

Association of anxiety persistence, premenstrual dysphoric disorder, and problematic internet use with cognitive dysfunction in anxious reproductive-aged women: a cross-sectional study

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ABSTRACT

INTRODUCTION: Women of reproductive age often face hormonal fluctuations, dual-role pressures, and a tendency to use the internet as a coping mechanism, all of which may lead to persistent distress and impair memory and concentration. This study aimed to identify the associations between anxiety persistence and severity, premenstrual dysphoric disorder (PMDD), and problematic internet use (PIU) and cognitive function in women of reproductive age.

METHODS: In this cross-sectional analytic observational study, 86 women aged 19–45 were recruited via accidental sampling. Initial anxiety screening used the GAD-7, excluding scores 0–4 and including only respondents with scores ≥ 5 . We then assessed PMDD with the Premenstrual Symptoms Screening Tool (PSST), PIU via a standardized questionnaire, and cognitive dysfunction using Montreal Cognitive Assessment-Indonesian Version (MoCA-INA), where dysfunction was defined as a score < 26 .

RESULTS: The majority of respondents experienced cognitive dysfunction (74.42%, $n=64$). This occurred within a sample where 61.63% ($n=53$) exhibited severe anxiety and 53.49% ($n=46$) had anxiety lasting ≥ 5 years. Additionally, 39.53% ($n=34$) screened positive for PMDD and 77.91% were classified as having problematic internet use. Significant associations were found between cognitive dysfunction and anxiety severity (Odds Ratio, OR = 4.7; 95% Confidence Interval, CI: 1.23–17.9; p -value, $p = 0.023$), anxiety duration ≥ 5 years (OR = 4.9; 95% CI: 1.27–18.9; $p = 0.021$), PMDD positivity (OR = 7.3; 95% CI: 1.48–36.6; $p = 0.015$), and problematic internet use (OR = 5.7; 95% CI: 1.33–24.7; $p = 0.019$).

CONCLUSION: Anxiety severity and duration, PMDD, and problematic internet use are associated with cognitive dysfunction among reproductive-aged women.

Keywords: Anxiety, premenstrual dysphoric disorder, problematic internet use, cognitive dysfunction

INTRODUCTION

Globally, anxiety affects 4% of the world's

population (around 970 million people), with higher prevalences in the United States (11–18% of adults) and Europe (4–7% annually) [1].

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Importantly, chronic anxiety elevates cortisol, damaging the hippocampus and impairing critical cognitive functions like memory and concentration [2-7]. This can form a vicious cycle where prolonged anxiety leads to cognitive decline, which in turn exacerbates stress [8]. The onset of this cognitive impairment varies with anxiety severity, symptom intensity, and duration [9].

This psychological burden is often compounded by other factors. Problematic internet use (PIU), for example, can disrupt sleep, reduce physical activity, increase social anxiety, and contribute to cognitive decline [10]. Furthermore, Premenstrual Dysphoric Disorder (PMDD) increases women's vulnerability to cognitive dysfunction due to mood and anxiety exacerbations from hormonal fluctuations during the luteal phase [11].

Despite the established individual links between anxiety, PMDD, and problematic internet use with cognitive impairment, a comprehensive understanding of their combined and synergistic impact on cognitive function in women of reproductive age remains underexplored. This gap is particularly significant as much of the existing research on cognitive dysfunction predominantly focuses on elderly populations or clinical neurological conditions, often overlooking complex interactions in younger, non-clinical cohorts [12-15]. Consequently, there is a limited understanding of how these multifaceted psychosocial and hormonal factors uniquely affect cognitive health in reproductive-aged women. This study aims to examine these complex associations in women of reproductive age, specifically integrating anxiety persistence and severity, PMDD, and problematic internet use.

METHODS

Study Design and Setting

This study adopted an analytical observational approach with a cross-sectional design and was carried out at the General Polyclinic of the Baiturrahman Community Health Center, Banda Aceh, Indonesia, from January to March 2025.

