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Migraine in the Corporate Sector: Prevalence, Risk Factors, Job Efficiency Impact, and Management Strategies

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Data Interpretation D
Manuscript Preparation E
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Background: Migraine, a prevalent neurological disorder characterized by recurrent episodes of severe headache, significantly impacts individuals worldwide. This study aimed to evaluate migraine prevalence, identify key risk factors, assess the impact on job performance, and explore commonly used management strategies.

Material/Methods: This cross-sectional study involved corporate sector employees visiting outpatient neurology departments in Pakistan. A questionnaire was developed to quantify the overall burden of migraine. Inferential statistics, including the Mann-Whitney U test and Kruskal-Wallis H test, were used to evaluate group differences. An exploratory factor analysis (EFA) was conducted to confirm the questionnaire's structural validity.

Results: The questionnaire showed strong reliability (Cronbach's α=0.81) and validity (S-CVI=0.86, KMO=0.82, P<0.001). Migraines significantly impacted job efficiency (p=0.015), with 43.8% experiencing episodes lasting 4 to 8 h. Gender (P=0.012), age (P=0.029), and income (P=0.045) were significantly associated with migraine burden. The most common triggers were stress (27.7%) and sleep deprivation (23.2%), while over-the-counter medication (62.5%) was the most commonly used treatment. Gender (β=0.23, P=0.012), age (β=-0.19, P=0.029), and income (β=-0.17, P=0.045) significantly predicted the migraine burden. A higher migraine burden significantly predicted lower job efficiency (β=-0.31, P=0.015).

Conclusions: Migraines have a significant impact on job efficiency in the Pakistani corporate sector, necessitating comprehensive management strategies and targeted interventions to mitigate their effects.

Keywords: Anxiety • Health • Income • Migraine Disorders • Sleep

Abbreviations: **EFA** – exploratory factor analysis; **YLD** – years lost due to disability; **WHO** – World Health Organization; **MIDAS** – migraine disability assessment; **KMO** – Kaiser-Meyer-Olkin; **CVI** – content validity index; **COR** – crude odds ratio; **CI** – confidence interval; **AOR** – adjusted odds ratio

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Introduction

Migraine, a common neurological disorder marked by recurrent severe headaches, greatly affects people worldwide [1]. These episodes often come with symptoms like nausea, photophobia, and phonophobia, which add to the disorder's disabling nature [2]. The World Health Organization (WHO) ranks migraine as the sixth leading cause worldwide of years lost due to disability (YLD), highlighting its importance as a major public health issue [3]. Globally, migraines affect about 15% of the population, particularly adults aged 25 to 55 years, thereby disrupting some of the most economically productive years [4,5]. This is especially significant in low- and middle-income countries (LMICs) like Pakistan, where the economic burden of lost productivity is worsened by underdeveloped healthcare systems and a lack of supportive workplace policies [6,7].

The pathophysiology of migraine involves complex neurological mechanisms, and its risk factors include genetic predispositions, environmental triggers, and lifestyle factors [8]. In the specific context of Pakistan, a recent study showed that migraine remains a major health concern, with common risk factors such as physical stress and hormonal changes [9]. Additionally, cultural and socioeconomic factors like reliance on faith healers and gender-specific barriers to healthcare contribute to significant underreporting and undertreatment of migraine, making it harder to assess the true burden of the disease in the country [10-13]. Limited access to specialized healthcare and low awareness of migraine among healthcare providers worsen the situation. This results in a dependence on over-the-counter medications instead of personalized treatment plans [9,10,14,15]. The economic impact is also substantial, with notable productivity losses due to work absences and decreased job performance caused by migraine [13].

Migraine-related workplace productivity losses are a major yet under-researched concern in Pakistan's developing economy [6]. Both absenteeism (missed workdays) and presenteeism (reduced work efficiency while at work) contribute to substantial economic losses. Employees suffering from chronic migraines often struggle with concentration, reduced cognitive function, and frequent work interruptions, making it challenging to meet job demands [16]. Research has shown that workers experiencing migraines are more likely to miss deadlines, request sick leave, or even quit employment due to unmanaged symptoms, which collectively burdens both employers and the economy [17-19]. However, the specific impact on Pakistan's corporate sector remains unquantified. Furthermore, the absence of formal workplace policies addressing chronic pain conditions in the country exacerbates these issues, leaving employees to resort to self-management strategies [20]. Many individuals suffering from migraine in Pakistan turn to a combination of allopathic and traditional remedies in addition to conventional care. These include home remedies such as herbal teas, essential oils, and dietary modifications, as well as religious and spiritual practices, for symptom relief and management. This is evident in urban corporate settings where stress levels are high [12,21-23]. The efficacy, patterns of use, and interplay between these traditional practices and modern self-medication are poorly understood within the Pakistani workforce, creating a critical knowledge gap. Given this context, there is a clear need for local evidence to inform effective public health and corporate wellness strategies that are both medically sound and culturally congruent. Therefore, this study assessed the impact of migraines on job efficiency specifically and explored the management strategies, including conventional remedies, used by corporate employees in Pakistan. By focusing on these aspects, this research will provide a foundation for informed policy-making that addresses the medical, economic, and sociocultural dimensions of migraine management in the Pakistani workforce.

Material and Methods

Study Objective and Research Question

This study aimed to assess the burden of migraine among corporate employees in Lahore, Pakistan. The primary research question was: "What is the prevalence of migraine, its associated risk factors, its impact on job efficiency, and the management practices employed by corporate employees presenting at a neurology outpatient department?" In this study, the corporate sector was defined as private organizations in finance, manufacturing, and administrative services employing full-time salaried staff.

Study Design, Setting, and Duration

This questionnaire-based, cross-sectional, quantitative study was conducted in Lahore, Pakistan, from May 2024 to October 2024.

