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Prevalence and Severity of Depression Among Primary Family Caregivers of Patients Admitted in Medical and Surgical Intensive Care Units (ICUs) Using the Patient Health Questionnaire-9 (PHQ-9): A Multicenter Cross-Sectional Study at Tertiary Care Hospitals in Pakistan

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ABSTRACT

PURPOSE

In Pakistan, strong familial bonds make family members as primary caregivers for patients admitted to intensive care units (ICUs). Despite continuous multidisciplinary care in ICUs, caregivers' mental health needs are often overlooked, creating a significant psychological burden alongside critical decision-making responsibilities. This multicenter cross-sectional study assessed the prevalence and severity of depression among primary caregivers of ICU patients in tertiary-care hospitals in Karachi, Pakistan.

METHOD

This study was conducted from February to July 2025 in the ICUs of Jinnah Postgraduate Medical Centre (JPMC), Liaquat National Hospital (LNH), and Civil Hospital Karachi (CHK). A total of 161 primary caregivers of medical and surgical ICU patients were enrolled. Participants completed the validated Urdu version of the Patient Health Questionnaire-9 (PHQ-9) and provided sociodemographic as well as clinical data. Eligible participants were first-degree relatives or friends able to communicate in English, Urdu, or Sindhi. Data were analyzed using SPSS version 26 with descriptive statistics, chi-square tests, and multivariable linear regression to identify independent factors associated with PHQ-9 scores.

RESULTS

The median PHQ-9 score was 6 (IQR: 2–11). Depression severity included 41.6% minimal, 25.5% mild, 19.3% moderate, 9.9% moderately severe depression, and 3.7% severe depression. On multivariable linear regression, admission to a medical ICU, patient mechanical ventilation, and a higher number of caregiver comorbidities were independently associated with higher PHQ-9 scores. Sleep disruption and witnessing other patients' suffering were strongly associated with increased depressive symptoms.

CONCLUSION

Primary family caregivers of ICU patients experience a substantial burden of depressive symptoms, highlighting the need for targeted psychological support, language-sensitive communication, and institutional policies addressing caregiver mental health in resource-limited settings.

KEYWORDS

Intensive care unit, caregiver depression, family caregivers, Patient Health Questionnaire-9, critical illness

INTRODUCTION

Intensive Care Units (ICUs) provide round-the-clock multidisciplinary care to patients with life-threatening illnesses or critical injuries, with the primary aim of stabilization and survival [1,2]. ICU admission can be a psychologically stressful experience not only for patients but also for their family members or primary caregivers. Healthcare workers focus primarily on patient care, often leaving caregivers' psychological well-being underrecognized during the ICU stay. In countries like Pakistan, where familial bonds and kinship are central to cultural norms, the mental health of primary caregivers of critically ill patients is frequently neglected [3].

ICU admissions pose significant social, financial, and health challenges for families and are frequently associated with psychological distress, including depression, anxiety, and post-traumatic stress disorder (PTSD). Notably, family members and caregivers are also at risk, with depression being the most common condition reported [4,5]. Many patients are intubated, sedated, or undergoing complex interventions, limiting their ability to participate in informed decision-making. This places significant emotional and cognitive stress on family members acting as surrogate decision-makers, who must advocate for the patient, make critical treatment decisions, and prepare for potential adverse outcomes [6].

In Pakistan and other resource-limited South Asian countries, mental health services are limited, stigmatized, and often inaccessible due to financial constraints. Families consider it their primary duty to remain at the patient's bedside throughout hospitalization, frequently putting their own mental and physical health at risk [3]. Despite these challenges, there is a clear scarcity of empirical data examining the prevalence and severity of depressive symptoms among primary caregivers of ICU patients in Pakistan.

The Patient Health Questionnaire-9 (PHQ-9) is a widely used and validated depression screening tool and is recommended for use in primary care and community settings by the US Preventive Services Task Force (USPSTF). It consists of nine items assessing depressive symptoms over the previous two weeks, with higher scores indicating greater symptom severity [7–9]. Studies report that PHQ-9 has 85% sensitivity and 89% specificity for detecting major depressive disorder [7]. The tool is simple to administer, culturally adaptable, and suitable for screening caregiver populations in clinical settings [8–12]. Timely detection of depressive symptoms in caregivers is essential to provide appropriate psychological support and prevent adverse outcomes.

This study aims to address the literature gap by assessing the prevalence and severity of depression among primary caregivers of patients admitted to medical and surgical ICUs in three major tertiary-care hospitals in Karachi, Pakistan. We believe that our findings will inform future interventions to support caregiver mental health and highlight the importance of caregiver-focused policies and psychosocial support in resource-limited critical care settings.

METHODS

Study design and Setting

This investigation employed a multicenter, cross-sectional design to assess the prevalence and severity of depressive symptoms among family caregivers of critically ill patients and to examine caregiver-, patient-, and context-level correlates of depression. The methodological framework adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for cross-sectional research.

The primary outcome was caregiver depressive symptom severity categorized using standard PHQ-9 cut-off scores. The study was conducted across the intensive care units (ICUs) of three major tertiary-care hospitals in Karachi, Pakistan: Jinnah Postgraduate Medical Centre (JPMC), Liaquat National Hospital (LNH), and Civil Hospital Karachi (CHK).

These institutions serve as high-volume referral centers providing medical and surgical critical care services. The ICUs operate under 24-hour admission cycles and maintain a continuous influx of emergency and postoperative

cases, offering substantial heterogeneity in case-mix and caregiver demographics. Data collection occurred over a six-month period from February to July 2025.

Study population

The source population comprised family caregivers of patients admitted to medical or surgical ICUs. For the purposes of this study, a primary caregiver was defined as an individual aged 18 years or older, identified as a parent, spouse, sibling, adult child, other close relative, or friend of an ICU patient, who was able to communicate in English, Urdu, or Sindhi, was present at the hospital during data collection, and provided informed verbal consent.

Caregivers under 18 years of age were excluded, as they may not be able to provide reliable responses or fully comprehend the questionnaire. Additional exclusion criteria included a self-reported history of a severe psychiatric disorder currently requiring active treatment, cognitive impairment, or inability to comprehend the questionnaire.

Information regarding previously diagnosed psychiatric illness was obtained through caregiver self-report during the interview based on their prior medical diagnosis. No formal psychiatric diagnostic or screening tool was administered to verify psychiatric history.

Sampling Method

A convenience sampling approach with consecutive recruitment was used. At each hospital, trained data collectors approached all potential caregivers who were present in the ICU waiting area during data collection shifts. Data collection was performed on weekday shifts during daytime hours. Eligibility was assessed, and all consenting individuals were enrolled until the end of the data collection period.

Caregivers were approached in the ICU waiting areas as this was the only feasible and standardized location where primary caregivers were consistently present and accessible during the patient's ICU stay across all participating hospitals. A total of 161 caregivers were included. The number of caregivers who were approached but declined participation or were ineligible was not formally recorded.

Sample Size

No a priori sample size calculation was performed because of limited prior local data on caregiver depression prevalence in ICU settings in Pakistan and logistical constraints. The final sample size was determined by feasibility and the number of eligible primary caregivers available during the study period across the participating hospitals. All eligible caregivers approached during the data collection period were invited to participate until the end of the study period, resulting in a final sample size of 161 participants.

Data Collection

A total of four trained data collectors (H.T., S.U.A.R., S.K., and S.A.A.S.) were involved in data collection across the three participating hospitals, with one to two data collectors assigned per site depending on shift availability. All received structured guidance on questionnaire administration, confidentiality, and management of distressed participants.

Data were collected using a structured questionnaire administered verbally to caregivers. Interviewers were trained to read each question clearly in the participant's preferred language (Urdu, Sindhi, or English), to provide neutral clarification when required, and to confirm participant understanding before recording responses. When caregivers appeared emotionally distressed, interviews were paused or discontinued at the participant's request to ensure comfort and voluntary participation.

To promote consistency across data collectors, all interviewers were provided with a standardized interview guide and were instructed to follow identical question wording and response options. No formal inter-rater reliability assessment was conducted. To reduce interviewer and social desirability bias, interviewers were instructed to

maintain neutral tone and to avoid providing feedback on participants' responses. The study instruments are described below.

