

Menopausal symptom severities and patterns are affected by medical profiles

Robin Andrews, Arron Lacey, Deborah Lancaster, Kate Bache & Emma J. Kidd

To cite this article: Robin Andrews, Arron Lacey, Deborah Lancaster, Kate Bache & Emma J. Kidd (14 Oct 2026): Menopausal symptom severities and patterns are affected by medical profiles, Post Reproductive Health, DOI: [10.1080/20533691.2026.2741118](https://doi.org/10.1080/20533691.2026.2741118)

To link to this article: <https://doi.org/10.1080/20533691.2026.2741118>



© 2026 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



[View supplementary material](#)



Published online: 14 Oct 2026.



[Submit your article to this journal](#)



Article views: 22



[View related articles](#)



[View Crossmark data](#)

RESEARCH ARTICLE



Menopausal symptom severities and patterns are affected by medical profiles

Robin Andrews^{a,b}, Arron Lacey^c, Deborah Lancaster^d, Kate Bache^b and Emma J. Kidd^a

^aSchool of Pharmacy and Pharmaceutical Sciences, Cardiff University, Cardiff, UK; ^bHealth & Her, Cardiff, UK; ^cSwansea University Medical School, Institute of Life Science 2, Swansea University, Sketty, Swansea, UK; ^dSchool of Psychology and Therapeutic Studies, University of South Wales, Pontypridd, UK

ABSTRACT

Objective: This study involved a secondary data analysis of Health & Her app data to investigate medical profiles and menopausal symptom clusters.

Study Design: Using a linear mixed effects model, we assessed how medical conditions, including Polyendocrine Metabolic Ovarian Syndrome (PMOS), premenstrual dysphoric disorder (PMDD), premature ovarian insufficiency (POI), cancers, depression, anxiety, uterine fibroids, endometriosis, adenomyosis and autoimmune disorders, predict menopausal symptom patterns. We also assessed medical procedures including bilateral oophorectomy, hysterectomy, unilateral oophorectomy, partial hysterectomy, endometrial ablation, and cancer treatment. Symptom clusters were identified via Principal Component Analysis. Linear mixed effects models analysed the effects of predictors on symptom outcomes.

Main outcome measures: Menopausal symptom clusters, and how menopausal symptom patterns and severities are associated with medical profiles.

Results: Data from 210,489 app users from October 2020 to June 2024 identified symptom clusters, including joint aches, sleeping problems, low libido, weight gain, vasomotor, psychological/cognitive, vaginal and physical symptoms. Depression and anxiety were associated with the strongest increases in menopausal symptoms. Gynaecological surgeries were associated with increased vasomotor symptoms. POI and endometriosis were associated with vaginal symptoms. Autoimmune diseases had significant associations with joint aches, and physical and psychological/cognitive symptoms. PMOS, adenomyosis and PMDD were associated with reduced vasomotor symptoms. Undergoing cancer treatment was associated with reduced symptoms in most domains, albeit vaginal and vasomotor symptoms increased. Likewise, breast and gynaecological cancers were associated with low libido, and increased vasomotor and sleep symptoms.

Conclusions: Our findings highlight the importance of healthcare professionals considering comorbidities when supporting women with menopausal symptoms.

KEYWORDS

Menopause; menopausal symptoms; medical co-morbidities; pre-existing medical conditions; pre-existing diagnoses

1. Introduction

There is rising public awareness and demand for better care provision for menopausal women. This has been reflected by heightened investment in menopause research [1] and the gradual increase in the number of publications focused on menopause since the early 1990s [1].

However, menopause-related research can be methodologically limited as it suffers from a systematic failure to account for key modifiers, independent explanatory variables and confounders [1]. These factors include medical comorbidities, menopause-specific

treatment preferences, age at first experiencing menopausal symptoms, cause of menopause (e.g. surgical vs. natural) and time since last period [1].

These limitations probably attenuate the ecological validity of research reports, as comorbidities and gynaecological procedures which can induce menopausal symptoms are widespread among midlife women, regardless of menopausal status [2]. These include depression impacting 19% of UK women [3], gynaecological conditions such as endometriosis, polyendocrine metabolic ovarian syndrome (PMOS, previously polycystic ovary syndrome or PCOS) and uterine fibroids affecting up to 10% [4], 26% [5], and

CONTACT Robin Andrews  AndrewsR16@cardiff.ac.uk  School of Pharmacy and Pharmaceutical Sciences, Cardiff University, King Edward VII Avenue, Cardiff, CF10 3NB, UK.

 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/20533691.2026.2741118>.

© 2026 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

80% [6] of UK women, respectively. Data from the Middle East suggests that women with depression report higher rates of urogenital symptoms, hot flushes, heart discomfort, joint pain and sleeping problems during menopause [7]. Endometriosis and PMOS symptoms can be impacted by excess estrogen and testosterone levels, while lowered levels of these hormones have been implicated in the genesis of menopausal symptoms such as vasomotor and vaginal symptoms [8,9]. Thus, women with these conditions during menopause may report variances in their menopausal symptoms compared to women without. Furthermore, hormone agonist treatments for gynaecological conditions such as endometriosis [9], premenstrual dysphoric disorder (PMDD) and uterine fibroids [10], can induce menopause.

Age at menopause onset can also influence menopausal symptom severities. Women with early menopause (before the age of 45) often experience severe VMS, more severe sleep disturbance and reduced quality of life compared to women starting menopause later [11]. Premature ovarian insufficiency (POI, defined as spontaneous menopause before age 40) occurs in ~1-4% of women and 5% of women enter natural menopause before age 45 [11]. In the UK, approximately 20% of women undergo hysterectomy with or without bilateral oophorectomy during their lifetime [12]. In our electronic health record-based menopause cohort (derived from Welsh primary and secondary NHS data) and in UK Biobank, the prevalence of bilateral oophorectomy has been estimated at 7.3-7.6% among women ages 40-65 [13]. Therefore, a large proportion of women will experience menopause prematurely.

Menopause-related multimorbidity is also highly relevant to NHS preventive healthcare initiatives. In England, adults aged 40-74 are eligible for the NHS Health Check programme, a national cardiovascular and metabolic risk assessment initiative designed to identify early risk factors for conditions including heart disease, stroke, diabetes and kidney disease. Menopause is increasingly recognised as a critical period for the emergence or acceleration of cardiometabolic risk, particularly among women experiencing early menopause, premature ovarian insufficiency (POI), surgical menopause, obesity, depression, or metabolic disorders such as PMOS. Given the high prevalence of these conditions among midlife women, understanding how comorbidities and gynaecological histories interact with menopausal symptom profiles may have implications extending beyond symptom management alone, potentially helping to identify women at elevated long-term risk of

adverse physical and mental health outcomes. Findings from this study may therefore help inform more personalised and preventative approaches to midlife women's healthcare within both digital health platforms and wider NHS wellness and prevention strategies.

Given that many midlife women have comorbidities or undergo gynaecological procedures which can impact the menopause transition, it is important to understand how such factors could influence their experience of menopausal symptoms. This information will be valuable to patients and their healthcare providers, enabling them to predict and prepare for varying symptom outcomes arising from menopause. Furthermore, it will help to overcome the limitations described above.