Participants

Inclusion and Exclusion Criteria

Inclusion criteria were: (1) adults aged 18 years and older, (2) a confirmed diagnosis of migraine by a neurologist, (3) currently employed full-time in the corporate sector, and (4) provision of written informed consent.

Exclusion criteria were: (1) individuals with other chronic painful conditions that could confound the assessment of headache impact, (2) those who did not give consent, (3) those

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with severe psychiatric comorbidities, and (4) inability to understand the questionnaire.

Sampling Method

A consecutive sampling technique was used. Every eligible individual who visited the outpatient department during the study period and met the inclusion criteria was invited to participate until the required sample size was achieved. This method was chosen for its practicality in a clinical setting and to minimize selection bias by providing an equal opportunity for all eligible patients during the data collection period [24].

Data Collection Method

Data were collected in person by the principal investigator (A.B.). A standardized script was developed to introduce the study, obtain consent, and provide neutral instructions, thereby ensuring the questionnaire was completed without influencing responses.

Exposure and Outcome Variables

Exposure variables included sociodemographic characteristics (age, gender, marital status, income), as well as specific migraine risk factors. The primary Outcome Variables were: (1) Migraine severity score, (2) Overall migraine burden score (low, moderate, high), (3) Impact on job efficiency score, and (4) Migraine management effectiveness score.

Data Collection Tool

The data collection tool had several parts. Part A pertained to the patient's sociodemographic characteristics, including gender, age group, marital status, and monthly income. In Part B (Prevalence of Migraine), classifications range from mild (scores 0-10) for infrequent and mild symptoms to severe (scores 21+) for chronic and intense migraines. Part C (Risk Factors) sorts respondents into low (0-15), moderate (16-30), and high (31+) risk categories based on how often triggers provoke migraines. Part D (Influence on Job Efficiency) evaluates the impact on work and categorizes it as minimal (0-10), moderate (11-20), or severe (21+). Part E (Management of Migraine Attack) assesses the effectiveness of migraine management on a scale from well-managed (0-10) to poorly managed (21+). The types of questions vary from multiple-choice to Likert scale responses, where symptoms and impact on job efficiency are rated on a 1 ("Never") to 5 ("Always") scale, and management practices are assessed on effectiveness (1 "Not effective" to 5 "Very effective") and usage frequency (1 "Never" to 3 "Always"). The total scores from all sections determine the overall migraine burden as low (0-30), moderate (31-60), or high (61+), providing a comprehensive assessment of severity, triggers, job impact, and management. A Migraine Disability Assessment (MIDAS) questionnaire was used to measure the burden of migraines on patients [27].

Questionnaire Development and Pilot Study

Questionnaire development was informed by a comprehensive review of relevant literature on migraine and work productivity, including frameworks from established tools like the Migraine Disability Assessment (MIDAS) questionnaire [25]. The instrument was reviewed by an expert panel comprising the principal investigator, a supervisor, a neurologist, and a public health expert to ensure content relevance. A pilot study was conducted on a small sample (N=30) to assess the clarity, reliability, and feasibility of the questionnaire. Based on expert feedback, minor modifications were made. A pilot study was conducted on 30 participants to assess feasibility, clarity, and reliability. Findings from the pilot indicated excellent internal consistency, with a Cronbach's alpha of 0.89 for the entire instrument. The Content Validity Index (CVI) was calculated at 0.92, confirming the relevance of the items. Exploratory factor analysis (EFA) conducted during the pilot phase supported the hypothesized 4-factor structure of the questionnaire, confirming its construct validity. Detailed results are presented in the Results section.

Study Size

The sample size was calculated using the formula [26]:

$$n = \frac{Z^2 P(1-P)}{d^2}$$

where Z=1.96 (for 95% confidence level), *P*=estimated migraine prevalence from previous studies, and d=margin of error (5%). Based on this calculation, the required sample size was 385 participants, with adjustments for non-responses bringing the final sample to 387.

Ethical Considerations

Ethics approval was obtained from the Institutional Review Board (IRB) of the University of Lahore (IREC-2024-04H; dated February 1, 2024). Written informed consent was obtained from all participants, and data confidentiality was strictly maintained throughout the study. All questionnaires were assigned a unique code, and any documents linking codes to personal identifiers were stored separately on a password-protected computer accessible only to the principal investigator. Data were anonymized before analysis.

Statistical Methods

Data were analyzed using descriptive statistics (n, %) to detail the demographic characteristics of the respondents. The

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Table 1. Demographic characteristics of respondents.

Demographic variable	Frequency n (%)
Age (in years)	
18-25	73 (18.8%)
26-35	159 (41.1%)
36-45	107 (27.7%)
46 and above	48 (12.5%)
Gender	
Male	88 (22.7%)
Female	299 (77.3%)
Marital status	
Unmarried	166 (42.9%)
Married	153 (39.5%)
Divorced	34 (8.9%)
Widowed	34 (8.9%)
Corporate industry	
IT	41 (10.7%)
Manufacturing	62 (16.1%)
Telecommunications	24 (6.3%)
Finance/banking	76 (19.6%)
Retail	34 (8.9%)
Healthcare	48 (12.5%)
Education	38 (9.8%)
Government sector	38 (9.8%)
Hospitality	24 (6.3%)
Current role in the corporate sector	
Entry-level employee	100 (25.9%)
Mid-level employee	149 (38.4%)
Senior-level employee	79 (20.5%)
Management/executive	59 (15.2%)
Income per month (PKR)	
Below 18 000	41 (10.7%)
18 001-36 000	142 (36.6%)
36 001-50 000	131 (33.9%)
Above 50 000	73 (18.8%)

instrument was validated by testing for reliability (Cronbach's alpha) and validity (content and construct validity) in a preliminary study. Furthermore, the adequacy of the sample size and the suitability of the data for factor analysis were assessed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. Exploratory factor analysis (EFA) was conducted to validate the questionnaire's structure. The normality of continuous data was assessed using the Shapiro-Wilk test, and all key outcome variables were found to be non-normally distributed. Given the non-normal distribution of the data, non-parametric inferential tests, such as the Mann-Whitney U test and Kruskal-Wallis H test, were used to assess differences in migraine-related variables across demographic groups. To identify predictors of overall migraine burden and job efficiency impact, multiple linear regression models were applied, and binary logistic regression identified factors associated with poor migraine management. Variable selection was guided by the study's objectives and relevant literature. Model fit was assessed via R^2 and Nagelkerke R^2, with significance set at $P<0.05$. Assumptions of linearity, multicollinearity (VIF<10), and normality of residuals were confirmed for all models. SPSS version V.21 and R version 4.4.1 were used for statistical analysis.

