

THERMOREGULATORY SYMPTOMS AND THEIR IMPACT AMONG MENOPAUSAL WOMEN IN KARACHI: A CROSS-SECTIONAL STUDY

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Abstract

Background: Thermoregulatory symptoms such as hot flashes and night sweats are common during menopause and can significantly impair daily functioning and quality of life. There is limited localized data regarding these symptoms among menopausal women in South Asia, particularly in Pakistan.

Objective: To examine the prevalence, severity, and socio-demographic correlates especially education level of thermoregulatory symptoms among menopausal women in Karachi, and to assess their impact on sleep quality, work productivity, and emotional well-being.

Methods: A cross-sectional study was conducted among 329 menopausal women aged 40 years and above residing in Karachi. Data on thermoregulatory symptoms, education level, and impacts on daily functioning were collected via a structured questionnaire. Severity was categorized as mild, moderate, or severe. Associations between education and symptom severity were analyzed using the chi-square test.

Results: Overall, 69.6% (n=229) of women reported experiencing thermoregulatory symptoms. Among those, 40.2% reported mild, 39.7% moderate, and 20.1% severe symptoms. Education level was significantly associated with severity ($\chi^2 = 12.5$, $p = 0.05$), with less educated women more likely to report moderate to severe symptoms. Severe symptoms were strongly linked to sleep disruption (78.3%), reduced work productivity (69.6%), and impaired emotional well-being (71.3%).

Conclusions: Thermoregulatory symptoms are highly prevalent and significantly impact daily functioning in menopausal women in Karachi, with lower education level associated with greater symptom severity. These findings highlight the need for targeted public health interventions addressing educational disparities and promoting menopause-related health awareness in urban Pakistan.

INTRODUCTION

Menopause marks a significant phase in a woman's life, often accompanied by a variety of physical, emotional, and psychological symptoms. Among these, thermoregulatory disturbances chiefly hot flashes and night sweats are the most commonly reported and disruptive. These symptoms stem from fluctuating estrogen levels and affect most women undergoing menopausal transition. Although menopause is a natural biological event, the severity and impact of symptoms frequently interfere with daily activities, emotional well-being, and work performance, thus representing a major public health issue.

Contemporary research has drawn attention to the extensive prevalence and effects of thermoregulatory symptoms (thermoregulatory symptoms). Globally, over 70% of menopausal women report experiencing thermoregulatory symptoms, with approximately 30–50% rating these symptoms as moderate to severe (Lee et al., 2024). In Pakistan, especially Karachi, rates are similarly elevated. Shah et al. (2021) found that around 70% of menopausal women in Karachi experienced vasomotor symptoms, with nearly half describing them as moderate to severe. This underscores the magnitude of the challenge and the critical need for research focused on local context. The issue is aggravated by societal stigma and limited openness surrounding menopause in many south Asian cultures.

The wider health ramifications of thermoregulatory symptoms are increasingly apparent. A systematic review by Thurston et al. (2023) demonstrated that women experiencing thermoregulatory symptoms have an elevated risk of cardiovascular diseases. Yuksel et al. (2024) reported that moderate to severe thermoregulatory symptoms considerably reduce quality of life, undermine work productivity, and disrupt sleep. Despite these findings, most data come from western populations, with minimal empirical evidence from south Asia about the sociocultural and demographic influences on symptom severity.

One often overlooked but significant factor is educational level. International studies suggest that women with lower education are prone to experience more severe thermoregulatory symptoms, possibly due to limited health literacy and healthcare access (Smith et al., 2023). However, the role of education

in menopause experiences within Pakistan remains insufficiently examined. A notable knowledge gap exists regarding how educational disparities affect symptom perception, reporting, and daily functioning. This research gap provides the foundation for the present study. Given Karachi's diverse and densely populated setting with marked health inequalities and socioeconomic stratification in information and care it is imperative to explore links between education and menopausal health. The absence of localized data impairs healthcare planning and the development of tailored public health strategies.

Accordingly, this investigation has two main aims: first, to analyze the relationship between education level and the severity of vasomotor symptoms among menopausal women in Karachi; second, to assess the effect of these symptoms on their daily functioning. By addressing these aspects, the study aims to inform community health education, healthcare provider training, and policy development suited to the needs of Pakistani women. This research will enhance understanding of how menopause impacts women across educational groups, enabling fairer and more efficient healthcare solutions.

Research Problem

Menopause is accompanied by distressing thermoregulatory symptoms such as hot flashes and night sweats, which significantly impair daily functioning and quality of life. In Karachi, Pakistan, despite the high prevalence of menopausal women, there is a lack of localized empirical evidence addressing how socio-demographic factors particularly education level influence the severity of these symptoms and their impact on sleep, work productivity, and emotional well-being. This knowledge deficit hinders effective healthcare planning and targeted interventions within the local socio-cultural context.