This study explored how different medical diagnoses and surgical procedures are associated with menopausal symptom clusters using secondary data provided by users of the Health & Her app. Health & Her is a digital healthcare company providing support for women during hormonal health transitions including the menopause [14]. The app enables women to track their menopausal symptoms and triggers and menstrual periods and provides activities to help manage their menopausal symptoms including health and lifestyle articles and products designed to support wellness, including own-brand Health & Her dietary supplements. The app collects data on symptoms, medical diagnoses and treatments and gynaecological surgeries which could impact menopausal symptoms.

The study was conducted to evaluate the impact of historical, pre-existing and/or comorbid medical diagnoses on women's experiences during the menopause transition.

We had three research questions.

1. What symptom clusters present among Health & Her app users?
2. How do medical profiles impact menopausal symptom presentations?
3. How do medical diagnoses, treatments, or gynaecological procedures, influence menopausal symptom clusters and severities?

2. Methods

2.1. Design

This study involved a secondary data analysis of medical data provided by consenting users of the Health & Her app. The app was not designed for the purposes of this study. Instead, this study provides an

opportunity to investigate real-world patterns of menopausal symptoms and comorbidities in a significant self-selected sample. Symptom clusters were identified using Principal Component Analysis, and linear mixed-effects models were used to analyse the effects of diagnosed medical conditions and procedures on these symptom domains.

2.2. Participants

This study used anonymised Health & Her app data collected between October 2020 and June 2024 from women who downloaded the app, consented to research participation, and completed onboarding questions. The app is freely available; users discovered the app via social media, the Health & Her website, word of mouth, app stores, or supplement packaging. Participants were linked by unique identification codes generated through Amazon Web Services (AWS).

2.2.1. Exclusions

Users were excluded if they did not consent to data use or did not complete onboarding. To ensure relevance to menopause, users under 40 were excluded unless they reported POI or bilateral oophorectomy and users over 80 were excluded to control for broader age-related effects and reduce misclassification and heterogeneity. Users who reported that they were unsure of their menopausal status (i.e., perimenopausal, menopausal, postmenopausal) were also excluded, unless their menopausal status could be inferred from their period data or medical history (see [supplementary table S1](#) to view how users were asked to report their menopausal status).

Of 253,435 women who logged symptoms, 210,489 met inclusion criteria.

2.2.2. Patient & public involvement

Patients and the public were not involved in study design or development but could access the app freely and were included as participants. User reviews informed improvements to app experience, questions, and services. Menopause specialist GPs advised on question development.

2.3. Data collection

After first downloading and opening the app, users are asked to engage with an onboarding process which asks users to provide information on their age, medical history, HRT use, hormonal contraceptive use, menopausal status, dietary supplement usage and

current menopausal symptoms. See [supplementary Table S1](#) to view all onboarding questions. Once all onboarding questions have been answered, users are asked to enter their current menopausal symptoms. Once the user has entered their menopausal symptoms, this signifies completion of app onboarding.

2.3.1. Menopausal symptoms

The app recorded 22 symptoms based on a British Menopause Society survey [15], including hot flushes, night sweats, sleeping problems, joint aches, low libido, and more. Users rated symptom severity on a scale of 1 (mild) to 3 (severe).

To reduce dimensionality and explore relationships with medical diagnoses, Principal Components Analysis (PCA) identified four symptom clusters (physical, psychological, vasomotor, vaginal). Four symptoms (low libido, joint aches, sleeping problems, weight gain) were analysed independently. A ninth outcome combined all symptoms ('Combined Symptoms').

Symptom clusters were averaged and rounded to create ordinal scores for analysis. For example, a user rating hot flushes as 2 (moderate) and night sweats as 3 (severe) would receive a vasomotor score of 3.

2.3.2. Medical profiles

During the onboarding process (prior to inputting menopausal symptom data) the Health & Her app asks users to indicate what stage they are in their menopause transition: Unsure, Perimenopausal, Menopausal, or Postmenopausal (see [supplementary Table S1](#) to view how these stages were defined to users). Users were then asked whether they have been diagnosed with any of the following medical conditions, and users can select more than one medical condition: Breast or gynaecological cancer, Other cancers, Endometriosis, Pre/postnatal depression, Uterine fibroids, Premenstrual Syndrome/Premenstrual Dysphoric Disorder (PMDD), Depression, Anxiety, Adenomyosis, Autoimmune disease (thyroid disease, diabetes, rheumatoid arthritis), POI, PMOS. Users then select whether they had undergone any surgical procedures from a drop-down menu: bilateral oophorectomy (both ovaries removed), unilateral oophorectomy (one ovary removed), hysterectomy (womb removed), partial hysterectomy (subtotal hysterectomy), endometrial ablation, cancer treatment (chemotherapy/radiotherapy).

2.4. Covariates

Covariates were included to control for confounding and improve model accuracy. Dichotomous variables

included hormone replacement therapy (HRT), hormonal contraception (HC) and supplement use. Menopause stage was added as a factor variable with three levels: perimenopause (experiencing periods and menopausal symptoms), menopause (no longer experiencing periods and experiencing menopausal symptoms), post-menopause (no longer experiencing periods, most symptoms have abated except urogenital symptoms). Total number of days since last period was added as a continuous variable.

2.5. Data analysis

Anonymised data were accessed from AWS by the lead author. Data are not publicly available. Analyses were conducted in R Studio [16]. Only data collected at onboarding were analysed.

2.5.1. Identification of menopausal symptom clusters

PCA was performed using the ‘psych’ package in R [17], which provides functions for factor analysis, reliability, descriptive statistics, item response theory, and scale construction. Symptom severity data were aggregated per menopausal symptom per user. A zero was assigned for symptoms not experienced. Oblimin and simplimax rotations indicated no correlation between components; varimax was used for final analysis. Statistical significance was set at $p < 0.05$. The KMO statistic of 0.95 was calculated to assess the adequacy of our sampling, indicating the data are highly suitable for factor analysis, as values closer to 1 suggest that factor analysis is likely to be reliable [18]. Sampling adequacy was confirmed by $KMO = 0.95$. Bartlett’s test was significant ($\chi^2(231) = 1,561,463$, $p < 0.001$), supporting factor analysis. Structure coefficients ≥ 0.32 were used to determine symptom cluster inclusion; cross-loadings were resolved using a threshold of 0.40 and a 0.20 loading difference. Unmatched items were treated as independent symptoms [19]. Cronbach’s alpha was used to assess the internal consistency of symptom clusters identified through exploratory factor analysis, indicating the extent to which symptoms within each cluster reliably measured the same underlying construct. Each symptom cluster was summarised into a single outcome.

2.5.2. Descriptive statistics

Frequencies (N, %) described app user selections at onboarding in relation to age, menopausal status, symptoms, procedures undergone, diagnosed conditions and medication and dietary supplement use.

2.5.3. Correlations between symptoms, diagnoses and procedures

Spearman rank correlations were used to assess associations between symptom domains and binary indicators of diagnoses and procedures/treatments, using pairwise complete observations. Results were visualised as heatmaps to explore patterns across medical profiles. Given the large sample size and differing variable types, correlations were interpreted descriptively, with emphasis on magnitude and pattern rather than statistical significance and recognising that coefficients may be attenuated for less prevalent conditions.