Results

Demographic Characteristics

A total of 387 corporate employees with migraine were included in this study. The sample consisted predominantly of women (299, 77.3%) and young adults aged 26 to 35 years (159, 41.1%). Most participants were unmarried (166, 42.9%) or married (153, 39.5%), worked in finance/banking (76, 19.6%) or manufacturing (62, 16.0%), held mid-level positions (149, 38.5%), and earned monthly incomes between PKR 18 001 and 36 000 (142, 36.7%) (**Table 1**).

Reliability of Questionnaire

Reliability analysis of the migraine impact questionnaire (N=112) demonstrated good internal consistency (α=0.81 overall). Section-specific reliability varied: Part B (Prevalence) showed acceptable consistency (α=0.73; range=0.70-0.72 if item deleted), while Part C (Risk Factors) exhibited stronger reliability (α=0.84; range=0.81-0.83). Part D (Job Efficiency) maintained moderate consistency (α=0.78; range=0.75-0.77), and Part E (Management) showed the lowest but still marginal reliability (α=0.69; range=0.65-0.68). These results support

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Table 2. Migraine characteristics and prevalence among respondents.

Variable	Frequency (n,%) or mean (SD)
Overall score (0-30)	18.3 (+6.9)
Migraine prevalence group	
Mild prevalence (0-10)	97 (25.0%)
Moderate prevalence (11-20)	156 (40.2%)
Severe prevalence (21+)	135 (34.8%)
Type of migraine	
Migraine with aura	135 (34.8%)
Migraine without aura	149 (38.4%)
Chronic migraine	55 (14.3%)
Hemiplegic migraine	48 (12.5%)
Duration of migraine experience	
Less than 1 year	83 (21.4%)
1-5 years	128 (33.0%)
6-10 years	107 (27.7%)
More than 10 years	69 (17.9%)
Frequency of migraine attacks	
Less than once a month	76 (19.6%)
1-3 times a month	121 (31.3%)
4-6 times a month	100 (25.9%)
More than 6 times a month	90 (23.2%)
Duration of a typical episode	
Less than 4 h	93 (24.1%)
4-8 h	169 (43.8%)
More than 8 h	125 (32.1%)
Frequency of aura before attack	
Never	55 (14.3%)
Rarely	86 (22.3%)
Sometimes	166 (42.9%)
Always	79 (20.5%)
Migraine severity	
Not at all severe	28 (7.1%)
A little severe	34 (8.9%)
Somewhat severe	100 (25.9%)
Moderately severe	135 (34.8%)
Quite severe	83 (21.4%)
Extremely severe	41 (10.7%)
Type of pain experienced	
Throbbing or pulsating pain	183 (47.3%)
Constant, dull pain	111 (28.6%)
Sharp or stabbing pain	93 (24.1%)
Pain location during migraine	
One side of the head	162 (42.0%)
Both sides of the head	104 (26.8%)
Around or behind the eyes	86 (22.3%)
Neck or shoulders	35 (8.9%)

the questionnaire's reliability in assessing the multidimensional impacts of migraine.

CVI Score of Questionnaire

The questionnaire demonstrated strong content validity, with an overall scale-level CVI (S-CVI) of 0.86, indicating high relevance across all items. Part B (migraine prevalence) showed particularly robust validity, with Item-level CVI (I-CVI) scores ranging from 0.80 to 1.00 and an average S-CVI of 0.92. Part C (risk factors) maintained good validity (I-CVI: 0.78-0.95; S-CVI: 0.87), as did Part D (job efficiency impact; I-CVI: 0.80-0.90; S-CVI: 0.85). Part E (migraine management) showed slightly lower but acceptable validity (I-CVI: 0.75-0.88; S-CVI: 0.80).

Exploratory Factor Analyses

Exploratory factor analysis (EFA) of the migraine impact questionnaire demonstrated strong validity, with a Kaiser-Meyer-Olkin (KMO) measure of 0.82 (indicating sample adequacy) and a significant Bartlett's test of sphericity (χ^2=865.23, P<0.001), confirming the suitability of the factor analysis. Four factors were extracted, collectively accounting for 68.50% of the total variance, indicating a robust latent structure. Factor loadings were consistently high – Factor 1 (0.78-0.85), Factor 2 (0.72-0.80), Factor 3 (0.70-0.83), and Factor 4 (0.65-0.79) – indicating strong item correlations and the questionnaire's effectiveness in measuring multidimensional migraine impact.

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Migraine Characteristics and Symptoms

Most participants reported having moderate (156, 40.2%) or severe (135, 34.8%) migraines. Migraine without aura was most common (149, 38.4%), and the majority experienced attacks lasting 4 to 8 h (169, 43.8%) with throbbing pain (183, 47.3%). Photophobia (217, 56.1%) and phonophobia (208, 53.7%) were the most frequently reported symptoms, followed by nausea (173, 44.7%) and vomiting (173, 44.7%) (**Table 2**).