Participants and Sampling

The required sample size for this study was determined using Slovin's formula to ensure accurate population representation. The target population (N) was identified from the total female patients visiting the Baiturrahman Community

Health Center General Polyclinic during January 2025, which amounted to 591 individuals. Based on this formula, using a margin of error (e) set at 10% (0.1), the minimum required sample size was calculated to be 85.52, which was rounded up to establish a representative minimum sample of 86 respondents.

Following this calculation, a final sample of 86 women of reproductive age (19–45 years) was selected. Primary data were collected through questionnaires. Initial anxiety screening was performed using the Generalized Anxiety Disorder-7 (GAD-7). Respondents with scores of 0–4 (normal) were excluded, and only those with scores ≥ 5 (mild to severe anxiety) were included in the analysis. Thus, the study sample comprised women of reproductive age experiencing anxiety.

Participants included patients visiting the general polyclinic, women of reproductive age (19–45 years), possessing a minimum of elementary school education, and providing informed consent to participate in the study. Conversely, patients were excluded if they had metabolic syndrome disorders (e.g., hypertension, diabetes) that could influence study results; were diagnosed with severe mental disorders (e.g., psychosis); were experiencing menopause; had comorbidities such as central nervous system disorders (e.g., infections, post-stroke) or a history of head trauma and/or cerebral hemorrhage; were illiterate; or were uncooperative.

Variables

The dependent variable was cognitive dysfunction in women of reproductive age. Independent variables included duration of anxiety, severity of anxiety, problematic internet use (PIU), and premenstrual dysphoric disorder (PMDD).

Instruments

Standardized instruments were used for data collection, including the Generalized Anxiety Disorder-7 (GAD-7) [18] to assess anxiety severity, the Premenstrual Symptoms Screening Tool (PSST) [19] to assess PMDD, the Problematic Internet Use Questionnaire (PIUQ) [20,21] to assess problematic internet use, and the Montreal Cognitive Assessment Indonesia (MoCA-INA) [22] questionnaire to evaluate cognitive function in women of reproductive age with anxiety.

For the analysis, several quantitative variables were dichotomized based on established clinical

cut-offs or prior literature. The dependent variable, Cognitive Status, was categorized using the standard guideline for the Montreal Cognitive Assessment (MoCA-INA), where a score of < 26 was classified as 'Cognitive Dysfunction' and a score \geq 26 was classified as 'Normal Cognitive Function'. Although MoCA is widely used for screening in older adults, its use in this study's population (ages 19-45) is appropriate and well-supported.

The instrument was originally developed to detect mild cognitive impairment in patients 18 years and older [23]. Furthermore, recent literature confirms its valid application in assessing cognitive deficits in younger adult populations and within mental health contexts, such as early-stage psychosis [24]. For the independent variables, Anxiety Severity was grouped based on standard GAD-7 scoring thresholds: 'Mild' (total score 5-9) and 'Severe' (total score 10-21). Anxiety Duration was categorized into '< 5 Years' and ' \geq 5 Years' to distinguish chronic anxiety based on definitions used in prior research. Problematic Internet Use (PIU) was classified using the standard PIUQ instrument cut-off, where a total score of \geq 41 was defined as 'Problematic'. Finally, PMDD status was determined using the official diagnostic criteria of the Premenstrual Symptoms Screening Tool (PSST), which requires a participant to meet three specific criteria: (1) at least one severe core mood symptom (#1-4), (2) at least four moderate-to-severe total symptoms (#1-14), and (3) at least one instance of severe functional impairment (A-E).

Data Collection

This study was conducted at the General Polyclinic of the Baiturrahman Community Health Center. The sampling frame was established from the total number of patient visits during the research period, which amounted to 591 individuals. A non-probability, accidental sampling technique was employed to recruit participants from this frame. The recruitment process targeted women of reproductive age (19–45 years) who were present in the polyclinic's waiting queue. Prospective participants were approached, provided with a detailed explanation of the study, and subsequently underwent an initial verbal screening. The exclusion criteria for this first stage were: education level below the required threshold, illiteracy, or a self-reported history of hypertension, diabetes, severe mental disorders (e.g., hallucinations), stroke, brain

infections, or menopause. Individuals who met these initial criteria were then asked to provide written informed consent.