2.5.4. Symptom severities across diagnostic groups

To compare menopausal symptom severity across psychiatric and physical diagnoses, participants were categorised into four mutually exclusive groups: psychiatric (anxiety, depression, PMDD, pre/postnatal depression), physical (breast or gynaecological cancers, other cancers, endometriosis, adenomyosis, fibroids, autoimmune diseases, POI, PMOS), both (reporting at least one psychiatric and one physical diagnosis), or no diagnosis (no reported conditions). Group differences in symptom severity were assessed using Kruskal-Wallis tests implemented via ‘gtsummary’ [20], with Benjamini-Hochberg correction applied to account for multiple comparisons. These groupings were used for descriptive comparison only and were not intended to represent latent or data-driven clusters.

2.5.5. Linear mixed effects models

Nine linear mixed effects (LME) models were used to assess the nine symptom clusters in relation to medical profiles, computed with ‘lme4’ [21]. Random intercepts for country and random slopes for age by country were used to account for clustering and cross-country variation in menopause age. HRT, HC, supplements, days since last period and menopause stage (reference: menopause) were included as covariates. Each model simultaneously included all diagnoses (binary, Y/N) and procedures (binary, Y/N), allowing for adjustment for co-occurring conditions when estimating the association between each diagnosis/procedure and symptom severity domains. Model outputs were summarised using ‘gtsummary’ [20]. Collinearity was evaluated via correlation heatmaps using ‘corrplot’ [22]; no variable exceeded the ± 0.70 threshold [23].

Given the large sample, statistical significance alone was insufficient. ORs ≥ 1.10 ($p < 0.05$) were considered clinically meaningful [24–26], along with protective effects. Results were visualised with ‘ggplot2’ [27].

3. Results

3.1. Menopausal symptom clusters

Joint aches and weight gain did not load highly ($r < 0.40$) onto any clusters and were analysed separately. Low libido and sleeping problems showed cross-loadings with < 0.20 difference between clusters and were also treated as independent outcomes.

PCA was rerun excluding these four symptoms to reassess cluster reliability. All loadings in the second iteration met inclusion criteria, so symptoms within each of the four clusters were combined. Table 1 summarises the first PCA rotation:

- **Cluster 1 – Psychological/cognitive:** brain fog, low energy, low mood, memory loss, poor concentration, stress/anxiety.
- **Cluster 2 – Physical:** bloating, digestive issues, headaches, dizziness, palpitations, period changes, sensitive bladder, skin changes.
- **Cluster 3 – Vasomotor:** hot flushes, night sweats.
- **Cluster 4 – Vaginal:** painful sex, vaginal dryness.

3.2. Descriptive statistics

The study included 210,489 women with a mean age of 49.1 years (SD 4.8). The majority reported being perimenopausal (78%), with fewer being menopausal (19%) and postmenopausal (3.2%).

At onboarding, 16% reported using HRT, 19% were using hormonal contraception, and 44% reported taking dietary supplements.

Gynaecological procedures were relatively uncommon, with hysterectomy reported by 4.2% of women, and unilateral and bilateral oophorectomy and endometrial ablation occurring in 4.1% and 2% of the sample, respectively. Cancer treatment was reported by 1.8% of women.

Commonly diagnosed conditions included anxiety (27%) and depression (24%), while physical conditions such as uterine fibroids (10%), autoimmune diseases (9%), and endometriosis (6%) were also reported. Other conditions, including PMOS (3.8%), PMDD (3.9%), and POI (0.4%), were less prevalent. Total cancer diagnoses were reported by a small proportion of the sample (3%).

Across symptom domains, the highest mean severity scores were observed for weight gain (1.35), sleeping problems (1.32), joint aches (1.23) and low libido (1.17). Psychological/cognitive symptoms were also relatively prominent (1.13), while physical (0.71) and vaginal symptoms (0.46) showed lower average severity.

3.3. Correlations between symptoms, diagnoses, and procedures

As shown in Figure 1, there were consistent positive correlations between several diagnoses, procedures and symptom domains, although effect sizes

Table 1. Cronbach's alpha and cluster loadings across all menopausal symptoms.

Symptom	Cluster 1: Psychological/ cognitive	Cluster 2: Physical	Cluster 3: Vasomotor	Cluster 4: Vaginal
Cronbach's alpha ¹	0.85	0.76	0.65	0.74
Bloating		0.51		
Brain fog	0.73			
Digestive issues		0.63		
Dizziness		0.60		
Headaches		0.54		
Hot flushes			0.81	
Joint aches ²	0.37	0.39		
Low libido ²	0.41			0.55
Low energy	0.64			
Low mood	0.68			
Memory loss	0.67			
Night sweats			0.83	
Painful sex				0.79
Palpitations		0.53		
Period changes		0.49		
Poor concentration	0.73			
Sensitive bladder		0.49		
Skin changes		0.50		
Sleeping problems ²	0.37		0.54	
Stress and anxiety	0.63			
Vaginal dryness				0.78
Weight gain ²	0.35			

¹Cronbach's alpha in bold for all symptoms included in cluster.

²Symptom assessed independently as it did not meet criteria for cluster inclusion.