Migraine Triggers/Risk Factors and Symptoms

Stress (27.7%, n=107) and sleep deprivation (23.2%, n=90) emerged as the most prevalent migraine triggers. Hunger or skipped meals affected 26.8% (n=104) of respondents, while environmental factors such as bright lights (33.0%, n=128) and loud noises (31.3%, n=121) were commonly reported. Dietary triggers included chocolate (24.1%, n=93) and caffeine (25.9%, n=100). The mean overall risk factor score was 28.7 (±10.5). Complete results are shown in **Table 3**. Nausea was the most prevalent symptom, reported by 35.7% (n=138) of respondents sometimes and 27.7% (n=107) often. Vomiting affected 33.0% (n=128) sometimes and 26.8% (n=104) often. Sensory sensitivities were common, with 32.1% (n=124) frequently experiencing light sensitivity and 30.4% (n=118) having sound sensitivity. Neurological symptoms included tingling/numbness in the extremities (25.0%, n=97 reporting frequent occurrence) and speech difficulties/confusion (31.3%, n=121 sometimes; 26.8%, n=104 often) (**Table 3**).

Effect on Job Efficiency

Migraines often affected the ability to work for 104 (26.8%) respondents, and 73 (18.8%) respondents stated that their ability to work was always affected. Productivity was moderately impaired for 121 (31.3%), and 107 (27.7%) experienced significant impairment. Workload reduction or task changes due to migraines were reported often by 104 (26.8%). Important meetings or deadlines were significantly affected for 97 (25.0%), with 76 (19.6%) reporting a severe impact. Entire work absences due to migraines were reported by 114 (29.5%). The mean overall impact score was 18.5 (±7.3).

Management of Migraine

The mean management score was 16.3 (±8.5), with 37.5% (n=145) of respondents classified as poorly managed and 35.7% (n=138) as moderately managed. The most frequently used treatments were over-the-counter (62.5%, n=242) and prescription medications (50.9%, n=197). Hot or cold compresses were rated as very effective by 35.9% (n=139), making them the top-performing intervention. Consistent usage was highest for over-the-counter medications (53.6%, n=207) and trigger avoidance (54.5%, n=211). Detailed results are presented in **Table 4**.

Effectiveness of Treatments Used for Managing Migraines

Table 5 summarizes migraine treatment effectiveness ratings across 5 categories. Massage therapy, hot/cold compresses, and rest were most frequently rated as very effective (32.8%, 35.9%, and 31.3%, respectively), while relaxation techniques were also highly rated. Medications were widely used and considered effective, whereas herbal remedies, acupuncture, and yoga showed moderate success. Smoking, exercise, and dietary changes were viewed as least effective. Overall, non-drug approaches, such as massage and rest, alongside medications, were perceived as the most beneficial for migraine relief.

Frequency of Use of Migraine Management Strategies

Prescribed and over-the-counter medications were the most consistently used strategies, with over 50.9% of respondents reporting they "always" take them. Avoiding triggers was also common (54.5% always). Relaxation techniques were frequently used (49.1% always), while herbal remedies were used more variably (42.9% always, 37.5% sometimes).

Overall Burden of Migraine Among Respondents

In this study, 53.6% (n=207) of respondents reported a moderate burden, followed by high (24.1%, n=93) and low (22.3%, n=86) burden levels.

Comparison of Means Between Dependent and Independent Variables

Table 6 shows that males reported lower migraine prevalence, with a mean of 18.2 (SD=5.4, *P*=0.032), lower impact on job efficiency, with a mean of 16.5 (SD=7.0, *p*=0.015), and a lower overall burden score of 61.5 (SD=12.4, *P*=0.012). The youngest age group, 18-25 years, showed a lower prevalence of migraines, with a mean of 17.8 (SD=5.2, *P*=0.035) and lower job efficiency impact of 15.9 (SD=6.5, *P*=0.023), with their overall burden also lower, at 60.1 (SD=12.8, *P*=0.029). Respondents earning below 18 000 PKR had significantly lower prevalence (17.9; SD=5.5, *P*=0.045), job efficiency impact (16.4; SD=6.8, *P*=0.038), and overall burden (61.2; SD=12.9, *P*=0.031).

Cross-Tabulation of Demographics and Burden of Migraine Among Respondents

A significant association was found between gender and burden (*P*=0.012), with a higher proportion of females (35.7%, n=138) reporting high burden compared to males (21.4%, n=83). Age was also significantly associated with burden (*P*=0.029),

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Table 3. Migraine triggers/risk factors and symptoms.