1. **Sociodemographic and clinical variables**

Patient variables included age, sex, diagnostic category (medical vs. surgical condition), use of mechanical ventilation, hemodynamic parameters (e.g., presence of central venous pressure monitoring), and prior ICU or hospital admissions.

Caregiver variables included age, gender, marital status, education, occupation, household income bracket, comorbidities, relationship with the patient, previous caregiving experience, prior exposure to ICU settings, duration and frequency of hospital attendance, and distance travelled.

Standardized severity scores (e.g., APACHE II or SOFA) were not available for all patients and were therefore not included. Categorical variables (e.g., frequency of hospital admissions, duration of illness, prior ICU admissions, and socioeconomic indicators) were defined based on clinical relevance and local contextual considerations to facilitate participant comprehension and minimize non-response bias. Income categories (e.g., 10,000–50,000 PKR and higher categories used in the study questionnaire) were defined based on local income distribution data, national poverty thresholds, and government minimum wage benchmarks to reflect relevant socioeconomic strata in Pakistan [13,14].

2. **Caregiving experience indicators:**

Standardized Likert-scale items scored on a scale of 0 to 5 assessed caregivers' quality of communication with healthcare staff, perceived involvement in decision-making, informational sufficiency, emotional burden, sleep disruption, and exposure to distressing ICU events (e.g., observing resuscitation of other patients). Higher scores reflected greater frequency or intensity of the stated experience. No formal pilot study was conducted; however, the questionnaire was informally pre-tested during the initial phase of data collection to ensure comprehensibility, and no major difficulties or misunderstandings were reported by participants.

3. **Patient Health Questionnaire-9 (PHQ-9)**

Prevalence and severity of depressive symptoms among caregivers were measured using the 9-item Patient Health Questionnaire-9 (PHQ-9) [8]. The validated Urdu version was used [12]. The Urdu version has demonstrated acceptable internal consistency and construct validity in previous studies. No further cultural adaptations were made; however, the items were reviewed by the research team to ensure appropriateness and clarity for caregivers in the local context.

Items are scored from 0 to 3, yielding a total score ranging from 0 to 27. Higher scores indicate greater severity of depressive symptoms. The PHQ-9 is a screening instrument and does not establish a clinical diagnosis of major depressive disorder.

Consistent with established conventions, scores were categorized as follows: none/minimal depression (0–4), mild depression (5–9), moderate depression (10–14), moderately severe depression (15–19), and severe depression (20–27).

Statistical analysis

Data were analyzed using SPSS version 26 (IBM Corp., Armonk, NY). For descriptive statistics, continuous variables were summarized as medians with interquartile ranges (IQRs) owing to non-normal distributions, and categorical variables as frequencies and percentages. Differences in caregiver depression across categorical variables were assessed using the chi-square test or Fisher's exact test, as appropriate. Differences in continuous variables were assessed using the Mann–Whitney U test (for two-category variables) or Kruskal–Wallis test (for variables with more than two categories). A two-tailed p-value < 0.05 was considered statistically significant.

Variables showing significant differences in descriptive analyses ($p < 0.1$) were further evaluated using univariate linear regression to estimate effect sizes (β coefficients) for PHQ-9 total scores. Variables that remained statistically significant or were deemed clinically relevant were subsequently entered into multivariable linear regression models to identify independent predictors of caregiver depression. Regression coefficients (β), standard errors (SE), and 95% confidence intervals (CI) were reported for multivariable models.

All analyses followed a stepwise approach: descriptive comparisons (Table 5), univariate regression to quantify associations (Table 6), and multivariable regression to determine independent predictors (Table 7).

Ethical considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of Jinnah Postgraduate Medical Centre (JPMC) as the primary institution, and administrative ethical clearance was obtained from Liaquat National Hospital and Civil Hospital Karachi. All participants provided verbal informed consent, and confidentiality of data was strictly maintained. Participants who screened positive for severe depressive symptoms were informed about available mental health services within the respective hospital and advised to seek formal clinical evaluation.

RESULTS

Characteristics of Patients and Primary Family Caregivers

A total of 161 patient–caregiver dyads were included in the study. Patients had a median age of 40 years (IQR: 27–55) and were predominantly female (55.3%, n = 89) with males being (44.7%, n = 72). Most patients were married (78.3%, n = 126) and resided in urban areas (78.3%, n = 126). The largest occupational category among patients was homemakers, comprising (45.3%, n = 73), followed by employed individuals at (29.2%, n = 47). Most patients (41.8%, n = 66) reported having no major household responsibilities, while (20.9%, n = 33) served as primary earners. Nearly half of the families (48.7%, n = 77) had a monthly income ranging from PKR 10,000 to 50,000 (USD 35–177).

Most patients were admitted to medical ICUs (74.8%, n = 119), with most admissions occurring at JPMC (42.9%, n = 69), followed by CHK (29.8%, n = 48) and LNH (27.3%, n = 44). Leading causes for ICU admission included gastrointestinal/hepatobiliary conditions (20.1%, n = 32), obstetric/gynecologic issues (13.2%, n = 21), sepsis/infections (12.6%, n = 20), renal/electrolyte disorders (11.9%, n=19), respiratory illnesses (10.1%, n=16), oncologic/hematologic/toxicologic (10.1%, n=16), neurological (8.2%, n=13), trauma (6.9%, n=11), cardiovascular (3.8%, n=6), and other causes (3.1%, n=5). Most patients (73.1%, n = 117) had been ill for less than six months. Over half (54.7%, n = 88) had no prior hospitalizations, and a majority (79.1%, n = 125) had never been admitted to an ICU before. Central venous pressure lines were placed in (46.6%, n = 68), mechanical ventilation was required in (43.9%, n = 69), and nearly half (46.0%, n = 74) had no history of blood transfusions.

Primary family caregivers had a median age of 35 years (IQR 27–45), with males accounting for (64.0%, n=103) and females (36.0%, n=58). The majority resided in urban areas (82.0%, n=132), while (18.0%, n=29) lived in rural settings. Urdu was the most spoken language among caregivers (45.3%, n=73). The most common caregiver relationships observed were siblings, with brothers representing (16.1%, n=26) and sisters (9.9%, n=16), followed by sons (13.0%, n=21) and husbands (9.3%, n=15) of the critically ill patients. Most caregivers were married (78.3%, n=126), while (20.5%, n=33) were single and (1.2%, n=2) widowed. Employment was reported in (59.0%, n=95) of caregivers, and health-wise, (13.9%, n=22) had one comorbidity, with (6.3%, n=10) reporting two.

During the ICU stay, (77.6%, n=125) of caregivers had support from others to help manage responsibilities, but the majority (81.4%, n=131) had no previous experience caring for ICU patients. The predominant concern among caregivers was the patient's outcome, reported by (80.1%, n = 129). A large proportion of caregivers (78.1%, n=125) remained with the patient around the clock. Their length of stay varied: (41.5%, n=66) stayed less than 2 days, (29.6%, n=47) for 3–4 days, (9.4%, n=15) for more than 5 days, and (19.5%, n=31) for over a week.
The characteristics of the patients and their caregivers are detailed in Tables 1 and 2.

Experience of Primary Family Caregivers in the ICU

Caregivers described a wide spectrum of experiences while their loved ones were in the ICU, as detailed in Table 3. Slightly more than half (55.9%, n = 90) reported not feeling burdened by caregiving responsibilities, though a small portion (5.0%, n = 8) admitted to feeling burdened occasionally. Sleep disruption and fatigue were common, with (34.6%, n = 55) experiencing these issues very frequently and (10.1%, n = 16) encountering them intermittently. Observing the suffering of other patients in the ICU was particularly upsetting, affecting half of the caregivers (50.0%, n = 80) often or very often.

A minority (9.4%, n = 15) frequently felt that communication between departments and specialties was inadequate, wishing it had been more coordinated. Regarding updates from the medical team, only (37.8%, n = 60) reported that they were rarely informed about changes in the patient's clinical status, while (43.4%, n = 69) often or very often received clear explanations about treatment decisions.