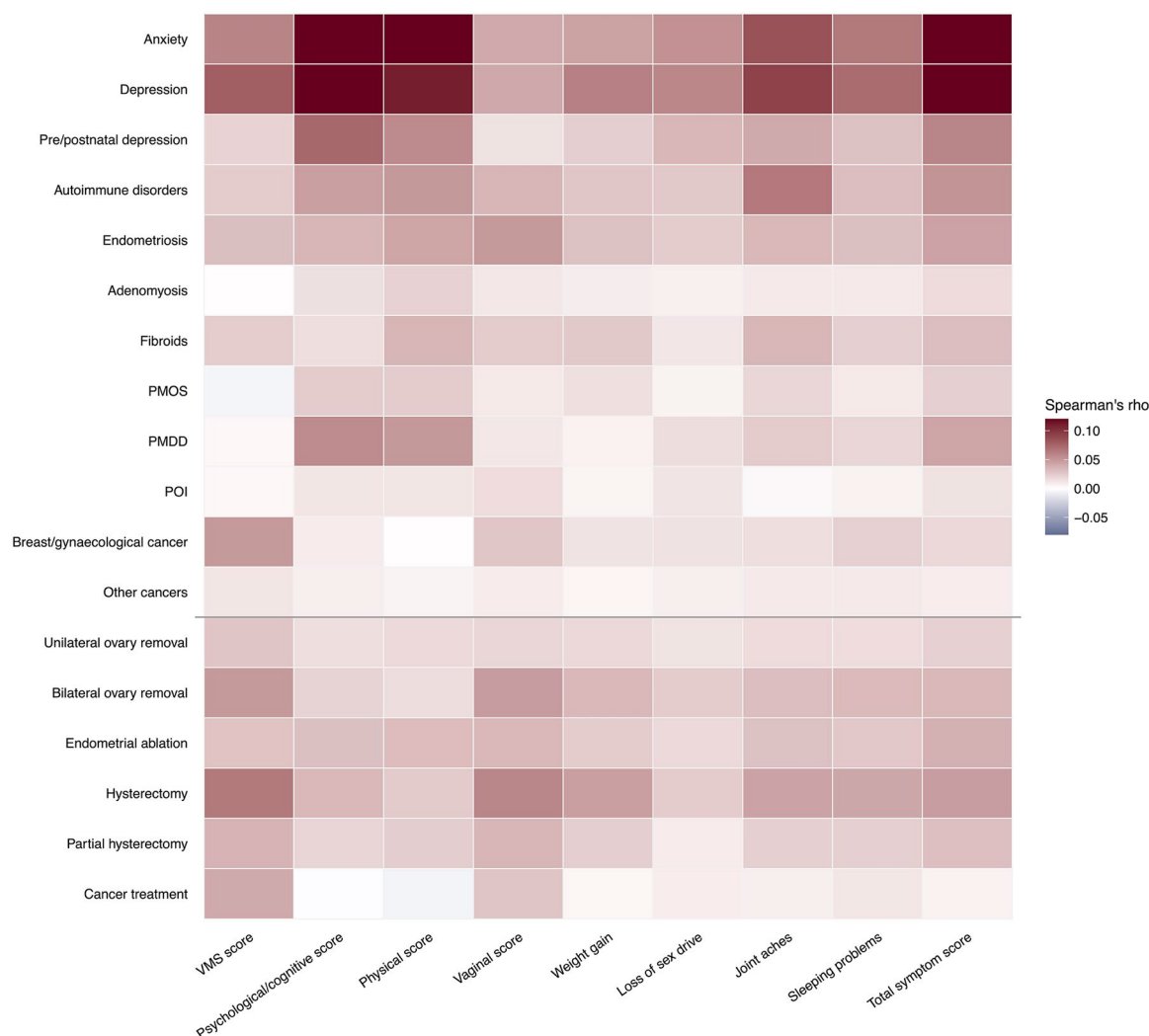


Figure 1. Heatmap of Spearman correlations between medical conditions, procedures and menopausal symptom domains. The plot was developed using R package 'ggplot2' [27] and shows Spearman's rho correlation coefficient magnitudes for each diagnosis, procedure/treatment and symptom domain.

Abbreviations: PMOS, Polyendocrine Metabolic Ovarian Syndrome; PMDD, Premenstrual Dysphoric Disorder; POI, Premature Ovarian Insufficiency; VMS, Vasomotor Symptoms.

were modest overall. The strongest associations were observed for anxiety and depression, which showed the highest correlations with psychological/cognitive scores as expected, as well as total symptom score, sleeping problems and joint aches. Pre/postnatal depression and autoimmune disorders demonstrated a similar but weaker pattern, with moderate correlations across psychological/cognitive, physical, and sleep-related domains. Endometriosis, and to a lesser extent, fibroids, were associated with a broader symptom profile, showing modest correlations across multiple domains including physical, urogenital and pain-related symptoms. Breast/gynaecological cancer had a strong correlation with VMS symptoms but much weaker correlations with all other

symptom domains. In contrast, conditions such as adenomyosis, PMOS, POI, and other cancers showed generally weak or near-null correlations across symptom domains. Procedure-related variables, particularly hysterectomy and bilateral ovary removal, were associated with modest increases across several symptom domains, including vasomotor, physical and vaginal scores. Cancer treatment showed largely weak associations overall, with near-null correlations across most domains and a slight negative correlation with physical score. Overall, correlations were attenuated for less prevalent conditions (e.g. POI) and were generally small in magnitude. Therefore, patterns should be interpreted descriptively rather than as evidence of independent effects.

3.4. Menopausal symptom severity across diagnostic groups

To examine differences in menopausal symptom severity across diagnostic profiles, participants were categorised into four groups: psychiatric diagnoses only (anxiety, depression, PMDD, pre/postnatal depression), physical diagnoses only (breast or gynaecological cancers, other cancers, endometriosis, adenomyosis, fibroids, autoimmune diseases, POI, PMOS), both types of diagnosis and no diagnosis (Table 3, Section A).

As shown in Table 3 (section B), menopausal symptom severities varied by diagnostic group, with women with both psychiatric and physical diagnoses reporting the highest severity scores. Women with psychiatric diagnoses alone showed the second highest symptom severity, while those with no diagnosis consistently reported the lowest scores across all symptom domains.

3.5. Linear mixed effects models

Clinically meaningful predictors of symptom outcomes are summarised below. Figure 2 presents a heatmap of exponentiated coefficients ($\exp\beta$), where red or blue coloured cells indicate statistically significant associations ($p < 0.05$), and diamonds indicate clinically meaningful effects ($p < 0.05$ and $\exp\beta > 1.09$ or < 0.99). Supplementary Table 2 provides full model outputs.

Compared to the menopause reference group, perimenopause was consistently associated with reduced symptom reporting across most domains, including physical, psychological/cognitive, vasomotor (VMS), vaginal, sleep, and weight-related symptoms. Postmenopause showed a similar pattern of reductions, though effects were generally smaller and less consistent, with increases observed in vaginal symptoms. POI showed few associations but was linked to

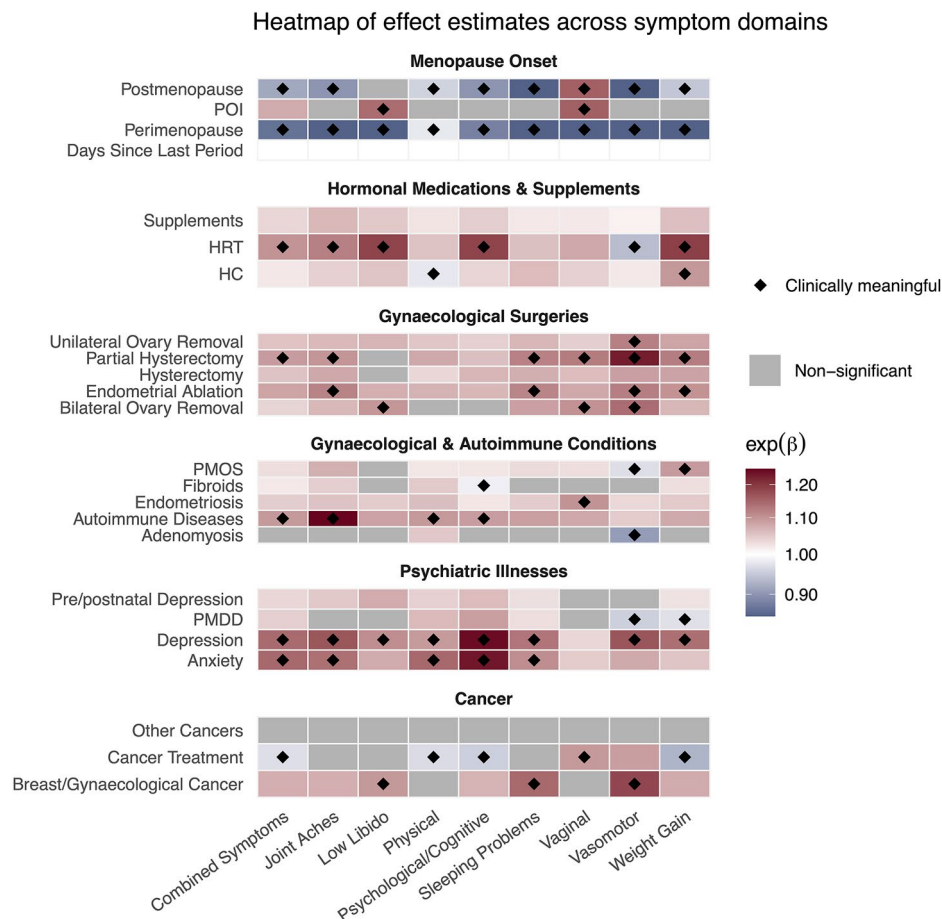


Figure 2. Heatmap of $\exp\beta$ coefficients of predictors of menopause symptom outcomes. The plot was developed using R package 'ggplot2' [27] and shows the 9 symptom domains determined from the principal components analysis: physical, psychological/cognitive, vasomotor (VMS), vaginal, low libido, joint aches, sleeping problems, weight gain and combined symptoms (overall). Clinically meaningful predictors are defined where $\exp\beta > 1.09$ or $\exp\beta < 0.99$ for statistically significant ($p < 0.05$) effects. Values > 1 indicate increased symptoms and values < 1 indicated decreased symptoms.