Triggers	Never n (%)	Rarely n (%)	Sometimes n (%)	Often n (%)	Always n (%)
Stress	27 (7.1%)	48 (12.5%)	121 (31.3%)	107 (27.7%)	83 (21.4%)
Sleep deprivation	31 (8.0%)	59 (15.2%)	138 (35.7%)	90 (23.2%)	69 (17.9%)
Hunger or skipping meals	34 (8.9%)	55 (14.3%)	131 (33.9%)	104 (26.8%)	62 (16.1%)
Loud noises	41 (10.7%)	73 (18.8%)	121 (31.3%)	86 (22.3%)	66 (17.0%)
Fatigue	24 (6.3%)	52 (13.4%)	131 (33.9%)	114 (29.5%)	66 (17.0%)
Strong smells	31 (8.0%)	69 (17.9%)	124 (32.1%)	90 (23.2%)	73 (18.8%)
Bright or flickering lights	27 (7.1%)	59 (15.2%)	128 (33.0%)	104 (26.8%)	69 (17.9%)
Changes in weather	41 (10.7%)	76 (19.6%)	107 (27.7%)	90 (23.2%)	73 (18.8%)
Cold weather	45 (11.6%)	62 (16.1%)	121 (31.3%)	93 (24.1%)	66 (17.0%)
Hot weather	38 (9.8%)	66 (17.0%)	124 (32.1%)	104 (26.8%)	55 (14.3%)
Prolonged digital screen time	31 (8.0%)	52 (13.4%)	121 (31.3%)	107 (27.7%)	76 (19.6%)
Physical activity or exercise	45 (11.6%)	69 (17.9%)	118 (30.4%)	97 (25.0%)	59 (15.2%)
Congested indoor work environment	52 (13.4%)	73 (18.8%)	118 (30.4%)	90 (23.2%)	55 (14.3%)
Increase in workload	31 (8.0%)	62 (16.1%)	121 (31.3%)	100 (25.9%)	73 (18.8%)
Thirst	34 (8.9%)	55 (14.3%)	138 (35.7%)	93 (24.1%)	66 (17.0%)
Food triggers					
Chocolate	41 (10.7%)	66 (17.0%)	124 (32.1%)	93 (24.1%)	62 (16.1%)
Cheese	45 (11.6%)	59 (15.2%)	121 (31.3%)	107 (27.7%)	55 (14.3%)
Caffeine (eg, coffee, tea)	31 (8.0%)	62 (16.1%)	111 (28.6%)	100 (25.9%)	83 (21.4%)
Processed meats	48 (12.5%)	69 (17.9%)	118 (30.4%)	97 (25.0%)	55 (14.3%)
Nuts	38 (9.8%)	55 (14.3%)	128 (33.0%)	104 (26.8%)	62 (16.1%)
Citrus fruits	34 (8.9%)	66 (17.0%)	121 (31.3%)	100 (25.9%)	66 (17.0%)
Fried or fatty foods	45 (11.6%)	62 (16.1%)	131 (33.9%)	90 (23.2%)	59 (15.2%)
Skipping meals	34 (8.9%)	59 (15.2%)	135 (34.8%)	93 (24.1%)	66 (17.0%)
Overall risk factor score	28.7 (+10.5)				
Symptoms					
Nausea	17 (4.5%)	59 (15.2%)	138 (35.7%)	107 (27.7%)	66 (17.0%)
Vomiting	34 (8.9%)	52 (13.4%)	128 (33.0%)	104 (26.8%)	69 (17.9%)
Sensitivity to light	14 (3.6%)	45 (11.6%)	111 (28.6%)	124 (32.1%)	93 (24.1%)
Sensitivity to sound	17 (4.5%)	48 (12.5%)	114 (29.5%)	118 (30.4%)	90 (23.2%)
Sensitivity to smell	27 (7.1%)	69 (17.9%)	104 (26.8%)	100 (25.9%)	86 (22.3%)
Visual disturbances	24 (6.3%)	62 (16.1%)	118 (30.4%)	104 (26.8%)	79 (20.5%)
Tingling or numbness in hands/feet	34 (8.9%)	55 (14.3%)	104 (26.8%)	97 (25.0%)	97 (25.0%)
Difficulty speaking or confusion	31 (8.0%)	66 (17.0%)	121 (31.3%)	104 (26.8%)	66 (17.0%)

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Table 4. Management of migraine among respondents.

Variable	n (%) or mean (SD)
Total management score (0-30)	16.3 (+8.5)
Management grouping	
Well-managed (0-10)	104 (26.8%)
Moderately managed (11-20)	138 (35.7%)
Poorly managed (21+)	145 (37.5%)
Treatments used	
Prescription medication	197 (50.9%)
Over-the-counter medication	242 (62.5%)
Herbal remedies (eg, ginger, feverfew)	118 (30.4%)
Acupuncture	52 (13.4%)
Massage therapy	97 (25.0%)
Yoga or meditation	104 (26.8%)
Dietary changes (eg, elimination of foods)	93 (24.1%)
Relaxation techniques (eg, deep breathing)	145 (37.5%)
Physical exercise	121 (31.3%)
Taking a break from work	166 (42.9%)
Smoking	69 (17.9%)
Spiritual therapy	62 (16.1%)
Hot or cold compress	156 (40.2%)
Sleeping or lying down	208 (53.6%)

Table 5. Effectiveness of treatments used for managing migraines.

Treatment	Not effective n (%)	Slightly effective n (%)	Somewhat effective n (%)	Effective n (%)	Very effective n (%)
Prescription medication	17 (4.5%)	24 (6.3%)	138 (35.7%)	104 (26.8%)	73 (18.8%)
Over-the-counter medication	24 (6.3%)	31 (8.0%)	145 (37.5%)	93 (24.1%)	94 (24.1%)
Herbal remedies	27 (7.1%)	38 (9.8%)	107 (27.7%)	97 (25.0%)	118 (30.4%)
Acupuncture	35 (8.9%)	45 (11.6%)	110 (28.4%)	87 (22.5%)	110 (28.4%)
Massage therapy	24 (6.3%)	35 (8.9%)	104 (26.8%)	97 (25.0%)	127 (32.8%)
Yoga or meditation	35 (8.9%)	41 (10.7%)	114 (29.5%)	90 (23.2%)	107 (27.7%)
Dietary changes	41 (10.7%)	52 (13.4%)	118 (30.4%)	86 (22.3%)	90 (23.2%)
Relaxation techniques	17 (4.5%)	31 (8.0%)	124 (32.1%)	114 (29.5%)	101 (26.1%)
Physical exercise	41 (10.7%)	52 (13.4%)	135 (34.8%)	90 (23.2%)	69 (17.9%)
Taking a break	24 (6.3%)	35 (8.9%)	121 (31.3%)	107 (27.7%)	100 (25.8%)
Smoking	52 (13.4%)	69 (17.9%)	90 (23.2%)	97 (25.0%)	79 (20.5%)
Hot or cold compress	17 (4.5%)	31 (8.0%)	107 (27.7%)	93 (24.1%)	139 (35.9%)
Sleeping or lying down	17 (4.5%)	31 (8.0%)	114 (29.5%)	104 (26.8%)	121 (31.3%)

particularly among respondents aged 36 to 45 years, who had the highest proportion of high burden (12.5%, n=48). Marital status showed no significant association with burden (P=0.052), although unmarried respondents (18.8%) reported a moderate burden. Income level was significantly associated with burden (P=0.045), with the highest proportion of high burden observed among those earning above PKR 50 000 (13.4%). Detailed findings are presented in **Table 7**.