In terms of participation in decision-making, (21.7%, n = 35) were very often satisfied with their involvement, yet (18.6%, n = 30) felt rarely included by the hospital team. Feeling pressured to consent to treatment was uncommon, with (49.7%, n = 79) reporting never experiencing pressure, though (5.7%, n = 9) sometimes felt compelled. The way bad news was communicated left many caregivers dissatisfied: (28.3%, n = 45) were rarely satisfied, compared with (20.1%, n = 32) who were very often satisfied.

The ICU waiting area was also a source of dissatisfaction, with (31.1%, n = 50) never satisfied and (21.7%, n = 35) rarely satisfied with the environment. Visits to patients were similarly limited in satisfaction; (39.1%, n = 63) were never satsfied or rarely satisfied, while (21.7%, n = 35) and (18.0%, n = 29) were often or very often content with their visiting experiences.

Over half (51.2%, n = 82) reported that their stress and uncertainty were never addressed by psychiatric social workers, and (65.4%, n = 104) indicated that their psychological needs were not assessed at all.

Caregiver Depression and Associated Factors

The median Patient Health Questionnaire-9 (PHQ-9) score among family caregivers was 6 (range 2–11). Analysis of depression severity revealed that (41.6%, n = 67) of caregivers had minimal depression, (25.5%, n = 41) mild depression, (19.3%, n = 31) moderate depression, (9.9%, n = 16) moderately severe depression, and (3.7%, n = 6) severe depression (Table 4).

Associations between caregiver depression levels and patient characteristics were assessed. Statistically significant differences were observed across the hospital of admission ($p < 0.001$) and type of ICU ($p = 0.0017$). Caregivers of patients admitted to CHK were more likely to report moderately severe or severe depression (68.8% and 33.3%, respectively), whereas those associated with LNH tended to report minimal to mild depression (31.3% and 34.1%, respectively). Similarly, caregivers of patients admitted to medical ICUs reported higher levels of depression (87.5% moderately severe and 83.3% severe) compared to those in surgical ICUs (12.5% moderately severe and 16.7% severe).

Other patient characteristics, including age, primary diagnosis/reason for admission, residence, urban vs. rural, gender, marital status, occupation, history of previous hospital admissions, illness duration, history of blood transfusions, patient role in household, history of previous ICU admissions, CVP status, total family monthly income, and mechanical ventilation use, were not significantly associated with caregiver depression levels ($p > 0.05$ for all). These results are summarized in Table 1.

Additionally, statistically significant associations were observed between caregiver depression levels and the presence of comorbidities ($p = 0.007$), the number of comorbidities if present ($p = 0.004$), and mother tongue ($p = 0.031$) (Table 2). Caregivers with comorbid conditions reported higher PHQ-9 scores, indicating greater depressive symptoms, with those having two comorbidities exhibiting the highest levels of depression. Additionally, differences in depression scores were noted across mother tongue groups.

Other caregiver characteristics, including age, relationship with the patient, residence (urban vs. rural), gender, marital status, occupation, availability of help from others, primary concern, duration of stay with the patient, previous ICU experience as attendant, and staying round the clock at the hospital, were not significantly associated with depression levels among caregivers ($p > 0.05$ for all). These results are summarized in Table 2.

Caregiver responses to experience-related statements were assessed to explore their association with depression levels (PHQ-9 total scores) (Table 3). Statistically significant associations were observed for several experience-related factors. Caregivers reporting compromised sleep and fatigue were more likely to exhibit higher depression scores ($p = 0.0001$). Similarly, those who indicated that the treating team kept them informed about the developing clinical picture ($p = 0.0292$) and received clear explanations of patient care procedures ($p = 0.008$) showed significant differences in PHQ-9 scores. Additionally, caregivers who found it upsetting to see what happened to other patients reported higher levels of depressive symptoms ($p = 0.0004$).

Other experience-related factors, including feeling burdened by caregiving, feeling pressurized to consent to treatment/interventions, desire for better coordination between wards/specialties, feelings of inadequacy in disease knowledge and management, satisfaction with how bad news was communicated, satisfaction with involvement in decision-making, satisfaction with the waiting area atmosphere, satisfaction with visits to the patient, routine mental health support by psychiatric social workers, and exploration of mental health needs, were not significantly associated with PHQ-9 scores (all $p > 0.05$). These results are summarized in Tables 3.

Univariate and Multivariable Analyses of Factors Associated with Caregiver Depression

To further explore factors influencing caregiver depression, univariate analyses were conducted examining patient and caregiver characteristics in relation to PHQ-9 total scores (Table 5).

Significant differences were observed across hospital of admission ($p = 0.001$), with caregivers of patients admitted to CHK reporting higher median PHQ-9 scores (10, IQR: 4.75–15.25) compared to those at JPMC (5, IQR: 1–12) and LNH (5, IQR: 2–9). Similarly, type of ICU admission was associated with PHQ-9 scores ($p = 0.002$), with caregivers of patients in medical ICUs exhibiting higher median scores (8, IQR: 2.5–13) relative to surgical ICUs (2, IQR: 1–7).

Caregiver characteristics also demonstrated significant associations. Caregivers with comorbidities reported higher PHQ-9 scores (median: 8.5, IQR: 5.25–15.75) than those without (median: 5, IQR: 2–10; $p = 0.007$). The number of comorbidities was positively associated with depression severity ($p = 0.004$), with those having two comorbidities exhibiting the highest median scores (13, IQR: 9–17). Mother tongue was also significantly associated with PHQ-9 scores ($p = 0.032$), with the highest median scores observed among participants categorized as “Other” (median: 13, IQR: 11–14) and lowest among Pashto speakers (median: 2, IQR: 1–5.5).

Univariate linear regression analyses corroborated these findings (Table 6). Relative to JPMC, caregivers of patients admitted to CHK had a higher mean PHQ-9 score ($\beta = 3.66$, 95% CI: 1.45–5.86, $p = 0.001$), whereas LNH was not statistically significant ($\beta = -1.32$, 95% CI: −3.59–0.94, $p = 0.25$). Medical ICU admission was associated with higher PHQ-9 scores compared with surgical ICU ($\beta = 3.39$, 95% CI: 1.20–5.59, $p = 0.003$). The presence of caregiver comorbidities independently predicted higher depression scores ($\beta = 3.81$, 95% CI: 1.43–6.19, $p = 0.002$), with two comorbidities demonstrating the largest effect ($\beta = 6.94$, 95% CI: 3.02–10.85, $p < 0.001$). Among mother tongue categories, Pashto speakers had lower PHQ-9 scores relative to Urdu speakers ($\beta = -3.67$, 95% CI: −6.70 to −0.64, $p = 0.018$), while participants categorized as “Other” had higher scores ($\beta = 4.53$, 95% CI: 0.29–8.77, $p = 0.036$).

Multivariable linear regression identified independent predictors of caregiver depression (Table 7). After adjustment, medical ICU admission remained significantly associated with higher PHQ-9 scores ($\beta = 4.396$, SE = 1.447, $p = 0.003$). Absence of mechanical ventilation was associated with lower depression scores ($\beta = -2.154$, SE = 1.022, $p = 0.037$). Number of comorbidities showed a strong dose-response relationship: one comorbidity was marginally significant ($\beta = 3.068$, SE = 1.553, $p = 0.050$), while two comorbidities predicted substantially higher

scores (β = 7.371, SE = 1.791, p < 0.001). Other patient and caregiver variables, including age and gender, were not independently associated with PHQ-9 scores in the multivariable model.

DISCUSSION

In the studied cohort of primary family caregivers, depressive symptoms were both highly prevalent and varied in severity. In this multicenter cross-sectional study, nearly one-third of participants experienced moderate-to-severe depressive symptoms, as measured by the PHQ-9. These findings align with local studies in Pakistan [15] and global literature [6], highlighting a high and contextually modulated burden of depressive symptoms among ICU caregivers.

A greater prevalence of severe depression was observed among caregivers of older patients, which may reflect heightened concern regarding perceived vulnerability. However, this trend did not reach statistical significance. Among the patient characteristics examined, only the hospital of admission and type of ICU admission showed statistically significant associations with caregiver stress levels. This finding suggests that the institutional and clinical environment plays a central role in shaping caregiver well-being, in line with previous literature [16,17]. Although caregivers at CHK initially appeared to have higher depressive symptoms, this effect was no longer independent after accounting for ICU type and caregiver characteristics. Admission to medical ICUs, however, remained a robust predictor of higher depressive symptoms, emphasizing the role of ICU environment and illness acuity in shaping caregiver stress.