Following consent, a second screening was administered using the Generalized Anxiety Disorder-7 (GAD-7) questionnaire to identify the target analytical sample. Respondents with a GAD-7 score of 0–4 (normal range) were excluded from the study. Only those with a score of \geq 5, indicating at least mild anxiety, were included in the final sample.

Data for the final sample were collected by two trained enumerators with backgrounds in public health. The data point for anxiety severity was taken directly from the GAD-7 score obtained during the second screening. The following additional instruments were administered: the Premenstrual Symptoms Screening Tool (PSST) to assess PMDD, the Problematic Internet Use Questionnaire (PIUQ), and the Montreal Cognitive Assessment (MoCA) to evaluate cognitive function. The entire interview and assessment process lasted approximately 8–10 minutes per respondent. This duration varied slightly, primarily because specific sections of the MoCA, such as the pattern drawing test, required more time and concentration from the participant.

From the total 591 patient visits (sampling frame), 240 individuals were approached and screened. After the two-stage screening process (verbal and GAD-7), a final sample of 86 participants with anxiety was obtained. The lower interview-to-visit ratio is primarily attributed to a high volume of elderly patients who did not meet the age criteria, as well as patient refusals or individuals not being in a suitable condition for an interview.

Data Analysis

Data analysis was performed using STATA MP-17 statistical software. Missing data were handled using listwise deletion, where participants with any missing data on the variables of interest were excluded from the analysis. All 86 participants provided complete data for the final model. The analysis employed multivariate binary logistic regression with a stepwise approach, where variables were selected for inclusion in the model based on a P-value threshold of <0.05.

Ethical approval for the study was obtained

from The Research Ethical Committee of Health Polytechnic of Health Ministry of Aceh (Ethical Approval Number: DP.04.03/12.7/222/2025). Prior to data collection, all participants received comprehensive information regarding the study's objectives, procedures, potential risks, and benefits. Written informed consent was obtained from each participant, ensuring their voluntary participation. Participants were also informed of their right to withdraw from the study at any time without prejudice. Confidentiality and anonymity of all collected data were strictly maintained throughout the study.

RESULTS

The sociodemographic and basic clinical characteristics of the 86 respondents are presented in Table 1. The majority of respondents were in the 35–45-year age group (43.02%), followed by the 25–34-year group (38.37%). A significant majority were Housewives (82.56%) and had completed Senior High School (70.93%). Age at menarche varied, with the most common onset ages being 11 years (30.23%) and 13 years (26.74%).

Table 1: Respondent Characteristics (n=86)

Characteristics	n	%
Respondent Age		
19-24 Years	16	18.6
25-34 Years	33	38.37
35-45 Years	37	43.02
Occupation		
Housewives	71	82.56
Employed	15	17.44
Highest Education Level		
Junior High School	2	2.33
Senior High School	61	70.93
Higher Education	23	26.74
Age at Menarche		
10 Years	1	1.16
11 Years	26	30.23
12 Years	17	19.77
13 Years	23	26.74
14 Years	19	22.09

Further analysis focused on the prevalence and distribution of key study variables. In the univariate analysis, as detailed in Table 2, it was found that the majority of respondents experienced cognitive dysfunction (74.42%) compared to those with normal cognitive function (25.58%). Furthermore, the proportion of respondents with severe anxiety (61.63%) was notably higher than those with mild anxiety (38.37%). Regarding the duration of

anxiety, there was an almost equal distribution between respondents suffering for five years or more (53.49%) and those suffering for less than five years (46.51%). In terms of PMDD, 39.53% of respondents were identified as experiencing the condition, while 60.47% did not. Lastly, analysis of internet use indicated that 77.91% of respondents were categorized as problematic users, whereas 22.09% did not experience such issues. Comprehensive univariate data for these variables are presented in Table 2.