Predictors of Overall Migraine Burden Among Respondents

Multiple linear regression identified age (β=0.74, P=0.002), female gender (β=2.25, P=0.018), stress score (β=0.51, P<0.001), and sleep deprivation (β=0.38, P=0.007) as significant predictors of higher migraine burden, while higher income (β=-0.39, P=0.041) and better management (β=-0.56, P<0.001) were associated with a reduced burden. Multicollinearity was assessed,

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Table 6. Comparison of means between dependent and independent variables.

Demographic variable	Prevalence of migraine		Risk factors		Job efficiency impact		Management of migraine		Overall burden	
	Mean (+SD)	*P* value	Mean (+SD)	*P* value	Mean (+SD)	*P* value	Mean (+SD)	*P* value	Mean (+SD)	*P* value
Gender										
Male	18.2±5.4	**0.032***	22.1±7.1	0.058	16.5±7.0	**0.015***	18.3±6.6	0.082	61.5±12.4	**0.012***
Female	19.7±5.7		23.6±7.5		17.9±6.8		19.2±6.9		63.8±13.2	
Age (in years)										
18-25	17.8±5.2	0.035*	21.9±7.3	0.064	15.9±6.5	**0.023***	17.1±6.2	0.054	60.1±12.8	**0.029***
26-35	19.3±5.8		23.2±7.8		17.6±6.9		19.3±6.8		63.8±13.5	
36-45	21.1±6.1		24.7±7.6		18.5±7.0		20.2±7.4		65.7±14.1	
46 and above	20.9±5.9		24.1±7.9		19.0±6.7		18.5±7.2		64.0±13.7	
Marital status										
Unmarried	18.5±5.6	0.052	22.8±7.4	0.078	16.9±6.9	0.068	18.5±6.7	0.071	62.3±13.0	0.065
Married	19.9±5.9		23.4±7.7		18.1±7.0		19.6±6.9		64.1±13.5	
Divorced	20.2±6.0		24.3±7.8		19.0±7.1		20.2±7.4		65.3±14.0	
Widowed	20.0±5.9		23.9±7.9		18.7±6.8		19.0±7.3		64.8±13.6	
Income (PKR)										
Below 18 000	17.9±5.5	**0.045***	21.8±7.1	0.092	16.4±6.8	**0.038***	17.5±6.4	0.069	61.2±12.9	**0.031***
18 001-36 000	19.2±5.8		23.5±7.5		17.8±6.9		19.2±6.9		63.9±13.4	
36 001-50 000	20.1±6.0		24.1±7.7		18.5±7.0		19.8±7.1		64.5±14.0	
Above 50 000	20.5±5.9		24.4±7.8		19.2±7.2		20.0±7.3		65.0±13.8	

with all VIF values below 3.75, confirming acceptable collinearity. This model explained 57% of the variance. Results are described in **Table 8**.

Predictors of Job Efficiency Impact Due to Migraine Among Respondents

As described in **Table 9**, for job efficiency impact, significant predictors included migraine frequency (β=0.56, *P*<0.001), pain severity (β=0.68, *P*<0.001), stress score (β=0.39, *P*<0.001), and sleep deprivation (β=0.35, *P*=0.008). Females reported significantly higher impact (β=1.97, *P*=0.025), while better management (β=-0.47, *P*=0.001) improved job efficiency. VIF values remained below 4.21 for all predictors, supporting model stability, with the model explaining 60% of the variance.

Predictors of Poor Migraine Management Among Respondents

Logistic regression predicting poor migraine management identified severe migraines (AOR=2.47, *P*<0.001), frequent attacks (AOR=2.12, *P*=0.004), and high stress (AOR=1.79, *P*=0.015) as the strongest predictors. Female gender (AOR=1.58, *P*=0.084) and age (AOR=1.02, *P*=0.312) were not significant after adjustment, while income (AOR=0.89, *P*=0.241) also lost significance. The model demonstrated acceptable fit (Nagelkerke R^2=0.41), as shown in **Table 10 and Figure 1**.

Discussion

The current study assessed the prevalence of migraine, risk factors, occupational impact, and management approaches in Pakistan. Overall, the results reveal a substantial migraine burden that mirrors global patterns yet is distinctly shaped by local sociodemographic realities.

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Table 7. Cross-tabulation of demographics and burden of migraine among respondents.

Demographic variable	Low burden (0-30)	Moderate burden (31-60)	High burden (61+)	*P* value
Gender				
Male	50 (12.9%)	79 (20.5%)	83 (21.4%)	**0.012***
Female	34 (8.9%)	128 (33.0%)	138 (35.7%)	
Age (in years)				
18-25	27 (7.1%)	41 (10.7%)	34 (8.9%)	**0.029***
26-35	31 (8.0%)	86 (22.3%)	41 (10.7%)	
36-45	14 (3.6%)	45 (11.6%)	48 (12.5%)	
46 and above	14 (3.6%)	34 (8.9%)	41 (10.7%)	
Marital status				
Unmarried	41 (10.7%)	72 (18.8%)	52 (13.4%)	0.052
Married	27 (7.1%)	66 (17.0%)	59 (15.2%)	
Divorced	10 (2.7%)	24 (6.3%)	21 (5.4%)	
Widowed	7 (1.8%)	14 (3.6%)	10 (2.7%)	
Income (PKR)				
Below 18 000	21 (5.4%)	34 (8.9%)	24 (6.3%)	**0.045***
18 001-36 000	27 (7.1%)	72 (18.8%)	41 (10.7%)	
36 001-50 000	24 (6.3%)	52 (13.4%)	41 (10.7%)	
Above 50 000	14 (3.6%)	48 (12.5%)	52 (13.4%)	

Table 8. Multiple linear regression predicting overall migraine burden among respondents.