Abbreviations: HRT, Hormone Replacement Therapy; HC, Hormonal Contraception; PMOS, Polyendocrine Metabolic Ovarian Syndrome; PMDD, Premenstrual Dysphoric Disorder; POI, Premature Ovarian Insufficiency.

Table 2. Baseline characteristics of the study population (N = 210,489).

Characteristic	Full sample ¹ N = 210489
Age (mean, SD)	49.1 (4.8)
Selected stage at onboarding:	
• Perimenopause	163,312 (78%)
• Menopause	40,441 (19%)
• Post-menopause	6,736 (3.2%)
Hormones & Supplements at onboarding:	
• Taking HRT	33,809 (16%)
• Using hormonal contraceptives	40,310 (19%)
• Taking dietary supplements	91,722 (44%)
Procedures/ treatments undergone:	
• Unilateral oophorectomy	4,449 (2.1%)
• Bilateral oophorectomy	4,260 (2.0%)
• Endometrial ablation	4,209 (2.0%)
• Partial hysterectomy	2,182 (1.0%)
• Hysterectomy	8,800 (4.2%)
• Cancer treatment	3,876 (1.8%)
Diagnosed conditions:	
• PMOS	7,950 (3.8%)
• Uterine fibroids	21,365 (10%)
• Autoimmune diseases	18,559 (9%)
• Endometriosis	12,617 (6%)
• Adenomyosis	1,346 (0.6%)
• POI	763 (0.4%)
• Anxiety	55,891 (27%)
• Depression	50,896 (24%)
• Pre/postnatal depression	14,404 (7%)
• PMDD	8,207 (3.9%)
• Breast/gynecological cancer	3,527 (1.7%)
• Other cancers	2,705 (1.3%)
Symptom severity scores (mean, SD)	
• Vasomotor symptoms	0.94 (1.06)
• Vaginal symptoms	0.46 (0.82)
• Psychological/cognitive symptoms	1.13 (0.95)
• Physical symptoms	0.71 (0.75)
• Joint aches	1.23 (1.19)
• Low Libido	1.17 (1.27)
• Sleeping problems	1.32 (1.21)
• Weight gain	1.35 (1.25)
• Combined symptoms	0.92 (0.75)

¹Mean values (SD) and percentage (%).

Abbreviations: HRT, Hormone Replacement Therapy; PMDD, Premenstrual Dysphoric Disorder; PMOS, Polyendocrine Metabolic Ovarian Syndrome; POI, Premature Ovarian Insufficiency.

increased low libido and vaginal symptoms, with little effect across other domains.

HRT was associated with increased symptoms across multiple domains, including combined symptoms, joint aches, low libido, psychological symptoms and weight gain, but showed a reduction in vasomotor symptoms. Hormonal contraception (HC) showed minimal associations overall, with a reduction in physical symptoms and an increase in weight gain being the most notable effects. Supplements were not associated with clinically meaningful changes.

All surgical procedures showed consistent increases in symptom burden, particularly for vasomotor symptoms, where effects were strongest. Partial hysterectomy demonstrated the most widespread associations, including increases in joint aches, sleep problems, weight gain, VMS, vaginal and combined symptoms. Bilateral oophorectomy was associated with increased

vaginal symptoms, low libido, and VMS, while endometrial ablation showed increases in joint aches, sleep, VMS, and weight-related symptoms. Effects were generally positive ($\exp\beta > 1$), indicating increased symptom reporting.

Endometriosis was associated with clinically significant increased vaginal symptoms and smaller significant increases across all symptom domains, while PMOS showed clinically significant increases in weight gain and reduced vasomotor symptoms. Fibroids were linked to reduced psychological symptoms, and adenomyosis showed minimal associations, with a reduction in vasomotor symptoms. Autoimmune diseases showed were associated with clinically significant increases across joint aches, physical, psychological, and combined symptoms.

Depression and anxiety demonstrated the largest and most consistent effects across all domains, particularly for psychological/cognitive symptoms and combined symptom burden. Both were also associated with increases in joint aches, physical symptoms, and sleep problems, with depression additionally linked to increased vasomotor symptoms, low libido, and weight gain. PMDD showed a contrasting pattern, with reductions in vasomotor symptoms and weight gain, and limited associations elsewhere.

Cancer treatment showed a mixed pattern, with increases in vasomotor and vaginal symptoms, but reductions in psychological, physical, combined symptoms and weight gain. Breast and gynaecological cancers were associated with increased vasomotor and sleep symptoms and reduced libido, with smaller or non-significant effects across other domains. No meaningful associations were observed for 'other cancers'.

4. Discussion

This study examined the effects of various diagnosed health conditions on menopausal symptoms and found clinically significant negative and positive associations between medical profiles and menopausal symptom reporting. These outcomes remained significant even after controlling for factors such as age, menopausal status, medication and supplement use. Among the most important findings were the strong positive associations between diagnosed depression and anxiety with a wide range of menopausal symptoms and higher severity scores compared with other pre-existing diagnoses. Additionally, women who had undergone POI, bilateral oophorectomy and other gynaecological surgeries reported more severe vasomotor

Table 3. Diagnostic group composition and menopausal symptom severity across groups.

Section A: Composition of diagnostic groups					
	No Diagnosis ¹ N = 105,786	Both Types ¹ N = 28,955	Physical only ¹ N = 28,855	Psychiatric only ¹ N = 46,893	
PMOS	0 (0%)	4,412 (15%)	3,538 (12%)	0 (0%)	
Uterine fibroids	0 (0%)	10,617 (37%)	10,748 (37%)	0 (0%)	
Autoimmune diseases	0 (0%)	9,972 (34%)	8,587 (30%)	0 (0%)	
Endometriosis	0 (0%)	6,762 (23%)	5,855 (20%)	0 (0%)	
Adenomyosis	0 (0%)	742 (2.6%)	604 (2.1%)	0 (0%)	
POI	0 (0%)	415 (1.4%)	348 (1.2%)	0 (0%)	
Anxiety	0 (0%)	21,439 (74%)	0 (0%)	34,452 (73%)	
Depression	0 (0%)	19,867 (69%)	0 (0%)	31,029 (66%)	
Pre/postnatal depression	0 (0%)	6,319 (22%)	0 (0%)	8,085 (17%)	
PMDD	0 (0%)	4,284 (15%)	0 (0%)	3,923 (8.4%)	
Breast/gynecological cancer	0 (0%)	1,512 (5.2%)	2,015 (7.0%)	0 (0%)	
Other cancers	0 (0%)	1,313 (4.5%)	1,392 (4.8%)	0 (0%)	
Section B: Menopausal symptom severity by diagnostic group					
Symptom severity score (mean, SD)	No diagnosis	Both types	Physical only	Psychiatric only	<i>P</i> ^{2,3}
Vasomotor	0.88 (1.04)	1.08 (1.09)	0.92 (1.06)	0.99 (1.06)	<0.001
Vaginal	0.42 (0.79)	0.57 (0.89)	0.49 (0.84)	0.45 (0.81)	<0.001
Psychological/cognitive	1.01 (0.93)	1.40 (0.97)	1.01 (0.92)	1.32 (0.96)	<0.001
Physical	0.63 (0.72)	0.89 (0.79)	0.67 (0.73)	0.79 (0.77)	<0.001
Joint aches	1.12 (1.16)	1.48 (1.23)	1.23 (1.18)	1.30 (1.20)	<0.001
Low Libido	1.10 (1.24)	1.33 (1.31)	1.16 (1.26)	1.26 (1.29)	<0.001
Sleeping problems	1.24 (1.20)	1.49 (1.23)	1.30 (1.20)	1.38 (1.22)	<0.001
Weight gain	1.28 (1.23)	1.50 (1.28)	1.36 (1.25)	1.40 (1.26)	<0.001
Combined symptoms	0.83 (0.73)	1.12 (0.77)	0.88 (0.73)	1.02 (0.75)	<0.001