Caregivers of patients admitted to CHK reported markedly higher PHQ-9 scores, with a substantial proportion of moderate-to-severe depressive symptoms concentrated in this hospital. This may reflect the fact that CHK is a government-sector hospital providing treatment free of charge or at highly subsidized rates, and therefore serving a larger proportion of caregivers from lower socioeconomic backgrounds [18,19]. In addition, overwhelming patient volumes, long waiting times, limited resources, and strained communication with medical teams may further intensify caregiver burden, contributing to the higher concentration of depressive symptoms observed in this setting [20,21].

Depressive symptoms were also higher among caregivers of patients admitted to Medical ICUs compared with Surgical ICUs. This difference may be explained by several interrelated mechanisms. The unpredictable and fluctuating trajectory of medical illnesses can increase perceived stress and reduce caregivers' sense of control, thereby contributing to feelings of helplessness. Moreover, caregivers in medical ICUs are more likely to experience secondary trauma through repeated exposure to prolonged suffering, life-threatening events, and clinical deterioration over time [22]. In contrast, surgical ICU admissions often follow more predictable perioperative courses, with standardized protocols and clearer short-term recovery trajectories, which may reduce uncertainty and emotional burden [23]. The combination of heightened environmental stressors, emotional arousal, and perceived lack of control may therefore exacerbate depressive symptoms among caregivers of patients in medical ICUs. These results confirm that medical ICU admission independently contributes to increased caregiver depressive symptoms, supporting the notion that unpredictable illness courses and high-acuity care amplify emotional burden.

Caregiver characteristics showed strong associations with depressive symptoms. Among these factors, the presence of comorbidities, the number of comorbid conditions, and caregivers' mother tongue were each significantly associated with depression scores.

Caregivers with comorbid health problems exhibited significantly higher depressive symptoms compared with those without comorbidities, with the highest proportion of moderate-to-severe depression observed among caregivers with multiple comorbid conditions. Caregivers with pre-existing health problems may have reduced physiological and psychological resilience, making them more vulnerable to the cumulative effects of chronic stress, fatigue, and emotional burden, consistent with allostatic load theory. In the ICU setting, caregiving requires sustained physical and emotional availability, and caregivers' own health limitations may hinder their ability to meet these demands [24].

Managing personal illness while simultaneously providing care may therefore create a twofold burden, which can contribute to feelings of guilt, helplessness, and emotional exhaustion, potentially precipitating or worsening

depressive symptoms [25]. The association was further strengthened by the number of comorbidities: caregivers with multiple health conditions experienced higher depressive symptoms, suggesting that pre-existing health vulnerabilities amplify the emotional and physical strain of ICU caregiving. An additional finding was that caregivers of patients requiring mechanical ventilation tended to report greater depressive symptoms. This may reflect the heightened perceived severity of illness and emotional stress associated with intensive life-support interventions, further underscoring the psychological impact of critical care on families.

Caregivers' mother tongue was also significantly associated with depressive symptoms, with higher levels observed among caregivers whose primary language was Urdu or a minority language. Reduced understanding of clinical information may amplify perceived uncertainty and loss of control, both of which are key contributors to caregiver stress and depressive symptomatology. Certain medical concepts are more easily communicated in English, where standardized clinical terminology is well established, whereas clear and widely accepted equivalents may be limited in minority languages and, in some cases, even in Urdu. This language gap may hinder caregivers' understanding of medical updates and their ability to participate meaningfully in decision-making, increasing anxiety regarding the patient's clinical course and outcomes [26,27]. Consistent with this interpretation, significant associations were also observed for caregivers' perceived involvement in the clinical process and clarity of explanations. Caregivers who felt excluded from decision-making or received unclear information reported higher depressive symptoms, indicating that structured, language-sensitive communication and shared decision-making may help mitigate emotional distress and anxiety [28]. Although the effect of mother tongue was not independent after adjusting for other factors, univariate trends suggest that language barriers may still contribute to uncertainty and increased depressive symptoms, reinforcing the importance of clear, culturally sensitive communication.

While longer duration of bedside presence showed a trend toward higher depressive symptoms, this association did not reach statistical significance. This may reflect the relatively uniform cultural expectation in Pakistan that close family members remain continuously present with hospitalized relatives, which limits variability in caregiving duration. There is a strong cultural emphasis on taking care of one's loved ones, which often necessitates that family members temporarily leave their other responsibilities and make themselves available for extended periods of time[29,30]. Nevertheless, a tendency toward higher stress with prolonged stays was observed, likely reflecting sustained exposure to the high-pressure and emotionally demanding ICU environment [31].

Among caregiving experience–related factors, sleep disruption showed the strongest association with higher PHQ-9 scores, with a substantial proportion of caregivers reporting moderate-to-severe depressive symptoms. This finding is consistent with well-established evidence identifying sleep disturbance as a major contributor to depression [32,33]. In the ICU context, sleep disruption is likely driven by persistent anxiety, prolonged bedside presence, and environmental factors such as noise and frequent clinical interruptions. These disruptions can impair restorative sleep, contributing to fatigue, irritability, and worsening mood symptoms. Moreover, sleep disturbance may amplify emotional reactivity and weaken cognitive coping mechanisms, thereby increasing vulnerability to depressive symptoms, consistent with stress–coping and bidirectional sleep–mood models [34,35].

A strong association was also observed between witnessing other patients' suffering and depressive symptoms. Beyond immediate emotional distress, repeated exposure to medical emergencies, visible suffering, and death may lead to vicarious or secondary trauma. Caregivers may internalize these events and anticipate similar outcomes for their own relatives, thereby increasing perceived threat and loss of control. This anticipatory stress can intensify anxiety and depressive symptoms, particularly when combined with prolonged bedside presence and limited psychosocial support [6,31].

Taken together, these findings illustrate that ICU type, critical interventions, caregiver health status, and socio-linguistic factors jointly influence caregiver depressive symptoms, highlighting the need for tailored psychosocial support and structured communication strategies.

PUBLIC HEALTH AND POLICY IMPLICATIONS

This study highlights the substantial psychological burden experienced by primary caregivers of ICU patients in Pakistan and underscores the need to recognize caregivers as an integral component of patient-centered critical care.

Routine screening for depressive symptoms using brief and validated tools, such as the PHQ-9, may enable early identification of caregivers at risk and facilitate timely referral to appropriate mental health services.

Language and communication barriers were associated with higher depressive symptoms, emphasizing the importance of multilingual communication strategies, culturally appropriate educational materials, and access to interpreters or bilingual healthcare staff. Improving caregivers' understanding of clinical information may enhance perceived control, reduce uncertainty, and support informed participation in decision-making. In parallel, structured psychosocial support programs, including brief counseling interventions, peer support groups, and stress-management strategies, should be incorporated into routine ICU practice. Even low-resource interventions, such as short counseling sessions or caregiver education workshops, may meaningfully reduce distress and improve coping.

At the policy level, hospitals and healthcare authorities should formally acknowledge caregiver well-being as a priority within critical care services. Integrating caregiver mental health support into ICU protocols and prioritizing assistance for caregivers from socioeconomically disadvantaged backgrounds may help reduce inequities in psychological outcomes. Strengthening support for caregivers has the potential to enhance resilience, reduce emotional exhaustion, and ultimately contribute to improved patient care and outcomes in resource-limited critical care settings.

LIMITATIONS

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design precludes any causal inferences; while associations between caregiver characteristics and depressive symptoms were observed, the directionality and temporal relationships cannot be established. Second, the study relied on self-reported data, including sociodemographic information, caregiver comorbidities, and any prior psychiatric diagnoses. No formal clinical assessment was conducted to verify psychiatric history, which may have introduced reporting bias or underestimation of mental health conditions.

Thirdly, a convenience sampling approach was used, and data collection was limited to caregivers present in ICU waiting areas during daytime weekday shifts. As a result, caregivers unable to be present at these times, or those with different caregiving experiences, may not be represented, limiting generalizability. Fourth, the study did not include standardized severity scores for patients (e.g., APACHE II or SOFA), which may have influenced caregiver burden and depressive symptoms. Additionally, other psychosocial factors, such as family support structures, prior mental health interventions, or cultural coping mechanisms, were not formally assessed.