Predictor	Coefficient (β)	Standard error	*t* value	*P* value
Age	0.74	0.24	3.08	0.002*
Gender (Female=1)	2.25	0.95	2.37	0.018
Income	-0.39	0.19	-2.05	0.041
Stress score	0.51	0.1	5.1	<0.001*
Sleep deprivation	0.38	0.14	2.71	0.007*
Dietary habits	0.22	0.12	1.83	0.068
Management score	-0.56	0.15	-3.73	<0.001*
Constant	22.97	3.98	5.77	<0.001*

First, the demographic distribution reveals a critical concentration among economically active young adults aged 26 to 35 years (41.1%), consistent with international studies that identify this life stage as a period of peak vulnerability, likely due to career pressures and the development of lifestyle patterns [4,9,27,28]. This vulnerability is further amplified by striking gender disparities, with females comprising 77.3% of cases, a pattern underscoring hormonal fluctuations as a key pathophysiological mechanism that necessitates gender-specific treatment protocols and dedicated research into hormonal therapies [29].

Second, occupational influences emerged as pivotal risk determinants, with significant representation in high-stress sectors,

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Table 9. Multiple linear regression predicting job efficiency impact of migraine among respondents.

Predictor	Coefficient (β)	Standard error	*t* value	*P* value
Age	0.43	0.21	2.05	0.042
Gender (Female=1)	1.97	0.88	2.24	0.025
Income	-0.29	0.16	-1.81	0.071
Frequency of migraine	0.56	0.15	3.73	<0.001*
Pain severity	0.68	0.18	3.78	<0.001*
Stress score	0.39	0.1	3.9	<0.001*
Sleep deprivation	0.35	0.13	2.69	0.008*
Management score	-0.47	0.14	-3.36	0.001*
Constant	18.45	3.67	5.03	<0.001*

Table 10. Predictors for poor migraine management among respondents.

Variable	COR (95% CI)	*P* value	AOR (95% CI)	*P* value
Gender (Female)	1.87 (1.21-2.89)	0.005**	1.58 (0.94-2.67)	0.084
Income	0.85 (0.72-1.00)	0.048*	0.89 (0.74-1.08)	0.241
Stress (high)	2.03 (1.34-3.07)	0.001**	1.79 (1.12-2.87)	0.015*
Migraine severity (severe)	2.71 (1.68-4.39)	<0.001**	2.47 (1.49-4.08)	<0.001**
Migraine frequency (high)	2.27 (1.45-3.54)	<0.001**	2.12 (1.27-3.55)	0.004**
Age	1.04 (1.00-1.09)	0.041*	1.02 (0.98-1.07)	0.312

COR – crude odds ratio; AOR – adjusted odds ratio; CI –confidence interval; * *P*<0.05; ** p<0.01.

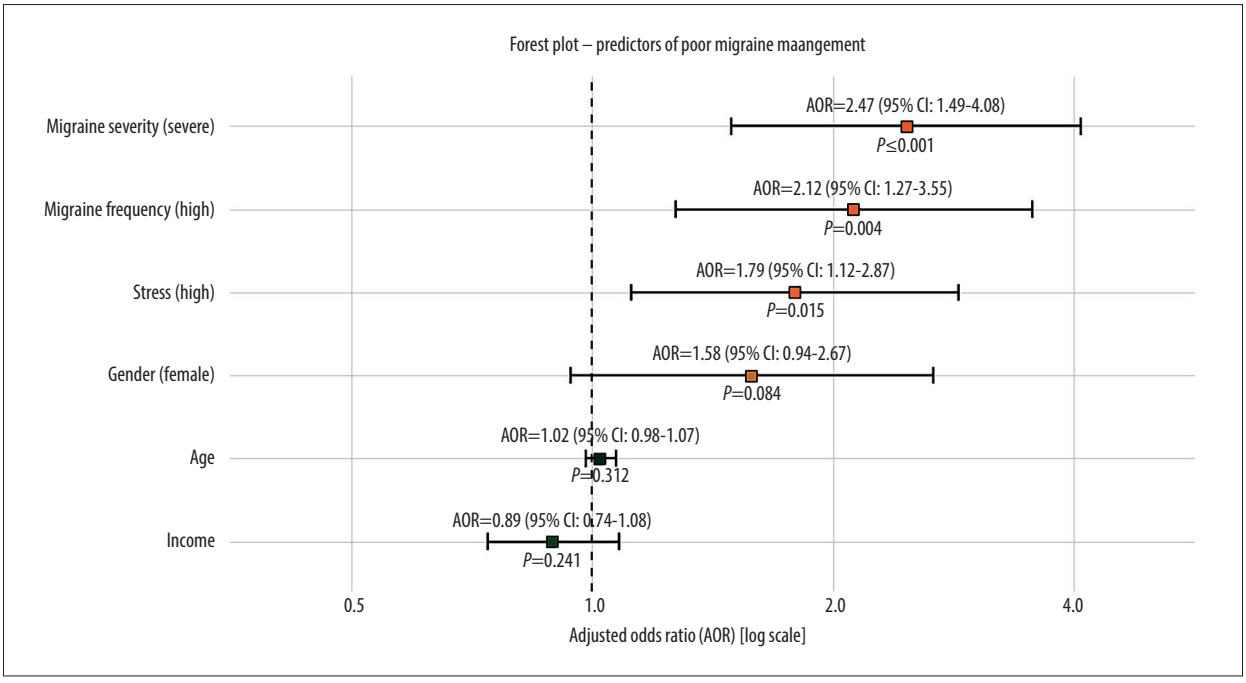

Figure 1. Forest plot of predictors for poor migraine management among corporate sector employees.