¹Mean values (SD) and Percentage (%).²Kruskal-Wallis rank sum test for differences between diagnostic groups.³Benjamini-Hochberg correction for multiple testing.

Abbreviations: PMDD, Premenstrual Dysphoric Disorder; PMOS, Polyendocrine Metabolic Ovarian Syndrome; POI, Premature Ovarian Insufficiency.

and vaginal symptoms. Conversely, diagnosed conditions such as PMOS, adenomyosis, fibroids, and PMDD were associated with reduced vasomotor symptom severities, and women who had undergone cancer treatment reported reduced symptom severities related to weight gain and psychological/cognitive and physical symptoms. Together, these results suggest a complex interaction between physical and psychological diagnoses experienced by women at midlife and the symptoms of their menopausal transition.

4.1. Menopausal symptom clusters

This is the largest study to identify symptom clusters during the menopause transition. Eight distinct clusters were identified: vasomotor, psychological, physical, vaginal, sexual, sleep, joint aches and weight gain. While our findings align with previous research on menopausal symptom clusters [28–32], unlike these earlier studies our analysis included independently assessed symptoms that did not fit principal component analysis (PCA) clusters. Given that low libido, sleeping problems, joint aches and weight gain did not load strongly onto any specific symptom cluster, this may reflect their non-specific nature and potential influence

from broader ageing, lifestyle, or comorbid processes, rather than being uniquely associated with the menopausal transition.

4.2. Menopause onset

Perimenopause and Postmenopause stage groups were associated with reduced symptoms, particularly VMS compared to the stage ‘Menopause’, which was linked to more severe symptoms aligning with previous research, probably due to abrupt and recent estrogen decline [33]. Vaginal symptoms were increased in the Postmenopause group compared to the Menopause and Perimenopause groups [30].

4.3. Hormones & dietary supplements

Exogenous hormones and supplements were associated with increased risks for most symptoms, particularly among women who were currently taking HRT. This may reflect initial symptom severity prompting intervention use. HRT appeared protective for VMS, as expected from its therapeutic role in managing these symptoms [34]. Notably, this outcome suggests that women taking HRT still reported increases in other types of menopausal symptoms compared to women not using HRT.

4.4. Surgeries

All gynaecological surgeries were associated with clinically significant effects on VMS. Surprisingly, partial hysterectomy showed the largest effect, surpassing bilateral oophorectomy with its associated steep decline in estrogen [11]. However, the unknown timing of surgeries could explain our data, as well as the indications for undergoing a partial rather than total hysterectomy. Thus, unrecorded comorbidities could be responsible for these variances. In addition, VMS from bilateral oophorectomy may initially be severe but may align with other gynaecological surgeries over time [35], while hysterectomy can increase VMS risk, regardless of ovary conservation, many years after surgery [35]. This may be due to hysterectomy causing vascular compromise of the ovaries and earlier ovarian failure or due to the original indication for the hysterectomy [35]. We also observed strong associations between bilateral oophorectomy and symptoms such as VMS, vaginal symptoms and sleeping problems, consistent with prior research, suggesting these symptoms may be more prevalent in women who undergo this type of surgery [11]. The original indication for surgery could mediate the varying associations between symptoms and gynaecological surgeries, as women who undergo bilateral oophorectomy may be more likely to have been diagnosed with cancer, or endometriosis, and more likely to be using HRT to treat menopausal symptoms and protect bone health, and these distinctions could influence menopausal symptom experiences [35]. The type and extent of surgical intervention could be crucial in symptom development and needs to be considered when supporting women.

4.5. Gynaecological & Autoimmune diseases

Gynaecological conditions like PMOS and adenomyosis were linked to reduced VMS, suggesting women with these conditions may report fewer vasomotor symptoms. Among women with adenomyosis there were no other significant differences found, aside from physical symptoms which were only slightly increased (HR = 1.05, $p=0.04$). However, PMOS was associated with increased symptoms overall, particularly in relation to weight gain and joint aches. Endometriosis, despite being an estrogen-dependent condition [9], was linked to clinically significant increases in vaginal symptoms, possibly via alternative mechanisms [36]. Symptoms related to these diagnoses, particularly heavy menstrual bleeding, may improve post-menopause when menstruation ceases

[8,9,37]. Autoimmune disease was associated with increased joint, physical and psychological symptoms, low libido and sleeping issues linked to chronic pain [38] and psychological issues [39], suggesting a need for targeted care as these symptoms can overlap with the conditions themselves. Women with POI reported increased vaginal symptoms and reduced libido, probably due to early hormonal decline leading to vaginal atrophy [40].

4.6. Psychiatric diagnoses

As expected, psychiatric diagnoses were linked to increased psychological menopausal symptom reports, as well as more severe symptoms overall. Having a diagnosis of anxiety or depression was associated with the most severe menopausal symptoms. Overlapping symptoms between menopause and psychiatric conditions possibly contribute to misdiagnosis [34]. Depression was also linked to joint aches, VMS, low libido and weight gain while diagnosed anxiety was associated with joint aches and physical symptoms. Prior work supports this link between psychiatric diagnoses and menopausal symptom severity [7]. Pre-/postnatal depression had small but significant effects, likely reflecting broader depressive tendencies [41]. Diagnosed PMDD was associated with decreased VMS and weight gain, which contrasts with the other psychiatric diagnoses but aligns with findings that PMDD may have different symptom patterns compared to general depression or anxiety [42]. While PMDD is listed as a psychiatric illness in the DSM, it is influenced by hormone levels which could explain why it is associated with reductions in more hormonally derived menopausal symptoms such as VMS [42]. Furthermore, women reporting PMDD may have been younger (as they may have still been having periods hence the diagnosis) and VMS has been found to peak in severity around the time of the final menstrual period. Notably, women with PMDD reported increased symptoms overall, largely driven by psychiatric/cognitive symptoms, physical symptoms and sleeping problems. Our findings underscore the need to consider mental health history in the comprehensive management of menopausal symptoms.

4.7. Cancer

Cancer treatment (e.g. chemotherapy or radiotherapy) was linked to lower overall symptom severity, possibly due to holistic care or treatment-induced suppression [43]. It should be noted that women may not

attribute symptoms to menopause, but instead to cancer or cancer treatment, and therefore underreport symptoms via the app. However, having undergone cancer treatment was associated with increased VMS and vaginal symptoms and breast/gynaecological cancers were linked to greater VMS and low libido, both consistent with the adverse hormonal effects of cancer and cancer treatments [44]. These findings suggest tailored symptom support is vital for cancer patients.