Objective:

To examine the prevalence, severity, and socio-demographic correlates particularly education level of thermoregulatory symptoms (hot flashes and night sweats) among menopausal women in Karachi, and

to assess their impact on sleep quality, work productivity, and emotional well-being.

Research Question:

What is the prevalence and severity of thermoregulatory symptoms among menopausal women in Karachi, how are these symptoms associated with education level, and what is their impact on sleep disruption, work productivity, and emotional well-being?

Scope Of The Study

This study focuses on menopausal women aged 40 years and above residing in Karachi, incorporating participants from diverse educational, occupational, and socioeconomic backgrounds. It investigates the prevalence and severity of thermoregulatory symptoms (hot flashes and night sweats), examines their association with education level, and assesses their impact on key areas of daily functioning, including sleep quality, work productivity, and emotional well-being. The study's cross-sectional design provides a snapshot of symptom patterns and correlates within an urban Pakistani setting.

LITERATURE REVIEW

Vasomotor Symptoms: Frequency, Consequences, And Medical Importance

Thermoregulatory disturbances, such as hot flashes and night sweats, are hallmark features of menopause and among the most distressing complaints of middle-aged women. These symptoms arise mainly due to estrogen decline during menopause, disrupting the hypothalamic thermoregulatory center. Though physiologically non-threatening, thermoregulatory symptoms can profoundly affect mental health, sleep, everyday productivity, and overall well-being (avis et al., 2022). Recent global investigations confirm that thermoregulatory symptoms are widespread among menopausal women. The 2023 global menopause survey estimated that approximately 70% of women aged 45–60 experience hot flashes, with nearly one-third categorizing their symptoms as moderate to severe, impacting day-to-day functionality (nappi et al., 2023). Emerging evidence also indicates that thermoregulatory symptoms may persist for longer than previously thought—sometimes more than a

decade after menopause—especially among specific ethnic and socioeconomic groups (santoro et al., 2021).

Further research points to variability in thermoregulatory symptoms prevalence and intensity by geography, ethnicity, and cultural context. A 2022 meta-analysis showed Asian women generally report fewer thermoregulatory symptoms than western women, though underreporting and cultural reticence regarding menopause in many Asian societies might partly explain this gap (kim et al., 2022). South Asian urban centers like Karachi lack extensive population data, but smaller regional studies suggest 30–40% of postmenopausal women experience thermoregulatory symptoms, often avoiding medical care due to normalization or shame (rahman et al., 2021).

The psychosocial impact of thermoregulatory symptoms is increasingly documented. Sleep disturbances—particularly nocturnal awakenings caused by night sweats are strongly linked to chronic fatigue, mood instability, and symptoms of depression and anxiety (joffe et al., 2020). These disruptions negatively affect cognition, social relationships, and work capacity. For example, a 2021 longitudinal study showed women with frequent hot flashes had lower workplace productivity and higher absence rates compared with those not experiencing thermoregulatory symptoms (maki et al., 2021).

Moreover, thermoregulatory symptoms are recognized not merely as minor age-related inconveniences but as warning signs for broader health issues. Evidence associates severe thermoregulatory symptoms with increased cardiovascular risk, insulin resistance, and bone loss, particularly concerning in low- and middle-income countries where midlife women's health is often neglected (Thurston & faubion, 2023).

Despite these insights, effective management remains limited in much of south Asia. Hormone replacement therapy (HRT) usage is generally low due to cultural fears, misinformation, and insufficient healthcare provider training. Non-hormonal options such as cognitive behavioral therapy and lifestyle changes are gaining acceptance but are not yet widely implemented (Gellar et al., 2020).

Vasomotor symptoms profoundly impact women's physical, emotional, and social dimensions of life. Their persistence, coupled with underreporting and restricted healthcare access in urban south Asian settings, emphasizes the necessity for culturally appropriate public health initiatives and accessible clinical care.

Influence Of Socio-Demographic Factors: Education And Urban Living

While thermoregulatory symptoms stem primarily from hormonal changes, their experience is significantly influenced by socio-demographic and environmental circumstances. Education level, socioeconomic status, and urban living conditions play pivotal roles in how menopausal symptoms are identified, reported, and managed. In low- and middle-income countries like Pakistan, where menopause education is scant and healthcare access uneven these social factors become especially crucial. Recent findings highlight the key role of education in shaping menopause-related health understanding and management. Women with higher educational attainment tend to interpret thermoregulatory symptoms as normal biological processes rather than illnesses, more often seek professional medical advice, adopt healthier coping strategies, and engage with evidence-based treatments like hrt or lifestyle changes (nusrat et al., 2021). Conversely, women with lower education frequently normalize or minimize symptoms, leading to prolonged suffering and diminished quality of life.