Finally, the PHQ-9 is a screening instrument and does not provide a clinical diagnosis of major depressive disorder. While it is validated and widely used, misclassification of depression severity is possible, particularly in a caregiver population experiencing situational stress rather than chronic depression. Despite these limitations, the study provides valuable insight into the prevalence and severity of depressive symptoms among ICU caregivers in a resource-limited setting and highlights areas for intervention and future research.

CONCLUSION

This multicenter cross-sectional survey demonstrates a substantial burden of depressive symptoms among primary caregivers of critically ill patients admitted to ICUs, with nearly one-third experiencing moderate to severe depression. Higher depression scores were observed among caregivers of patients admitted to medical ICUs and among caregivers with multiple comorbid conditions. Sleep disruption was significantly associated with higher depressive symptoms, and caregivers who reported distress related to observing the suffering of other ICU patients also exhibited greater psychological burden. Additionally, primary communication in a regional language was associated with increased depressive symptoms. These findings highlight the substantial psychological burden experienced by ICU caregivers and emphasize the importance of recognizing caregiver mental health within critical care settings.

ABBREVIATIONS

1. Intensive Care Units – **ICUs**
2. Jinnah Postgraduate Medical Center – **JPMC**
3. Civil Hospital Karachi – **CHK**
4. Liaquat National Hospital – **LNH**
5. Patient Health Questionnaire-9 – **PHQ-9**
6. Post-traumatic stress disorder – **PTSD**
7. Strengthening the Reporting of Observational Studies in Epidemiology – **STROBE**
8. Interquartile ranges – **IQRs**
9. Odds ratio – **OR**
10. Confidence Interval – **CI**
11. Central Venous Pressure – **CVP**

STATEMENTS AND DECLERATION

Ethics Approval and Consent to Participate

This study had institutional review board approval from the primary institution: Jinnah Postgraduate Medical Center as well as administrative approval was taken from other institutions: Civil Hospital Karachi and Liaquat National Hospital and Medical College. The study was conducted in accordance with institutional privacy and protocols.

Consent for Publication

All authors consent for the publication.

Availability of data and materials

All data supporting the findings of this study are available within the paper and its Supplementary Information.

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Table 1: Characteristics of patients (N = 161).

Variables	Minimal depression (n = 67)	Mild depression (n = 41)	Moderate depression (n = 31)	Moderately severe depression (n = 16)	Severe depression (n = 6)	Total(n = 161)	P-Value

Age (years)	35.0 (26.5–54.0)	42.0 (26.0–55.0)	43.0 (29.0–59.5)	36.0 (26.8–45.5)	52.5 (35.0–58.8)	40.0 (27.0–55.0)	0.2175
Primary Diagnosis/Reason for Admission*							
Gastrointestinal / Hepatobiliary	16 (24.2%)	6 (15.0%)	8 (25.8%)	1 (6.2%)	1 (16.7%)	32 (20.1%)	
Obstetric / Gynecologic	12 (18.2%)	4 (10.0%)	4 (12.9%)	0 (0.0%)	1 (16.7%)	21 (13.2%)	
Sepsis & Severe Infection	9 (13.6%)	5 (12.5%)	4 (12.9%)	1 (6.2%)	1 (16.7%)	20 (12.6%)	
Renal / Electrolyte	4 (6.1%)	9 (22.5%)	2 (6.5%)	4 (25.0%)	0 (0.0%)	19 (11.9%)	
Respiratory	4 (6.1%)	4 (10.0%)	1 (3.2%)	5 (31.2%)	2 (33.3%)	16 (10.1%)	0.2238
Oncologic / Hematologic & Toxicologic	6 (9.1%)	6 (15.0%)	4 (12.9%)	0 (0.0%)	0 (0.0%)	16 (10.1%)	
Neurological	6 (9.1%)	0 (0.0%)	5 (16.1%)	1 (6.2%)	1 (16.7%)	13 (8.2%)	
Trauma	6 (9.1%)	2 (5.0%)	1 (3.2%)	2 (12.5%)	0 (0.0%)	11 (6.9%)	
Cardiovascular	2 (3.0%)	1 (2.5%)	1 (3.2%)	2 (12.5%)	0 (0.0%)	6 (3.8%)	
Other	1 (1.5%)	3 (7.5%)	1 (3.2%)	0 (0.0%)	0 (0.0%)	5 (3.1%)	
Hospital admitted in?							
JPMC	34 (50.7%)	16 (39.0%)	10 (32.3%)	5 (31.2%)	4 (66.7%)	69 (42.9%)	
CHK	12 (17.9%)	11 (26.8%)	12 (38.7%)	11 (68.8%)	2 (33.3%)	48 (29.8%)	**< 0.001**
LNH	21 (31.3%)	14 (34.1%)	9 (29.0%)	0 (0.0%)	0 (0.0%)	44 (27.3%)	
Residence							
Urban	52 (77.6%)	27 (65.9%)	27 (87.1%)	14 (87.5%)	6 (100.0%)	126 (78.3%)	0.2637
Rural	15 (22.4%)	14 (34.1%)	4 (12.9%)	2 (12.5%)	0 (0.0%)	35 (21.7%)	
Gender							

Female	37 (55.2%)	24 (58.5%)	18 (58.1%)	6 (37.5%)	4 (66.7%)	89 (55.3%)	0.981
Male	30 (44.8%)	17 (41.5%)	13 (41.9%)	10 (62.5%)	2 (33.3%)	72 (44.7%)	
Marital Status							
Married	51 (76.1%)	31 (75.6%)	24 (77.4%)	14 (87.5%)	6 (100.0%)	126 (78.3%)	0.4565
Single	15 (22.4%)	9 (22.0%)	5 (16.1%)	2 (12.5%)	0 (0.0%)	31 (19.3%)	
Widowed	1 (1.5%)	1 (2.4%)	2 (6.5%)	0 (0.0%)	0 (0.0%)	4 (2.5%)	
Occupation							
Home maker	27 (40.3%)	21 (51.2%)	15 (48.4%)	6 (37.5%)	4 (66.7%)	73 (45.3%)	0.1626
Employed	22 (32.8%)	9 (22.0%)	8 (25.8%)	7 (43.8%)	1 (16.7%)	47 (29.2%)	
Unemployed	9 (13.4%)	5 (12.2%)	2 (6.5%)	0 (0.0%)	0 (0.0%)	16 (9.9%)	
Student	4 (6.0%)	3 (7.3%)	4 (12.9%)	0 (0.0%)	0 (0.0%)	11 (6.8%)	
Retired	2 (3.0%)	2 (4.9%)	2 (6.5%)	2 (12.5%)	1 (16.7%)	9 (5.6%)	
Part time	3 (4.5%)	1 (2.4%)	0 (0.0%)	1 (6.2%)	0 (0.0%)	5 (3.1%)	
History of Previous Hospital admissions							
No	40 (59.7%)	20 (48.8%)	18 (58.1%)	9 (56.2%)	1 (16.7%)	88 (54.7%)	0.5948
Yes, <2 times	19 (28.4%)	12 (29.3%)	11 (35.5%)	4 (25.0%)	3 (50.0%)	49 (30.4%)	
Yes, 2-4 times	6 (9.0%)	3 (7.3%)	1 (3.2%)	1 (6.2%)	2 (33.3%)	13 (8.1%)	
Yes, >4 times	2 (3.0%)	6 (14.6%)	1 (3.2%)	2 (12.5%)	0 (0.0%)	11 (6.8%)	
Illness duration*							
0-6 months	49 (74.2%)	30 (73.2%)	24 (77.4%)	10 (62.5%)	4 (66.7%)	117 (73.1%)	0.1905
6-12 months	9 (13.6%)	3 (7.3%)	2 (6.5%)	1 (6.2%)	1 (16.7%)	16 (10.0%)	
1-5 years	4 (6.1%)	6 (14.6%)	3 (9.7%)	3 (18.8%)	0 (0.0%)	16 (10.0%)	
more than 5 years	4 (6.1%)	2 (4.9%)	2 (6.5%)	2 (12.5%)	1 (16.7%)	11 (6.9%)	
History of blood Transfusions							