Table 2: Univariate Analysis of Factors Associated with Cognitive Status (n=86)

Variable	Frequency	Percentage
Cognitive Status		
Cognitive Dysfunction	64	74.42
Normal Cognitive Function	22	25.58
Severity of Anxiety		
Severe	53	61.63
Mild	33	38.37
Duration of Anxiety		
≥5 Years	46	53.49
<5 Years	40	46.51
Premenstrual Dysphoric Disorder (PMDD)		
PMDD	34	39.53
Non-PMDD	52	60.47
Problematic Internet Use (PIU)		
Problematic	67	77.91
Normal	19	22.09

Bivariate analysis using logistic regression (Table 3) revealed significant associations between the independent variables and cognitive function. Respondents experiencing severe anxiety had a prevalence of cognitive dysfunction of 88.68% compared to 51.52% in respondents with mild anxiety, with an Odds Ratio (OR) of 7.3 (95% CI: 2.47-21.9; $p < 0.001$), indicating that severe anxiety was significantly associated with cognitive dysfunction.

Furthermore, the duration of anxiety also showed a significant association with cognitive dysfunction. Respondents who had suffered from anxiety for ≥5 years had a cognitive dysfunction prevalence of 86.96%, whereas in the group with anxiety for less than 5 years, it was only 60% (OR = 4.4; 95% CI: 1.53-12.9; $p = 0.006$). Additionally, analysis of Premenstrual Dysphoric Disorder (PMDD) revealed a significant association, with respondents experiencing PMDD showing a cognitive dysfunction prevalence of 91.18% compared to 63.46% in the non-PMDD group (OR = 5.9; 95% CI: 1.60-22.1; $p = 0.004$).

Table 3: Bivariate Analysis of Factors Associated with Cognitive Status

Independent Variable	Cognitive Status				Total		OR	95% CI	P-value
	Cognitive Dysfunction (n)	Cognitive Dysfunction (%)	Normal Cognitive Function (n)	Normal Cognitive Function (%)	(n)	(%)			
Severity of Anxiety									
Severe	47	88.68	6	11.23	53	100	7.3	2.47-21.9	0.0001*
Mild	17	51.52	16	48.48	33	100			
Duration of Anxiety									
≥5 Years	40	86.96	6	13.04	46	100	4.4	1.53-12.9	0.006*
<5 Years	24	60	16	40	40	100			
Premenstrual Dysphoric Disorder (PMDD)									
PMDD	31	91.18	3	8.82	34	100	5.9	1.60-22.1	0.004*
Non-PMDD	33	63.46	19	36.54	52	100			
Problematic Internet Use (PIU)									
Problematic	57	85.07	10	14.93	67	100	9.7	3.09-30.8	0.0001*
Normal	7	36.84	12	63.16	19	100			

*Statistically significant at $p < 0.05$

Finally, regarding problematic internet use (PIU), respondents with problematic internet use had a cognitive dysfunction prevalence of 85.07% compared to 36.84% in non-problematic respondents (OR = 9.7; 95% CI: 3.09-30.8; $p < 0.001$), confirming a significant association between PIU and cognitive dysfunction. Detailed bivariate analysis results are presented in Table 3.

Multivariate analysis using stepwise logistic regression with a significance level of $p < 0.05$ (Table 4) revealed significant associations between cognitive status and the independent variables examined. Respondents with severe anxiety had an Odds Ratio (OR) of 4.7 (95% CI: 1.23–17.9; $p = 0.023$), indicating that severe anxiety significantly had higher odds of cognitive dysfunction. Additionally, a duration of anxiety of ≥5 years showed an OR of 4.9 (95% CI: 1.27–18.9; $p = 0.021$), confirming that a longer duration of anxiety was significantly associated with cognitive dysfunction. Furthermore, respondents testing positive for Premenstrual Dysphoric Disorder (PMDD) had an OR of 7.3 (95% CI: 1.48–36.6; $p = 0.015$), and individuals with problematic internet use (PIU) showed an OR of 5.7 (95% CI: 1.33–24.7; $p = 0.019$). These findings confirm that all four variables were significant factors associated with the respondents' cognitive status.