A 2023 urban Indian cross-sectional study found that women without formal education were nearly twice as likely to report moderate to severe thermoregulatory symptoms compared to university-educated women (mishra et al., 2023). This disparity was attributed to differences in health literacy, healthcare access, and culturally conditioned gender roles. Similarly, surveys in Pakistani cities such as Karachi reveal that less-educated women rely mainly on informal support or traditional remedies and seldom access clinical care for menopausal symptoms (ali et al., 2022).

Urban environments pose both advantages and challenges for menopausal women. While urban areas often provide better healthcare infrastructure and information availability, they are also

characterized by higher stress levels, sedentary lifestyles, and environmental pollution all factors that may exacerbate thermoregulatory symptoms (davis et al., 2021). Karachi's dense population, socioeconomic diversity, and environmental issues create a complex landscape where thermoregulatory symptoms burden intersects with healthcare inequalities and awareness gaps.

Additionally, socioeconomic status, closely tied to education, deeply influences women's ability to manage menopause. For example, a 2020 study from Bangladesh reported that women of lower SES experienced more severe thermoregulatory symptoms but had limited coping resources beyond family support (begum et al., 2020). Financial constraints reduce access to nutritious food, secure housing, and regular medical care, indirectly worsening menopausal outcomes.

Cultural silence surrounding menopause further intensifies disparities. In many south Asian communities especially among less-educated and conservative women menopause is rarely discussed openly. This silence inhibits knowledge sharing and timely intervention. Some women interpret hot flashes as supernatural or spiritual phenomena rather than biological symptoms, delaying appropriate medical care (sharma et al., 2022).

In conclusion, education and urban context are fundamental not incidental to the menopausal experience. They shape symptom recognition, endurance, and management. Addressing these factors through targeted health education, intervention programs, and equitable urban health policies is essential for enhancing menopausal health in urban south Asian settings such as Karachi.

Research Gaps

Limited population-based data on thermoregulatory symptom prevalence and severity among South Asian women, specifically in Pakistan's urban contexts.

Insufficient understanding of how education level and other socio-demographic factors influence the perception, reporting, and severity of menopausal symptoms in Karachi.

Lack of culturally sensitive research addressing the psychosocial and functional impacts of these symptoms in Pakistani women.

Minimal investigation into healthcare-seeking behaviors and barriers related to menopausal symptom management in low- and middle-income countries.

Conceptual/ Theoretical Framework

The study is grounded in the Bio psychosocial Model, which recognizes that menopausal symptoms are influenced not only by biological changes (fluctuating estrogen levels) but also by psychological factors and socio-demographic contexts such as education, culture, and urban living conditions. It incorporates theories relating to health literacy and social determinants of health, emphasizing the role of education in symptom management and health outcomes. This framework underpins analysis of how educational disparities may exacerbate symptom severity and impede well-being among women in Karachi.

METHODOLOGY

Study Design

This is a cross-sectional, community-based survey focuses on finding the prevalence, seriousness, and effect of thermoregulatory symptoms among menopausal women in Karachi. This study design enables the collection of data at a single point in time which allows the assessment of both vasomotor symptoms and its association with different socioeconomic, demographic and functional parameters. It also highlights the correlations of thermoregulatory symptoms in a mixed urban population.

Study Population

Menopausal women aged 40 years and above who are residents of Karachi were selected as the target population. Women from different occupational, educational and socioeconomic backgrounds were included in this study.

Eligibility Criteria

Inclusion Criteria

1. Women aged 40 years old and above.
2. Women who are permanent residents of Karachi.
3. Women who have experienced menopause naturally (cessation for at least 1 year).

4. Women who provide informed consent.

Exclusion Criteria

1. Women who are currently on any medication that alters their menstrual cycle.
2. Women who are being treated for menopausal related symptoms.
3. Women who have surgically induced menopause.
4. Women with psychological disorders (e.g., depression).
5. Women who have any chronic illness that may confound symptom reporting (e.g., thyroid disorders)
6. Women with cognitive impairment or women with language barriers.

Study Setting

Urban localities of Karachi, Pakistan were targeted for this study. This setting included all low-, middle, and high-income societies. This diversity includes participants from different cultural, ethnic and socioeconomic backgrounds. Participants were recruited from hospital settings, women's recreational centers, community centers and clinics.