No	30 (44.8%)	20 (48.8%)	14 (45.2%)	7 (43.8%)	3 (50.0%)	74 (46.0%)	
Yes, <2 times	26 (38.8%)	10 (24.4%)	12 (38.7%)	8 (50.0%)	2 (33.3%)	58 (36.0%)	0.7192
Yes, 2-4 times	9 (13.4%)	10 (24.4%)	1 (3.2%)	1 (6.2%)	1 (16.7%)	22 (13.7%)	
Yes, >4 times	2 (3.0%)	1 (2.4%)	4 (12.9%)	0 (0.0%)	0 (0.0%)	7 (4.3%)	
The patient was*							
Did nothing	29 (44.6%)	20 (50.0%)	12 (38.7%)	3 (18.8%)	2 (33.3%)	66 (41.8%)	
Ran household	18 (27.7%)	13 (32.5%)	11 (35.5%)	5 (31.2%)	3 (50.0%)	50 (31.6%)	0.2529
Primary bread winner	14 (21.5%)	5 (12.5%)	5 (16.1%)	8 (50.0%)	1 (16.7%)	33 (20.9%)	
Responsible for logistics	4 (6.2%)	2 (5.0%)	3 (9.7%)	0 (0.0%)	0 (0.0%)	9 (5.7%)	
Type of Admission*							
Medical ICU	42 (63.6%)	30 (75.0%)	28 (90.3%)	14 (87.5%)	5 (83.3%)	119 (74.8%)	**0.0017**
Surgical ICU	24 (36.4%)	10 (25.0%)	3 (9.7%)	2 (12.5%)	1 (16.7%)	40 (25.2%)	
History of Previous ICU admissions*							
No	55 (83.3%)	28 (68.3%)	24 (82.8%)	14 (87.5%)	4 (66.7%)	125 (79.1%)	
Yes, <2 times	11 (16.7%)	10 (24.4%)	5 (17.2%)	2 (12.5%)	2 (33.3%)	30 (19.0%)	0.8435
Yes, 2-4 times	0 (0.0%)	3 (7.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (1.9%)	
Is CVP passed?*							
Yes	27 (45.0%)	17 (47.2%)	13 (44.8%)	7 (46.7%)	4 (66.7%)	68 (46.6%)	0.4585
No	33 (55.0%)	19 (52.8%)	16 (55.2%)	8 (53.3%)	2 (33.3%)	78 (53.4%)	
Total Family monthly income (PKRs)*							
1000-10,000	4 (6.2%)	4 (9.8%)	0 (0.0%)	2 (12.5%)	1 (16.7%)	11 (7.0%)	
10,000-50,000	28 (43.1%)	22 (53.7%)	14 (46.7%)	8 (50.0%)	5 (83.3%)	77 (48.7%)	0.3073

50,000-100,000	28 (43.1%)	10 (24.4%)	13 (43.3%)	5 (31.2%)	0 (0.0%)	56 (35.4%)	
100,000+	5 (7.7%)	5 (12.2%)	3 (10.0%)	1 (6.2%)	0 (0.0%)	14 (8.9%)	
Is mechanical ventilation being used?*							
Yes	27 (41.5%)	13 (33.3%)	14 (45.2%)	11 (68.8%)	4 (66.7%)	69 (43.9%)	0.1098
No	38 (58.5%)	26 (66.7%)	17 (54.8%)	5 (31.2%)	2 (33.3%)	88 (56.1%)	

* Percentages are based on non-missing data.
Note: All categorical variables are presented as frequencies and percentages, while continuous variables are presented as medians and interquartile ranges (IQR).
Statistical comparisons between caregiver depression scores (PHQ-9 total) and patient characteristics were performed using non-parametric tests. The Mann–Whitney U (Wilcoxon rank-sum) test for variables with two categories and the Kruskal–Wallis test for variables with more than two categories. For continuous variables such as age, Spearman's rank correlation test was used to assess associations with caregiver depression scores. A p-value < 0.05 was considered statistically significant.

Among all patient characteristics, only the hospital of admission ($p < 0.001$) and the type of admission ($p = 0.0017$) showed statistically significant associations with caregiver depression scores. Caregivers of patients admitted to CHK and those in the Medical ICU reported higher PHQ-9 scores, indicating greater depressive symptoms compared to caregivers of patients in other hospitals or in the Surgical ICU. No significant associations were observed for other patient factors, including age, gender, marital status, occupation, residence, or medical history variables.

Table 2: Characteristics of primary family caregivers (N = 161).

Variables	Minimal depression (n = 67)	Mild depression (n = 41)	Moderate depression (n = 31)	Moderately severe depression (n = 16)	Severe depression (n = 6)	Total(n = 161)	P-Value
Age (years)	35.0 (26.5–42.5)	35.0 (29.8–42.5)	34.0 (26.0–50.0)	35.0 (29.5–40.0)	45.0 (33.2–50.0)	35.0 (27.0–45.0)	0.6129
Relation with patient							
Child							
Son	8 (11.9%)	7 (17.1%)	4 (12.9%)	2 (12.5%)	0 (0.0%)	21 (13.0%)	0.9626
Daughter	2 (3.0%)	1 (2.4%)	4 (12.9%)	1 (6.2%)	0 (0.0%)	8 (5.0%)	

Spouse							
Husband	8 (11.9%)	4 (9.8%)	2 (6.5%)	1 (6.2%)	0 (0.0%)	15 (9.3%)	
Wife	4 (6.0%)	1 (2.4%)	2 (6.5%)	0 (0.0%)	1 (16.7%)	8 (5.0%)	
Parent							
Father	5 (7.5%)	2 (4.9%)	1 (3.2%)	3 (18.8%)	0 (0.0%)	11 (6.8%)	
Mother	2 (3.0%)	2 (4.9%)	2 (6.5%)	0 (0.0%)	1 (16.7%)	7 (4.3%)	
In-laws							
Sister in Law	4 (6.0%)	2 (4.9%)	0 (0.0%)	1 (6.2%)	1 (16.7%)	8 (5.0%)	
Brother in Law	2 (3.0%)	3 (7.3%)	0 (0.0%)	1 (6.2%)	0 (0.0%)	6 (3.7%)	
Mother in Law	2 (3.0%)	1 (2.4%)	2 (6.5%)	0 (0.0%)	0 (0.0%)	5 (3.1%)	
Daughter in Law	0 (0.0%)	2 (4.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (1.2%)	
Father in Law	0 (0.0%)	1 (2.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.6%)	
Sibling							
Brother	10 (14.9%)	7 (17.1%)	6 (19.4%)	3 (18.8%)	0 (0.0%)	26 (16.1%)	
Sister	8 (11.9%)	0 (0.0%)	4 (12.9%)	2 (12.5%)	2 (33.3%)	16 (9.9%)	
Others							
Cousin	5 (7.5%)	4 (9.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	9 (5.6%)	
Uncle	4 (6.0%)	3 (7.3%)	1 (3.2%)	0 (0.0%)	0 (0.0%)	8 (5.0%)	
Nephew	2 (3.0%)	1 (2.4%)	1 (3.2%)	2 (12.5%)	0 (0.0%)	6 (3.7%)	
Niece	1 (1.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (16.7%)	2 (1.2%)	
Friend	0 (0.0%)	0 (0.0%)	1 (3.2%)	0 (0.0%)	0 (0.0%)	1 (0.6%)	
Grandson	0 (0.0%)	0 (0.0%)	1 (3.2%)	0 (0.0%)	0 (0.0%)	1 (0.6%)	
Residence							
Urban	55 (82.1%)	28 (68.3%)	27 (87.1%)	16 (100.0%)	6 (100.0%)	132 (82.0%)	0.2424
Rural	12 (17.9%)	13 (31.7%)	4 (12.9%)	0 (0.0%)	0 (0.0%)	29 (18.0%)	
Gender							
Male	42 (62.7%)	31 (75.6%)	18 (58.1%)	12 (75.0%)	0 (0.0%)	103 (64.0%)	0.4373
Female	25 (37.3%)	10 (24.4%)	13 (41.9%)	4 (25.0%)	6 (100.0%)	58 (36.0%)	