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such as finance (19.6%) and manufacturing (16.0%). Our results specifically identified occupational stress (49.1%) and prolonged screen time (47.3%) as the most significant work-related triggers. Consequently, workplace interventions should prioritise stress-reduction strategies and ergonomic adjustments. The preponderance of unmarried respondents (42.9%) further suggests that irregular routines and limited social support can compound occupational stress, creating a feedback loop that exacerbates migraine frequency and severity [30].

Third, these interconnected demographic and occupational insights directly inform the patterns of migraine severity observed. Forty percent experienced moderate and 34.8% severe attacks, rates that parallel global severity trends, such as Viana et al's (2018) report of 51% chronic migraine in Italy [7]. Moreover, the predominance of migraine without aura (38.4%) aligns with global epidemiological trends [28]. The frequent duration of migraine episodes reported as 4 to 8 h aligns with durations reported in the broader literature, such as a 2014 study by Chang et al [21]. The frequent experience of migraine episodes 1 to 3 times per month in our cohort is indicative of a significant recurrent impact, highlighting the chronic nature of the condition and aligning with other studies [31,32]. Crucially, our data confirm modifiable lifestyle triggers as central drivers: stress, sleep deprivation, and irregular dietary habits were the most frequently reported triggers. This aligns with Johnson et al (2022), who emphasized that effective management must integrate behavioral interventions alongside pharmacotherapy [12]. In Pakistan, where high occupational stress, irregular meals due to demanding schedules, and disrupted sleep are prevalent in the young workforce, these findings necessitate culturally adapted lifestyle protocols as a first-line strategy, complemented by increased accessibility to both acute and preventive medications. Notably, the high incidence of these modifiable triggers strongly suggests that targeted educational programs on lifestyle management could significantly reduce migraine frequency and severity.

Fourth, the significant association of environmental triggers such as loud noises (31.3%) and strong smells (42%) indicates that workplace and public space modifications could benefit sensory-sensitive individuals, as advocated by Holden (2022) [23]. These findings collectively underscore the need for multidimensional intervention strategies.

Fifth, the occupational impact is particularly severe, with 33.0% of respondents experiencing moderate work impairment and 26.8% facing significant disruptions. These findings closely align with Minen et al's (2022) report of decreased productivity and increased absenteeism among migraine sufferers [33]. This highlights the substantial socioeconomic burden of the condition, particularly in Pakistan, where social safety nets for individuals with health-related work limitations are limited. Our data suggest that workplace adaptations can reduce the impact of migraine. Key modifications include flexible work arrangements during episodes, creating sensory-controlled spaces with reduced lighting and noise, and providing migraine-awareness training for effective management interventions [34-36]. Such measures would be particularly impactful in high-risk sectors, such as finance and manufacturing, identified in our study.

Sixth, management patterns reveal a dual approach: 62.5% frequently use over-the-counter (OTC) medications, while 26.8% use non-pharmacological strategies, such as yoga and meditation. This integrative trend is encouraging, as prior studies validate the efficacy of mindfulness-based practices in chronic migraine [37,38].

Lastly, regression analyses clarify the factors that drive migraine burden. After adjustment for covariates, female gender, younger age (26-35 years, β=-0.19, *P*=0.029), and lower income (β=-0.17, *P*=0.045) independently predicted greater severity – findings that illustrate how biological vulnerability intersects with socioeconomic disadvantage [16,39,40]. Moreover, higher migraine burden was associated with reduced work efficiency (β=-0.31, *P*=0.015), while poor migraine control was associated with increased burden (OR=2.56, *P*=0.001) and greater reliance on OTC drugs (OR=1.87, *P*=0.018). Collectively, these findings underscore the importance of developing migraine-friendly workplace policies and expanding employee access to preventive and acute care resources. Such multidimensional interventions promise not only to alleviate individual suffering but also to curb self-medication, enhance workplace productivity, and reduce the wider socioeconomic toll of migraine in Pakistan.

Conclusions

This study demonstrates that migraines exert a significant and detrimental impact on job efficiency within Pakistan's corporate sector. Its burden is influenced by gender, occupational stress, and income. Our data specifically identify modifiable workplace triggers, underscoring the need for organizational interventions, such as flexible scheduling and environmental modifications, to mitigate sensory exposures. The prevalent reliance on OTC medications reveals a critical gap in care access. The findings advocate for a dual strategy: implementing migraine-aware workplace policies and developing clinically guided, accessible care models to reduce the substantial personal and economic burden of migraine in the workforce. Future research should focus on longitudinal studies to gain a deeper understanding of the dynamics of migraine management and its outcomes.

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Limitations and Future Implications

While this study provides valuable insights into the migraine burden among corporate employees in Pakistan, several limitations must be acknowledged. Purposive sampling from neurology outpatient departments may overrepresent severe cases, limiting generalizability. Excluding rural employees and non-healthcare-seeking individuals creates geographic and socioeconomic gaps. Self-reported data are vulnerable to recall bias, and subjective ratings of severity and job impact lack objective validation. The cross-sectional design precludes causal inferences, and the absence of longitudinal data hinders understanding of migraine progression and treatment outcomes. The cultural context was insufficiently explored, despite mention of traditional remedies; no qualitative data were collected to examine self-medication practices or workplace stigma. Future research should include longitudinal studies to assess treatment adherence and economic impact, as well as mixed-methods designs to explore cultural practices, stigma, and gender-specific barriers. Clinical validation of self-reported data and targeted interventions for high-risk industries is also needed. Clinically, gender-specific protocols, improved access to preventive medications, and integrative care models that combine pharmacotherapy with culturally accepted strategies (eg, yoga, dietary changes) are needed.

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Data Availability

The data underlying this article can be obtained from the corresponding author upon reasonable request.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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