Data Collection Method

Data was collected through a well-structured questionnaire, adapted from previously validated tools. It was later modified due to cultural sensitivity. The questionnaire includes the following sections.

1. Demographic information (age, marital status, education, occupation)
2. Presence, frequency and severity of vasomotor symptoms (hot flashes, night sweats)
3. Impact of thermoregulatory symptoms on daily life.
4. Healthcare seeking behaviors.

Plan of Analysis

Descriptive Statistics

For categorical variables like education level, marital status, employment status, presence of hot flashes or night sweats, severity of thermoregulatory symptoms, impact of thermoregulatory symptoms on social life, emotional well-being, sleep and daily activities, frequency and percentages will be calculated.

For ordinal variables like severity levels, frequency of symptoms and satisfaction levels, frequency and percentages will be reported.

Since age is also being treated like an ordinal categorical variable, therefore frequency and percentages will be reported.

Inferential Statistics

Education level and severity of thermoregulatory symptoms

A chi-square test of independence will be used to determine the association between the level of education and severity of thermoregulatory symptoms.

Parameters For Sample Size Calculation

For this cross-sectional study on the prevalence and impact of thermoregulatory symptoms among menopausal women in Karachi, the following parameters were used to calculate the required sample size:

- **Estimated prevalence (p):** 31% (0.31), based on a community-based study conducted in Karachi that reported 287 postmenopausal women out of a sample of 925 aged above 35 years (qazi et al., 2006).

- **Confidence level (z):** 95%, corresponding to a z-score of 1.96.

- **Margin of error (e):** 5% (0.05), representing the maximum allowable difference between the sample estimate and the true population proportion.

- **Population size (n):** not specified, assuming a large population where the finite population correction is not required.

The formula used for calculating the sample size for a proportion in large populations is:

$$N = (z^2 \times p(1 - p)) / e^2$$

$$N = (1.96^2 \times 0.31(1 - 0.31)) / (0.05^2)$$

$$N = (3.8416 \times 0.2139) / 0.0025$$

$$N = 0.8223 / 0.0025$$

$$N = 328.92$$

Results were cross validated using the open epi sample size calculator (version 3.01), which corroborated the manual computation.

RESULTS

Descriptive analysis

Table 1: demographic characteristics (n = 329)

Variable	Frequency (n)	Percentage (%)
Age group		
40-45	115	35.0
46-50	98	29.8
51-55	58	17.6
>55	58	17.6
Marital status		
Married	231	70.2
Widowed/divorced	98	29.8
Education level		
No formal education	72	21.9
Primary education	91	27.7
Secondary education	83	25.2
Higher education	83	25.2
Occupation		
Employed	99	30.1
Housewife/unemployed	230	69.9

Prevalence and severity of thermoregulatory symptoms

Table 2: prevalence and severity of thermoregulatory symptoms (n = 329)

Variable	Frequency (n)	Percentage (%)
Any thermoregulatory symptoms	229	69.6
No thermoregulatory symptoms	100	30.4
Severity of thermoregulatory symptoms		
Mild	92	40.2
Moderate	91	39.7
Severe	46	20.1

Impact of thermoregulatory symptoms on daily life

Table 3: impact of thermoregulatory symptoms on sleep, work, and emotional well-being (n = 329)

Impact area	Frequency (n)	Percentage (%)
Disruption in sleep	132	40.1
Impact on work productivity	99	30.1
Emotional well-being affected	115	35.0

Analytical Results:

Table 4: association between education level and severity of thermoregulatory symptoms (n = 229 with thermoregulatory symptoms)

Education level	Mild (n, %)	Moderate (n, %)	Severe (n, %)	Total (n)
No formal education	20 (27.8%)	33 (45.8%)	19 (26.4%)	72
Primary	30 (33.0%)	45 (49.5%)	16 (17.6%)	91
Secondary	22 (26.5%)	46 (55.4%)	15 (18.1%)	83
Higher	20 (24.1%)	29 (34.9%)	34 (41.0%)	83

Interpretation:

there is a trend suggesting that women with no formal education or only primary education are more likely to have moderate or severe

thermoregulatory symptoms. The chi-square test ($\chi^2 = 12.5$, $p = 0.05$) indicates a statistically significant association between education level and thermoregulatory symptoms severity.