DISCUSSION

This study found significant associations between various psychological burdens, problematic digital behaviors, and cognitive dysfunction in reproductive-age women. Specifically, severe anxiety (OR = 4.7; $p = 0.023$), anxiety lasting ≥5 years (OR = 4.9; $p = 0.021$), Premenstrual Dysphoric Disorder (PMDD) (OR = 7.3; $p = 0.015$), and problematic internet use (PIU) (OR = 5.7; $p = 0.019$) were all factors significantly associated with cognitive dysfunction. The multivariate model, explaining a substantial 36.50% of the variability in cognitive dysfunction (Pseudo R² = 0.3650), underscores the strength of these associations. This highlights that chronic psychological stressors, mood fluctuations, and uncontrolled digital habits are linked to core cognitive functions, necessitating an integrated intervention framework focused on cognitive behavioral therapy, healthy digital literacy, and long-term clinical support to optimize women's cognitive health and overall quality of life.

The significant association between anxiety severity and cognitive dysfunction is well-supported by existing literature. Severe anxiety consistently impairs cognitive performance across domains like working memory, executive control,

Table 4: Multivariate Logistic Regression Model for Cognitive Dysfunction

Cognitive Dysfunction	OR	95% CI	P-value
Severity of Anxiety (Severe)	4.7	1.23-17.9	0.023*
Duration of Anxiety (≥5 Years)	4.9	1.27-18.9	0.021*
Premenstrual Dysphoric Disorder (PMDD) (Positive PMDD)	7.3	1.48-36.6	0.015*
Problematic Internet Use (PIU) (Problematic)	5.7	1.33-24.7	0.019*

Pseudo R²=0.3650; *Statistically significant at $p < 0.05$

and decision-making [25-27]. Studies indicate that higher anxiety levels are linked to reduced processing speed and increased odds of cognitive impairment, with anxiety induction shown to disrupt cognitive control [28-30]. Our finding of a high prevalence of severe anxiety (61.63%) in reproductive-age women suggests a considerable local burden, far exceeding global estimates [31]. This suggests that chronic psychological stress from severe anxiety can lead to sustained deficits in attention, memory, and concentration. Biologically, elevated cortisol and dysregulated neurotransmitters (serotonin, dopamine) likely contribute to these effects, compounded by factors like sleep disturbance and mental fatigue, emphasizing the need for early intervention and management. Similarly, the duration of anxiety was significantly associated with cognitive dysfunction, with over half of our sample reporting anxiety for five years or more. Prolonged exposure to anxiety can compromise neuroplasticity and accelerate neuronal degeneration in critical brain regions like the hippocampus and prefrontal cortex. This aligns with longitudinal studies showing that chronic stress and anxiety increase the risk of long-term cognitive decline, including mild cognitive impairment and dementia [32-35]. Furthermore, the co-occurrence of subjective cognitive decline and anxiety symptoms dramatically increases the risk of progression to MCI or dementia [36-38]. Our findings support the assumption that longer anxiety exposure leads to greater accumulated stress impact on the brain, especially when coupled with ineffective stress adaptation and limited psychosocial support. Thus, long-term anxiety management is crucial for preserving cognitive function in this demographic.

The presence of Premenstrual Dysphoric Disorder (PMDD) also emerged as a significant risk factor for cognitive dysfunction, affecting nearly two in five women in our study (39.53%). PMDD's characteristic hormonal fluctuations and mood disturbances likely linked to neurocognitive processes, particularly attention, memory, and decision-making. Significant hormonal shifts during the menstrual cycle can dysregulate neurotransmitters, like serotonin, vital for cognitive function. While self-reported cognitive difficulties strongly correlate with PMDD severity, objective cognitive tests may show a weaker link, highlighting the subjective experience's salience

[39]. Our results are consistent with research showing higher anxiety and depression levels in women with PMDD, with generalized anxiety disorder significantly increasing PMDD risk [40,41]. This suggests that PMDD's link to cognitive dysfunction, via biological and psychological mechanisms, necessitates targeted interventions to prevent long-term cognitive impact.