4.8. Strengths, limitations & future directions

An important advantage of this study is the very large sample size suggesting the findings are generalisable to many menopausal women. However, this also inflates very small effect sizes and thus the study focused on findings with a clinically significant impact so smaller, but potentially important, effects may have been overlooked. The cross-sectional design, and lack of data on the timing of diagnoses, treatments and procedures, mean it is not possible to infer causality between menopausal symptoms and the symptoms of other conditions, nor to assess whether temporal effects could have explained some findings. Ultimately it should be acknowledged that some symptoms may not be attributable solely to menopause, as several of the conditions included in this study present with symptom profiles that overlap with menopausal symptoms. Symptom severity is subjective; however, we used a conservative, well-understood 3-point Likert scale to counteract this. This study was limited to only being able to analyse the data collected via the app, and the app was not developed to conduct the present study. Therefore, validated data collection tools for researching menopausal symptoms, menopause stages, ethnicity and other medical and reproductive characteristics were not included. A notable limitation was that data on different cancers and cancer treatments, and the timing of said treatments, were not captured by the app, therefore findings relating to cancer survivors should be interpreted with caution. This also applies to women who were taking HRT, as the timing of HRT initiation was not captured by the app. However, given the large sample size and the ecological validity of data collected in real-world, non-clinical settings, this analysis provides valuable insights into menopausal symptom experiences across diverse groups of midlife women. This form of secondary analysis offers a unique opportunity to explore naturally occurring symptom patterns and medical associations at a scale rarely achievable in controlled research environments. In addition, as diagnoses and other medical information were limited

by the app, and diagnoses and medical characteristics were self-reported and not verified, we could not assess and control for all medical characteristics. We acknowledge that self-reported diagnostic and procedural data may lack clinical precision, particularly for gynaecological surgeries where terminology may not be well understood. Of note, the app uses menopausal stage classifications that differ from widely accepted clinical terminology. It categorises women as perimenopausal; menopausal (≥ 12 months since their last menstrual period but still experiencing most menopausal symptoms); or postmenopausal (≥ 12 months since their last menstrual period and with most symptoms having abated, except for vaginal and sexual symptoms). Consequently, data reported for the app's 'postmenopausal' group may predominantly reflect women who are several years beyond menopause, rather than the broader clinical definition of postmenopause, which includes women from 12 months after their final menstrual period onwards. In addition, some conditions (e.g. fibroids and adenomyosis) may be identified incidentally via imaging and may not always be clinically significant, introducing further heterogeneity in diagnostic reporting. This represents an important limitation; however, such misclassification is likely to be non-differential and would tend to attenuate, rather than exaggerate, observed associations. Finally, using an app could skew the population of women in this study towards particular socioeconomic groups and those who are motivated to track the menopause, so the results may not be generalisable to all menopausal women.

5. Conclusions

This study is the largest to date investigating the link between medical profiles and menopausal symptoms. It therefore provides a unique contribution to the literature about the complex interplay between mental health, medical diagnoses, surgical procedures and menopausal symptoms. It significantly extends previous literature by analysing symptom clusters and individual symptoms that do not fit into these clusters. The findings suggest a need for personalised treatment approaches for menopausal symptoms covering both psychological and physiological health variables. Furthermore, these findings may have implications beyond symptom management alone, particularly for NHS midlife preventive strategies such as the NHS Health Check programme, as several diagnoses associated with severe menopausal symptoms are also linked to elevated long-term cardiometabolic and mental health risk. Given that menopausal symptoms can

influence future health [45], research should focus on longitudinal studies to understand the progression of menopausal symptoms in women with different medical diagnoses and validate the impact of comorbidities on specific symptoms. Such research will be crucial in developing optimal treatment strategies tailored to individual medical profiles, ultimately improving the quality of life for women navigating menopause.

Acknowledgments

We would like to thank Dr Harriet Connell for providing her clinical perspective on this paper, drawing from her expertise as a GP and women's health specialist.

Disclosure statement

Dr Robin Andrews is employed part-time by Health & Her. Dr Arron Lacey is a consultant for Health & Her. Mrs Kate Bache is the CEO of Health & Her. Prof Deborah Lancaster and Prof Emma J Kidd have no conflicts of interest to declare.

Ethical approval

The ethics committee of The Cardiff School of Pharmacy and Pharmaceutical Sciences Research Ethics Committee approved this study (SREC number: 2324-02).

Funding

This work was supported by the Waterloo Foundation (grant number 1890/5027), with additional funds provided by Health & Her.

Previous dissemination

Andrews R., Lancaster D., Lacey A., Bache K., & Kidd E.J. (2024) Menopausal Symptom Variances According to Medical Profiles. Poster. British Menopause Society 34th Annual Scientific Conference.

Transparency statement

The lead author Dr Robin Andrews affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

References

- [1] Al Wattar BH, Rogozińska E, Vale C, et al. Effectiveness and safety of menopause treatments: pitfalls of available evidence and future research need. *Climacteric*. 2024;27(2):154–158. doi:10.1080/13697137.2023.2297880
- [2] Sharman Moser S, Chodick G, Bar-On S, et al. Healthcare Utilization and Prevalence of Symptoms in Women with Menopause: A Real-World Analysis. *Int J Womens Health*. 2020;12:445–454. doi:10.2147/IJWH.S246113
- [3] Office for National Statistics. Cost of living and depression in adults. Great Britain; 2022. <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/mentalhealth/articles/costoflivinganddepressioninadultsgreatbritain/29septemberto23october2022>
- [4] National Institute for Health and Care Excellence (NICE). Endometriosis. 2025. <https://cks.nice.org.uk/topics/endometriosis/background-information/prevalence/>
- [5] National Institute for Health and Care Excellence (NICE). Polycystic ovary syndrome. 2025. <https://cks.nice.org.uk/topics/polycystic-ovary-syndrome/background-information/prevalence/>
- [6] National Institute for Health and Care Excellence (NICE). Fibroids. <https://cks.nice.org.uk/topics/fibroids/background-information/prevalence/>
- [7] Muharam R, Setiawan MW, Ikhsan M, et al. Depression and its link to other symptoms in menopausal transition. *Middle East Fertility Soc. J*. 2018;23(1):27–30. doi:10.1016/j.mefs.2017.08.003
- [8] Helvacı N, Yildiz BO. Polycystic ovary syndrome and aging: Health implications after menopause. *Maturitas*. 2020;139:12–19. doi:10.1016/j.maturitas.2020.05.013
- [9] Ottolina J, Villanacci R, D'Alessandro S, et al. Endometriosis and adenomyosis: modern concepts of their clinical outcomes, treatment, and management. *J Clin Med*. 2024;13(14):3996. doi:10.3390/jcm13143996
- [10] Saleh FL, Taylor HS. Clinical applications of gonadotropin-releasing hormone analogues: a broad impact on reproductive medicine. *F S Rep*. 2023;4(2 Suppl):83–87. doi:10.1016/j.xfre.2023.01.008
- [11] Kingsberg SA, Larkin LC, Liu JH. Clinical effects of early or surgical menopause. *Obstet Gynecol*. 2020;135(4):853–868. doi:10.1097/AOG.0000000000003729
- [12] Taylor JA, Burnell M, Ryan A, et al. Association of hysterectomy and invasive epithelial ovarian and tubal cancer: a cohort study within UKCTOCS. *BJOG*. 2022;129(1):110–118. doi:10.1111/1471-0528.16943
- [13] Kidd EJ, Andrews RA, Lacey AS. The secure anonymised information linkage databank menopause e-cohort (SAIL-MENO). *Inf Med Unlocked*. 2026;63:101766. doi:10.1016/j.imu.2026.10176
- [14] Health & Her. 2025. <https://healthandher.com>
- [15] The British Menopause Society. Data on women's experience of menopause in survey women in Great Britain. 2016. https://thebms.org.uk/wp-content/uploads/2016/05/FINAL_BMS-2016-Annual-Conference_Press-Release_060516.pdf
- [16] R Foundation. R: A language and environment for statistical computing (Version 4.03.1). 2025. <https://www.r-project.org/>
- [17] Revelle W. Procedures for psychological, psychometric, and personality research (R package 'psych' version