Mother Tongue							
Urdu	30 (44.8%)	21 (51.2%)	13 (41.9%)	4 (25.0%)	5 (83.3%)	73 (45.3%)	
Sindhi	14 (20.9%)	7 (17.1%)	7 (22.6%)	7 (43.8%)	0 (0.0%)	35 (21.7%)	
Pashto	13 (19.4%)	5 (12.2%)	2 (6.5%)	0 (0.0%)	0 (0.0%)	20 (12.4%)	**0.0319**
Balochi	3 (4.5%)	5 (12.2%)	1 (3.2%)	2 (12.5%)	0 (0.0%)	11 (6.8%)	
Punjabi	4 (6.0%)	1 (2.4%)	3 (9.7%)	0 (0.0%)	0 (0.0%)	8 (5.0%)	
Saraiki	2 (3.0%)	1 (2.4%)	0 (0.0%)	2 (12.5%)	0 (0.0%)	5 (3.1%)	
Other	1 (1.5%)	1 (2.4%)	5 (16.1%)	1 (6.2%)	1 (16.7%)	9 (5.6%)	
Marital Status							
Married	52 (77.6%)	34 (82.9%)	24 (77.4%)	13 (81.2%)	3 (50.0%)	126 (78.3%)	
Single	15 (22.4%)	6 (14.6%)	7 (22.6%)	3 (18.8%)	2 (33.3%)	33 (20.5%)	0.4646
Widowed	0 (0.0%)	1 (2.4%)	0 (0.0%)	0 (0.0%)	1 (16.7%)	2 (1.2%)	
Occupation							
Employed	41 (61.2%)	30 (73.2%)	15 (48.4%)	9 (56.2%)	0 (0.0%)	95 (59.0%)	
Home maker	17 (25.4%)	8 (19.5%)	11 (35.5%)	2 (12.5%)	4 (66.7%)	42 (26.1%)	
Student	4 (6.0%)	0 (0.0%)	3 (9.7%)	3 (18.8%)	0 (0.0%)	10 (6.2%)	0.5812
Part time	3 (4.5%)	0 (0.0%)	0 (0.0%)	1 (6.2%)	2 (33.3%)	6 (3.7%)	
Unemployed	1 (1.5%)	2 (4.9%)	2 (6.5%)	0 (0.0%)	0 (0.0%)	5 (3.1%)	
Retired	1 (1.5%)	1 (2.4%)	0 (0.0%)	1 (6.2%)	0 (0.0%)	3 (1.9%)	
Comorbidities*	8 (12.1%)	9 (23.1%)	6 (19.4%)	5 (31.2%)	4 (66.7%)	32 (20.3%)	**0.0072**
Number of Comorbidities*							
One	8 (12.1%)	6 (15.4%)	2 (6.5%)	4 (25.0%)	2 (33.3%)	22 (13.9%)	**0.004**
Two	0 (0.0%)	3 (7.7%)	4 (12.9%)	1 (6.2%)	2 (33.3%)	10 (6.3%)	
I have other people to help me							
Yes	53 (79.1%)	28 (68.3%)	27 (87.1%)	12 (75.0%)	5 (83.3%)	125 (77.6%)	0.7867
No	14 (20.9%)	13 (31.7%)	4 (12.9%)	4 (25.0%)	1 (16.7%)	36 (22.4%)	

I am most concerned about							
patient outcome	50 (74.6%)	31 (75.6%)	29 (93.5%)	14 (87.5%)	5 (83.3%)	129 (80.1%)	0.3198
financial burden	5 (7.5%)	2 (4.9%)	0 (0.0%)	2 (12.5%)	1 (16.7%)	10 (6.2%)	
length of hospital stay	6 (9.0%)	3 (7.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	9 (5.6%)	
future treatment	2 (3.0%)	2 (4.9%)	2 (6.5%)	0 (0.0%)	0 (0.0%)	6 (3.7%)	
post discharge morbidity	3 (4.5%)	2 (4.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	5 (3.1%)	
uncertainty & stress	1 (1.5%)	1 (2.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (1.2%)	
Days of staying with attendant*							
<2days	28 (42.4%)	20 (50.0%)	10 (32.3%)	6 (37.5%)	2 (33.3%)	66 (41.5%)	0.0743
3-4 days	20 (30.3%)	12 (30.0%)	10 (32.3%)	3 (18.8%)	2 (33.3%)	47 (29.6%)	
>5 days	3 (4.5%)	1 (2.5%)	6 (19.4%)	4 (25.0%)	1 (16.7%)	15 (9.4%)	
>7 days	15 (22.7%)	7 (17.5%)	5 (16.1%)	3 (18.8%)	1 (16.7%)	31 (19.5%)	
History of Previous ICU experience as attendant							
No	60 (89.6%)	29 (70.7%)	24 (77.4%)	13 (81.2%)	5 (83.3%)	131 (81.4%)	0.1925
Yes, <2 times	6 (9.0%)	10 (24.4%)	5 (16.1%)	2 (12.5%)	1 (16.7%)	24 (14.9%)	
Yes, 2-4 times	1 (1.5%)	2 (4.9%)	2 (6.5%)	1 (6.2%)	0 (0.0%)	6 (3.7%)	
Stay at hospital round the clock*							
Yes	53 (79.1%)	32 (78.0%)	22 (73.3%)	13 (81.2%)	5 (83.3%)	125 (78.1%)	0.6972
No	14 (20.9%)	9 (22.0%)	8 (26.7%)	3 (18.8%)	1 (16.7%)	35 (21.9%)	

* Percentages are based on non-missing data.

Note: All categorical variables are presented as frequencies and percentages, while continuous variables are presented as medians and interquartile ranges (IQR).

Statistical comparisons between caregiver depression scores (PHQ-9 total) and caregiver characteristics were performed using non-parametric tests. The Mann–Whitney U (Wilcoxon rank-sum) test for variables with two categories and the Kruskal–Wallis test for variables with more than two categories. For continuous variables such as age, Spearman's rank correlation test was used to assess associations with caregiver depression scores. A p-value < 0.05 was considered statistically significant.

Among all primary family caregiver characteristics, the presence of comorbidities (p = 0.0072), the number of comorbidities (p = 0.004), and mother tongue (p = 0.0319) showed statistically significant associations with PHQ-9 scores. Caregivers with comorbidities, especially those with two health conditions, reported higher PHQ-9 scores, indicating greater depressive symptoms. Differences in depression scores were also observed across mother tongue groups. No significant associations were found for other caregiver factors.

Table 3: Distribution of caregiver responses to experience-related statements and their association with depression levels (PHQ-9 Total)

Statement	Never true	Rarely true	Sometimes true	Often true	Very Often true	P-Value
I feel burdened caring for the patient	90 (55.9%)	51 (31.7%)	8 (5.0%)	8 (5.0%)	4 (2.5%)	0.0709
I feel being pressurized to consent to treatment/interventions*	79 (49.7%)	52 (32.7%)	9 (5.7%)	15 (9.4%)	4 (2.5%)	0.9071
I wish the liaison regarding patient between various wards/specialties were more coordinated*	52 (32.5%)	44 (27.5%)	32 (20.0%)	17 (10.6%)	15 (9.4%)	0.6528
I encountered feelings of inadequacy of knowledge for disease process,management and outcome	40 (24.8%)	56 (34.8%)	12 (7.5%)	30 (18.6%)	23 (14.3%)	0.2683
My sleep has been compromised causing fatigue*	24 (15.1%)	34 (21.4%)	16 (10.1%)	30 (18.9%)	55 (34.6%)	**0.0001**
I am satisfied with the way bad news is broken to me by the treating team*	21 (13.2%)	45 (28.3%)	24 (15.1%)	37 (23.3%)	32 (20.1%)	0.3889
I am satisfied with the way hospital team involves me in the informed decision making process	31 (19.3%)	30 (18.6%)	17 (10.6%)	48 (29.8%)	35 (21.7%)	0.2116
I am satisfied with the atmosphere in the waiting area	50 (31.1%)	35 (21.7%)	26 (16.1%)	36 (22.4%)	14 (8.7%)	0.1248
I am satisfied with the visits to patient	39 (24.2%)	24 (14.9%)	34 (21.1%)	35 (21.7%)	29 (18.0%)	0.6157