Finally, problematic internet use (PIU) was identified as a strong independent correlate of cognitive dysfunction, with a high prevalence (77.91%) in our sample. Excessive internet use can disrupt concentration, sleep patterns, and diminish cognitive stimulation from productive activities, leading to mental fatigue and reduced cognitive performance in memory and attention [42,43]. Meta-analyses consistently link PIU to deficits in inhibitory control, decision-making, and working memory, regardless of gaming, age, or comorbidities [44]. Conversely, regular internet use has shown protective effects on cognitive function and against neurodegenerative diseases [44,45]. Our findings suggest PIU acts as a risk factor through mental fatigue, sleep disruption, reduced social cognitive stimulation, and persistent distraction, underscoring the urgent need for education on healthy internet use for cognitive health. However, this study has several methodological limitations. First and foremost, as explicitly noted by our reviewers, the cross-sectional design prevents any inference of causality. This study successfully demonstrates a strong association between factors like anxiety duration, PMDD, and PIU with cognitive dysfunction, but it cannot determine if these factors cause the dysfunction or vice-versa. Second, as the study aimed to explore factors within an anxious population, we did not include a non-anxious control group (i.e., GAD-7 score 0-4). The lack of this comparison group, as highlighted by our reviewers, limits the conclusions that can be drawn about the specific impact of anxiety itself. Third, while our multivariate analysis identified significant independent factors, other unmeasured confounding variables (e.g., diet, detailed sleep habits, social support) might still influence the observed associations. Finally, the study population from a single primary health care center (Puskesmas) limits the generalizability of these findings to broader populations in other settings.

This research underscores the urgent need for enhancing primary care services, particularly at community health centers like Puskesmas Baiturrahman, in detecting and managing risk factors for cognitive dysfunction in reproductive-age women. Given the strong association between anxiety severity and duration, PMDD, and PIU and the risk of cognitive impairment, Puskesmas should implement comprehensive, evidence-based screening for these conditions. This includes routine screening using standardized instruments (e.g., GAD-7 for anxiety [18], PSST for PMDD [19], and IAT for PIU [20,21]), systematic electronic health record keeping, and regular follow-up mechanisms by trained health personnel. Moreover, strengthening integrated referral pathways to psychologists or psychiatrists at the district/city level is crucial for complex cases beyond primary care capacity. Optimizing the role of nurses, midwives, and health promotion officers in providing education, initial counseling, and longitudinal monitoring is also a strategic step to prevent progression to cognitive dysfunction. These evidence-based interventions align with a promotive and preventive approach within the primary healthcare system, ultimately aimed at improving the quality of life for reproductive-age women.

For future research, a longitudinal design such as a cohort study is highly recommended to assess changes in cognitive function over time and its dynamic relationship with anxiety, PMDD, and PIU. Future studies should also endeavor to include additional confounding variables, such as social support, sleep habits, and caffeine consumption, as adjustment factors in the analytical models to enhance robustness. Furthermore, expanding the sample population to include multiple primary health care centers across different regions would significantly improve the generalizability of the findings.

Finally, adopting a mixed-methods approach that incorporates in-depth interviews or focus group discussions could provide a richer understanding of patients' subjective experiences and the underlying causal factors of cognitive impairment.

CONCLUSION

This study highlights that psychological burdens associated with anxiety—specifically its severity

and long-term presence (≥ 5 years), along with Premenstrual Dysphoric Disorder (PMDD) and problematic internet use (PIU)—are independent and significant factors associated with cognitive dysfunction in women of reproductive age experiencing anxiety. Our multivariate model confirmed the strength of these associations, explaining a notable portion of cognitive variability (i.e., distinguishing between impaired and normal cognitive function).

These findings underscore the critical interplay between specific mental health challenges, hormonal influences, behavioral patterns, and cognitive well-being within this vulnerable demographic. The high prevalence of these interconnected associated factors necessitates urgent, integrated interventions within primary healthcare, particularly through comprehensive screening, targeted support, and robust referral systems. Ultimately, addressing these interwoven challenges is vital for safeguarding cognitive function and enhancing the overall quality of life for women of reproductive age.

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