Sayer-Jones & Sherman, 2023).

Q18a Has resistance training ever caused a flare in your endometriosis symptoms?

- ☐ Yes (1)
- ☐ No (2)
-

Display this question:

If Has resistance training ever caused a flare in your endometriosis symptoms? = Yes

Q18b Please specify (in minutes, hours, or days) how soon the flare occurred. For example, during or immediately after the session, or several hours after the session was completed.

Display this question:

If Has resistance training ever caused a flare in your endometriosis symptoms? = Yes

Q18c Please specify how severe the flare was on a scale of 1-10

- ☐ 0 (0)
 - ☐ 1 (1)
 - ☐ 2 (2)
 - ☐ 3 (3)
 - ☐ 4 (4)
 - ☐ 5 (5)
 - ☐ 6 (6)
 - ☐ 7 (7)
 - ☐ 8 (8)
 - ☐ 9 (9)
 - ☐ 10 (10)
-

Display this question:

If Has resistance training ever caused a flare in your endometriosis symptoms? = Yes

Q18d How often do you experience flares in your symptoms after participating in resistance training?

- ☐ Never (1)
 - ☐ Rarely (2)
 - ☐ Occasionally (3)
 - ☐ Frequently (4)
 - ☐ Always (5)
-

Display this question:

If Has resistance training ever caused a flare in your endometriosis symptoms? = Yes

Q18e What do you think contributes to your symptom flares during or after resistance training? (select all that apply)

- ☐ The type of resistance training I do (1)
 - ☐ How heavy the weights I lift are in a session (2)
 - ☐ If I train to failure during sets (3)
 - ☐ How intense the full session is (my overall level of effort) (4)
 - ☐ If my rest periods are too short between sets/exercises (5)
 - ☐ How many exercises I do in a single session (6)
 - ☐ The amount of resistance training sessions I do (7)
 - ☐ Other (please specify) (8)
-

Display this question:

If Has resistance training ever caused a flare in your endometriosis symptoms? = Yes

Q18f If you experience a flare-up of symptoms during your resistance training session, what do you do to manage these? (select all that apply)

- ☐ I stop participating in resistance training (1)
 - ☐ I change the type of resistance training (2)
 - ☐ I reduce the weight I lift (3)
 - ☐ I avoid training to failure (4)
 - ☐ I reduce my overall level of effort (5)
 - ☐ I increase my rest / recovery periods between sets/exercises (6)
 - ☐ I do less resistance training in a single session (7)
 - ☐ I continue participating in the resistance training I usually do (8)
 - ☐ Other (please specify) (9)
-

Display this question:

If Has resistance training ever caused a flare in your endometriosis symptoms? = Yes

Q18g After 48-72 hours following your resistance training session, and if you experienced a flare-up of your symptoms, what did you do to manage these? (select all that apply)

- ☐ Rested and reduced physical activity (1)
 - ☐ Used heat therapy (e.g., heating pad, hot shower or bath) (2)
 - ☐ Used cold therapy (e.g., ice packs or cooling treatments) (3)
 - ☐ Performed light stretching or mobility (4)
 - ☐ Engaged in light physical activity (e.g., walking, gentle yoga) (5)
 - ☐ Took over-the-counter pain relief (e.g., paracetamol, ibuprofen) (6)
 - ☐ Used prescribed medications (specific for symptom management) (7)
 - ☐ Practiced relaxation techniques (e.g., deep breathing, meditation) (8)
 - ☐ Improved sleep and rest quality (9)
 - ☐ Used massage therapy or self-massage tools (e.g., foam roller) (10)
 - ☐ Monitored and modified future resistance training intensity/volume (11)
 - ☐ Consulted a health care professional (e.g. doctor, physiotherapist) Please specify. (12)
-

☐ Consulted an exercise professional (e.g. exercise physiologist, personal trainer). Please specify. (13)

☐ Increased hydration and nutrition (e.g., protein intake) (14)

☐ Other (please specify) (15)

.....

Page Break

Carry Forward Selected Choices from "What are your endometriosis symptoms? (Check all that apply)"



Q19 How severe are your endometriosis symptoms right now, or when they most recently occurred, on a scale from 1-10, with 10 being most severe?

	1 (11)	2 (12)	3 (13)	4 (14)	5 (15)	6 (16)	7 (17)	8 (18)	9 (19)	10 (20)
Chronic pelvic pain (pain below your belly button that is not associated with menstrual bleeding) (x1)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dysmenorrhea (menstrual pain) (x2)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Heavy menstrual bleeding (x11)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dyschezia (painful defecation) (x3)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dysuria (painful urination) (x7)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dyspareunia (painful intercourse) (x4)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fatigue (x5)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bloating (x8)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Nausea (x9)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Headache/migraine (x10)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other (please specify) (x6)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Page Break

Thank you for completing the survey.

If you would like to be kept updated about future research, or to be sent a copy of the research paper, please provide your email address below.

End of Block: Facilitators, Barriers & Perceptions