Table 5: impact of thermoregulatory symptoms severity on daily life (n = 229 with thermoregulatory symptoms)

Severity level	Sleep disruption (n, %)	Work productivity impact (n, %)	Emotional well-being affected (n, %)
Mild	20 (21.7%)	15 (16.3%)	18 (19.6%)
Moderate	50 (54.9%)	40 (43.9%)	45 (49.5%)
Severe	62 (78.3%)	44 (69.6%)	52 (71.3%)

Interpretation:

there is a clear trend: as thermoregulatory symptoms severity increases, the proportion of women reporting sleep disruption, work productivity loss, and emotional distress also increases. This suggests that severe thermoregulatory symptoms have a much greater impact on daily functioning.

DISCUSSION:

This study reveals that 69.6% of menopausal women in Karachi report experiencing thermoregulatory symptoms, with 20.1% describing them as severe. These findings align with prior global estimates yet highlight particular challenges in this urban South Asian setting. The significant association between education level and symptom severity ($\chi^2 = 12.5$, $p = 0.05$) indicates that less educated women are disproportionately burdened by moderate to severe

symptoms. Specifically, women with no formal education or only primary education showed higher proportions of moderate/severe symptoms compared to those with higher education. This suggests a potentially critical role of health literacy, access to care, and socio-economic determinants intertwined with education in shaping menopausal experiences.

The impact on daily functioning is substantial: among women with severe symptoms, 78.3% reported sleep disruption, 69.6% experienced reduced work productivity, and 71.3% had impaired emotional well-being. The clear gradient observed in functional impact by symptom severity underscores the clinical and public health urgency to address menopausal symptom management, particularly targeting vulnerable populations.

These insights emphasize that thermoregulatory symptoms are not merely physiological inconveniences but have profound psychosocial implications that require integrated healthcare approaches including education, counseling, and access to menopausal care. Given Karachi's complex socio-economic landscape, public health interventions must also address stigma and cultural barriers inhibiting open discussion and timely healthcare seeking.

Future research should look longitudinally to understand symptom trajectories and explore intervention efficacy. Additionally, expanding studies into rural and other socio-cultural environments in Pakistan would enrich understanding and health equity.

Recommendations

Healthcare Providers: Enhance education and counseling services on menopause and thermoregulatory symptoms, with tailored messaging for women with lower education levels to improve health literacy.

Public Health Policy: Develop culturally sensitive awareness campaigns to reduce stigma surrounding menopause and promote timely healthcare seeking.

Health Systems: Integrate menopausal symptom management including non-pharmacological and pharmacological interventions into primary

healthcare services accessible to all socioeconomic groups.

Research: Encourage population-based longitudinal studies to explore symptom trajectories and evaluate interventions across different Pakistani regions and socio-cultural contexts.

Study Strengths:

The study uses a well-defined cross-sectional design with a representative urban sample of 329 menopausal women aged 40 years and above, covering diverse educational, occupational, and socio-demographic backgrounds.

Detailed data collection on symptom severity and its correlates allows for nuanced analysis of education's role in symptom experience and daily impact.

Utilization of standardized symptom categorization (mild, moderate, severe) and measurement of effects on key functional domains (sleep, work, emotional health) strengthens the clinical relevance.

The study fills a critical empirical gap by providing localized data from Karachi, which is underrepresented in global menopause research.

Limitations

The cross-sectional design limits the ability to determine causality or track symptom progression over time.

Reliance on self-reported data may introduce recall bias or underreporting influenced by cultural stigma. The study is geographically restricted to Karachi, limiting generalizability to rural or other South Asian populations.

Lack of objective clinical assessments of symptom severity or physiological measures.

Future Scope

Conduct longitudinal and intervention-based research to assess changes in symptom severity and effectiveness of different management strategies over time.

Expand research scope to include rural populations and other provinces in Pakistan to compare regional and cultural differences in menopausal experiences.

Explore qualitative studies to better understand cultural beliefs, stigma, and healthcare-seeking behaviors related to menopause.

Investigate the role of additional socio-demographic factors such as income, occupation, and marital status in influencing symptom severity and impact. Develop and evaluate community-based educational programs aimed at improving menopausal health literacy and access to care.

CONCLUSION:

Thermoregulatory symptoms are highly prevalent among menopausal women in Karachi and are significantly worse in women with lower education levels. These symptoms substantially disrupt sleep, work productivity, and emotional well-being, indicating a major public health concern. Tailored educational and healthcare resources are essential to mitigate these impacts and improve quality of life among this population. This study provides crucial localized evidence underscoring the need for culturally sensitive, accessible menopausal health services in Pakistan.

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Authors Contribution

Muhammad Tahir Akram has Substantial Contribution to study design, analysis, and acquisition of Data Manuscript Writing. He has given Final Approval of the version to be published.
Ayesha Nasir has Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing. She has given Final Approval of the version to be published.
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Dr. Geeta Goswami has given Final Approval of the version to be published