The treating team keeps me onboard with developing clinical picture*	30 (18.9%)	33 (20.8%)	27 (17.0%)	36 (22.6%)	33 (20.8%)	**0.0292**
I receive clear explanations of why things were done for patients*	30 (18.8%)	45 (28.1%)	27 (16.9%)	26 (16.2%)	32 (20.0%)	**0.008**
It was upsetting to see what happened to other patients*	20 (12.5%)	29 (18.1%)	31 (19.4%)	60 (37.5%)	20 (12.5%)	**0.0004**
My uncertainty and stress were addressed during hospitalization by psychiatric social workers as a routine therapeutic intervention*	82 (51.2%)	27 (16.9%)	22 (13.8%)	16 (10.0%)	13 (8.1%)	0.1194
My mental health needs/concerns were explored*	104 (65.4%)	22 (13.8%)	15 (9.4%)	9 (5.7%)	9 (5.7%)	0.707
Values are presented as n (%), based on non-missing data for each item. Percentages represent the proportion of respondents selecting each response category ("Never true" to "Very often true"). *** Percentages are based on non-missing data.** **P-values were obtained using the Kruskal–Wallis test, used here to compare median PHQ-9 depression scores across response categories for each statement.**						

Table 4: Distribution of depression severity among caregivers based on PHQ-9 total scores.

Variable (Range)	Frequency (n)	Percentage (%)
PHQ-9 (0–27)	6 (2–11)	
Minimal depression	67	41.60%
Mild depression	41	25.50%
Moderate depression	31	19.30%
Moderately severe depression	16	9.90%
Severe depression	6	3.70%

PHQ-9 = Patient Health Questionnaire-9.
Scores range from 0 to 27, with higher scores indicating greater depressive symptoms.
PHQ-9 total scores are presented as median (IQR) due to non-normal distribution.

Table 5. Descriptive univariate analysis of PHQ-9 total score by patient and primary family caregiver characteristics.

Variable	Categories	Median (IQR)	P-Value
Patient Characteristics			

Hospital admitted in?	JPMC	5 (1–12)	0.001
	CHK	10 (4.75–15.25)	
	LNH	5 (2–9)	
Type of Admission	Surgical ICU	2 (1–7)	0.002
	Medical ICU	8 (2.5–13)	
Caregiver Characteristics			
Comorbidities	N	5 (2–10)	0.007
	Y	8.5 (5.25–15.75)	
Number of Comorbidities	None	5 (2–10)	0.004
	One	7 (2.25–14.5)	
	Two	13 (9–17)	
Mother Tongue	Urdu	7 (2–11)	0.032
	Sindhi	7 (2–12.5)	
	Pashto	2 (1–5.5)	
	Balochi	5 (4.5–9.5)	
	Punjabi	4 (2.25–10)	
	Saraiki	8 (4–15)	
	Other	13 (11–14)	

Note: Median and interquartile range (IQR) are presented for PHQ-9 total score by group. P-values were calculated using Mann-Whitney U test (for two-category variables) or Kruskal-Wallis test (for variables with >2 categories). Only significant variables from Table 1 and Table 2 are included.

Table 5 presents the distribution of PHQ-9 total scores according to selected patient and caregiver characteristics. PHQ-9 scores differed significantly by hospital of admission ($p = 0.001$), with caregivers of patients admitted to CHK demonstrating higher median scores compared to those admitted to JPMC and LNH. A significant difference was also observed by type of admission ($p = 0.002$), where caregivers of patients admitted to the Medical ICU had higher median PHQ-9 scores than those in the Surgical ICU. Among caregiver characteristics, presence of comorbidities ($p = 0.007$) and number of comorbidities ($p = 0.004$) were significantly associated with higher PHQ-9 scores, particularly among caregivers with two comorbid conditions. PHQ-9 scores also varied significantly by mother tongue ($p = 0.032$), with Pashto-speaking caregivers exhibiting lower median scores, whereas caregivers categorized as "Other" mother tongue demonstrated higher median scores. These variables were subsequently evaluated using univariate linear regression analysis to estimate effect sizes (Table 6).

Table 6. Univariate Linear Regression of Factors Associated with PHQ-9 Total Score

Variable	**Categories**	**β (Mean Difference)**	**95% CI**	**P-Value**
Patient Characteristics				
Hospital admitted in?	JPMC	Reference	-	-
	CHK	3.66	1.45 to 5.86	**0.001**
	LNH	-1.32	-3.59 to 0.94	0.25
Type of Admission	Surgical ICU	Reference		
	Medical ICU	3.39	1.20 to 5.59	**0.003**

Caregiver Characteristics				
Comorbidities	N	Reference	-	-
	Y	3.81	1.43 to 6.19	**0.002**
Number of Comorbidities	None	Reference	-	-
	One	2.39	-0.36 to 5.15	0.088
	Two	6.94	3.02 to 10.85	**<0.001**
Mother Tongue	Urdu	Reference	-	-
	Sindhi	0.33	-2.13 to 2.80	0.789
	Pashto	-3.67	-6.70 to -0.64	**0.018**
	Balochi	-0.19	-4.08 to 3.69	0.922
	Punjabi	-2.22	-6.69 to 2.25	0.329
	Saraiki	2.13	-3.41 to 7.68	0.449
	Other	4.53	0.29 to 8.77	**0.036**

Note: Beta represents the change in PHQ-9 total score compared to the reference category. P-values < 0.05 considered statistically significant. PHQ-9: Patient Health Questionnaire-9.

In univariate linear regression analysis, caregivers of patients admitted to CHK had significantly higher PHQ-9 scores compared to those admitted to JPMC (β = 3.66, 95% CI: 1.45 to 5.86, p = 0.001). Admission to the Medical ICU was also significantly associated with higher PHQ-9 scores compared to Surgical ICU admission (β = 3.39, 95% CI: 1.20 to 5.59, p = 0.003). Presence of caregiver comorbidities was associated with increased PHQ-9 scores (β = 3.81, 95% CI: 1.43 to 6.19, p = 0.002). Caregivers with two comorbid conditions had substantially higher PHQ-9 scores compared to those without comorbidities (β = 6.94, 95% CI: 3.02 to 10.85, p < 0.001). With respect to language, Pashto-speaking caregivers had significantly lower PHQ-9 scores compared to Urdu speakers (β = -3.67, 95% CI: -6.70 to -0.64, p = 0.018), whereas caregivers categorized as “Other” mother tongue demonstrated higher PHQ-9 scores (β = 4.53, 95% CI: 0.29 to 8.77, p = 0.036).

Table 7. Multivariable Linear Regression of Factors Associated with Caregiver Depression (PHQ-9 Total Score)				
Variable	**Categories**	**β (Mean Difference)**	**Standard Error**	**P-Value**
Patient Characteristics				
Age (years)	-	0.046	0.026	0.075
Hospital admitted in?	JPMC	Reference	-	-
	CHK	1.996	1.591	0.212
	LNH	-2.823	1.608	0.081
Type of Admission	Surgical ICU	Reference	-	-
	Medical ICU	4.396	1.447	**0.003**
Mechanical ventilation	Yes	Reference	-	-
	No	-2.154	1.022	**0.037**
Caregiver Characteristics				
Age (years)	-	-0.03	0.039	0.444
Gender	Male	Reference	-	-
	Female	1.072	1.048	0.308
Number of Comorbidities	None	Reference	-	-
	One	3.068	1.553	0.05

	Two	7.371	1.791	**<0.001**

In multivariable linear regression with standard errors, admission to the medical ICU was independently associated with higher caregiver depression scores ($\beta = 4.40$, SE = 1.45, $p = 0.003$). Caregivers of patients receiving mechanical ventilation had significantly higher PHQ-9 scores ($\beta = 2.15$, SE = 1.02, $p = 0.037$). Caregiver comorbidities demonstrated a dose–response relationship; having two comorbidities was strongly associated with higher depression scores ($\beta = 7.37$, SE = 1.79, $p < 0.001$), while one comorbidity showed borderline statistical significance ($\beta = 3.07$, $p = 0.050$).