- 1.8.12). 2019. <https://personality-project.org/r/psych/psych-manual.pdf>
- [18] Kaiser HF. An index of factorial simplicity. *Psychometrika*. 1974;39(1):31–36. doi:10.1007/BF02291575
- [19] Howard MC. A review of exploratory factor analysis decisions and overview of current practices: what we are doing and how can we improve? *Int. J. of Human-Computer Interaction*. 2016;32(1):51–62. doi:10.1080/10447318.2015.1087664
- [20] Soberg DD, Larmarange J, Curry M, et al. Zabor, gtsummary: Presentation-ready data summary and analytic result tables. 2025. <https://www.danielsjoberg.com/gtsummary//reference/gtsummary-package.html>
- [21] Bates D, Mächler M, Bolker B, et al. Fitting linear mixed-effects models using lme4. *J Stat Soft*. 2015;67(1):1–48. doi:10.18637/jss.v067.i01
- [22] Wei T, Simko V. Visualization of a Correlation Matrix (R package 'corrplot' Version 0.84). 2017. <https://cran.r-project.org/web/packages/corrplot/corrplot.pdf>
- [23] Tabachnick BG, Fidell LS, Ullman JB. Using multivariate statistics. 7th ed. New York: Pearson; 2019.
- [24] Cohen J. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. New York: Routledge; 1988.
- [25] Khoudary SRE, Aggarwal B, Beckie TM, On behalf of the American Heart Association Prevention Science Committee of the Council on Epidemiology and Prevention; and Council on Cardiovascular and Stroke Nursing, et al. Menopause transition and cardiovascular disease risk, implications for timing of early prevention: A scientific statement from the american heart association. *Circulation*. 2020;142(25):e506–e532. doi:10.1161/CIR.0000000000000912
- [26] Tang R, Luo M, Li J, et al. Symptoms of anxiety and depression among Chinese women transitioning through menopause: findings from a prospective community-based cohort study. *Fertil Steril*. 2019;112(6):1160–1171. doi:10.1016/j.fertnstert.2019.08.005
- [27] Wickham H, editor. Data analysis. In *ggplot2 elegant graphics for data analysis*. 2nd ed. Cham: Springer; 2016. p. 189–201. doi:10.1007/978-3-319-24277-4_9
- [28] Cray L, Woods N, Mitchell E. Identifying symptom clusters during the menopausal transition: observations from the Seattle Midlife Women's Health Study. *Climacteric*. 2013;16(5):539–549. doi:10.3109/13697137.2012.746657
- [29] Prairie BA, Wisniewski SR, Luther J, et al. Symptoms of depressed mood, disturbed sleep, and sexual problems in midlife women: cross-sectional data from the Study of Women's Health Across the Nation. *J Womens Health (Larchmt)*. 2015;24(2):119–126. doi:10.1089/jwh.2014.4798
- [30] Greenblum CA, Rowe MA, Neff DF, et al. Midlife women: symptoms associated with menopausal transition and early postmenopause and quality of life. *Menopause*. 2013;20(1):22–27. doi:10.1097/gme.0b013e31825a2a91
- [31] Mishra GD, Dobson AJ. Using longitudinal profiles to characterize women's symptoms through midlife: results from a large prospective study. *Menopause*. 2012;19(5):549–555. doi:10.1097/gme.0b013e3182358d7c
- [32] Freeman EW, Sammel MD, Lin H, et al. Symptoms associated with menopausal transition and reproductive hormones in midlife women. *Obstet Gynecol*. 2007;110(2Pt 1):230–240. doi:10.1097/01.AOG.0000270153.59102.40
- [33] Santoro N, Roeca C, Peters BA, et al. The menopause transition: signs, symptoms, and management options. *J Clin Endocrinol Metab*. 2021;106(1):1–15. doi:10.1210/clinem/dgaa764
- [34] National Institute for Health and Care Excellence (NICE). Menopause Guidance. 2024. <https://www.nice.org.uk/guidance/ng23>
- [35] Huang AJ, Grady D, Jacoby VL, et al. Persistent hot flushes in older postmenopausal women. *Arch Intern Med*. 2008;168(8):840–846. doi:10.1001/archinte.168.8.840
- [36] Crandall CJ, Larson JC, Ensrud KE, et al. Are serum estrogen concentrations associated with menopausal symptom bother among postmenopausal women? Baseline results from two MsFLASH clinical trials. *Maturitas*. 2022;162:23–30. doi:10.1016/j.maturitas.2022.04.003
- [37] Ulin M, Ali M, Chaudhry ZT, et al. Uterine fibroids in menopause and perimenopause. *Menopause*. 2020;27(2):238–242. doi:10.1097/GME.0000000000001438
- [38] Lacagnina MJ, Heijnen CJ, Watkins LR, et al. Autoimmune regulation of chronic pain. *Pain Rep*. 2021;6(1):e905. doi:10.1097/PR9.0000000000000905
- [39] Weiss DB, Dyrud J, House RM, et al. Psychiatric manifestations of autoimmune disorders. *Curr Treat Options Neurol*. 2005;7(5):413–417. doi:10.1007/s11940-005-0033-z
- [40] Blümel JE, Chedraui P, Vallejo MS, et al. Genitourinary symptoms and sexual function in women with primary ovarian insufficiency. *Climacteric*. 2024;27(3):269–274. doi:10.1080/13697137.2024.2306278
- [41] Milgrom J, Gemmill AW, Bilszta JL, et al. Antenatal risk factors for postnatal depression: a large prospective study. *J Affect Disord*. 2008;108(1-2):147–157. doi:10.1016/j.jad.2007.10.014
- [42] Eccles H, Sharma V. The association between premenstrual dysphoric disorder and depression: A systematic review. *J Affect Disord Rep*. 2023;12:100504. doi:10.1016/j.jadr.2023.100504
- [43] Basch E, Deal AM, Kris MG, et al. Symptom monitoring with patient-reported outcomes during routine cancer treatment: a randomized controlled trial. *J Clin Oncol*. 2016;34(6):557–565. doi:10.1200/JCO.2015.63.0830
- [44] Hickey M, Basu P, Sassarini J, et al. Managing menopause after cancer. *Lancet*. 2024;403(10430):984–996. doi:10.1016/S0140-6736(23)02802-7
- [45] Andrews R, Lacey A, Bache K, et al. The role of menopausal symptoms on future health and longevity: A systematic scoping review of longitudinal evidence. *Maturitas*. 2024;190:108130. doi:10.1016/j.maturitas.2024.108130