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DEMOGRAPHIC ASSOCIATION AND RISK FACTORS WITH LOW BACK PAIN IN PATIENTS REFERRED FOR LUMBAR SPINE MAGNETIC RESONANCE IMAGING

Original Research

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ABSTRACT

Background: Low back pain (LBP) remains a major global cause of disability, influenced by a complex interaction of lifestyle, occupational, and demographic factors. Its burden is particularly pronounced in developing countries, where limited ergonomic awareness and healthcare access contribute to chronicity. Understanding the demographic and clinical correlates of LBP is essential for designing preventive interventions and guiding clinical decision-making.

Objective: To identify the demographic characteristics and risk factors associated with low back pain among patients referred for lumbar spine magnetic resonance imaging (MRI) at a tertiary care hospital in Peshawar, Pakistan.

Methods: A descriptive cross-sectional study was conducted in the Radiology Department of Hayatabad Medical Complex, Peshawar. A total of 225 patients aged 20–60 years with clinically diagnosed LBP who underwent lumbar spine MRI were included through non-probability sampling. Data were collected using a structured proforma covering demographics, pain characteristics, aggravating and relieving factors, and associated neurological symptoms. MRI findings were recorded and correlated with clinical variables. Statistical analysis was performed using SPSS version 26. Descriptive statistics summarized continuous and categorical data, and associations between variables were tested using the chi-square test, with a p-value <0.05 considered significant.

Results: Of the 225 participants, 114 (50.7%) were female and 111 (49.3%) were male. The highest prevalence was observed in the 51–60-year age group (32.9%), with 106 (47.1%) housewives, 137 (60.9%) rural residents, and 83 (36.9%) obese individuals. Radiating pain was reported by 176 (78.2%) patients, gradual onset by 136 (60.4%), and aching pain quality by 120 (53.3%). Numbness (45.8%) and tingling (19.1%) were the most frequent neurological symptoms. Bending (25.8%) and sitting (20.4%) were major aggravating factors, while walking (20.9%) and sitting (19.1%) served as the most common relieving factors. Significant gender differences were found in pain site, quality, and severity ($p<0.05$).

Conclusion: Female gender, older age, obesity, rural residence, and housewife occupation were identified as major demographic and occupational risk factors for LBP. The findings highlight the need for community-based ergonomic education, weight management programs, and early screening strategies to prevent chronicity and reduce the socioeconomic burden of low back pain in high-risk populations.

Keywords: Age distribution, Ergonomics, Gender disparities, Low back pain, Magnetic resonance imaging, Obesity, Risk factors.

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INTRODUCTION

Low back pain (LBP) is among the most prevalent musculoskeletal disorders, presenting as discomfort in the lumbosacral region with or without radiation to the lower extremities (1). It is generally localized between the 12th rib and the gluteal folds, often accompanied by stiffness and mobility restriction. Clinically, LBP may be classified as specific—when linked to identifiable pathologies such as fractures, infections, malignancies, or rheumatoid arthritis—or non-specific when no distinct structural or pathological cause can be determined (2,3). Globally, nearly 90% of individuals with low back pain experience the non-specific form, where no single etiology can be identified (4). Symptoms typically manifest as dull, aching pain localized in the lower back that may radiate to the buttocks or thighs. The initial episode frequently occurs between the ages of 20 and 55, often resulting in short-term disability or recurrent episodes throughout life. The financial burden is considerable, with annual costs in the United States alone exceeding $50 billion due to lost productivity, diagnostic imaging, and therapeutic interventions (5). Although many cases resolve spontaneously within weeks, a substantial proportion progress to chronic pain, which significantly reduces quality of life and work efficiency. The occupational dimension of LBP is particularly significant. Physical factors such as lifting heavy loads, frequent bending or twisting, exposure to vibration, and sustained awkward postures are major biomechanical contributors (6). Psychosocial stressors, including job dissatisfaction, low social support, and high job demands, further compound musculoskeletal strain. Evidence indicates that nearly 70% of individuals in industrialized nations experience non-specific LBP at some point, with the World Health Organization (WHO) ranking it as the second leading cause of global disability (7,8).

Chronic low back pain affects nearly one-fifth of the global population, and recurrence within the first year is common (9). Emerging data emphasize the strong association between occupational exposure and the onset of LBP. A cross-sectional study revealed that over 94% of individuals perceived a relationship between their back pain and their professional activities, with more than 70% reporting onset early in their careers (10). The WHO defines work-related musculoskeletal disorders as multifactorial in origin, arising from biomechanical, ergonomic, and psychosocial workplace factors (11). Among healthcare professionals and industrial workers, the prevalence of such conditions is notably higher, estimated at 5.7% and 8.8%, respectively (12). These statistics underscore the importance of understanding demographic and occupational determinants to develop preventive strategies tailored to high-risk groups. Given the substantial burden of LBP and its occupational implications, especially among healthcare professionals, this study aims to determine the demographic associations and risk variables for low back pain among patients undergoing lumbar spine magnetic resonance imaging (MRI) at a tertiary care hospital in Peshawar, Pakistan. This objective seeks to bridge the gap in regional data and support the development of targeted preventive and diagnostic measures for early intervention.

METHODS

This cross-sectional study was conducted at the Hayatabad Medical Complex (HMC), Peshawar, Pakistan, a tertiary care hospital providing both inpatient and outpatient diagnostic services. The study was performed in the Department of Radiology, which is equipped with advanced imaging facilities including a 1.5 Tesla Philips MRI machine, a 128-slice CT scanner, multiple ultrasound units, digital and conventional X-ray systems, mammography, and a DEXA scanner. The department handles an average of 90 low back pain (LBP) cases per month for magnetic resonance imaging (MRI), ensuring a sufficient and diverse patient pool for the study. The study population included patients presenting with low back pain who underwent MRI of the lumbar spine at HMC during the study period. All participants underwent detailed history-taking and comprehensive clinical assessment. Medical records were reviewed in collaboration with the referring radiologists to confirm diagnostic relevance and clinical details. The final sample size comprised 225 patients, calculated using the OpenEpi sample size calculator, based on an 82.2% prevalence rate of low back pain, a 5% margin of error, and a 95% confidence interval. Inclusion criteria encompassed adults aged 20 to 60 years who had a confirmed history of low back pain and had undergone lumbar spine MRI. Patients with no history of low back pain, those with traumatic injuries or falls directly involving the lumbar spine, or individuals with prior spinal surgery were excluded from the study. Ethical approval was obtained from the Institutional Review Board (IRB) of Hayatabad Medical Complex ensuring adherence to ethical standards for human research.

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Participant recruitment was carried out at the MRI reception area, where the study objectives and procedures were clearly explained. Written and verbal informed consent was obtained from all participants prior to inclusion. Confidentiality was maintained by anonymizing personal information using coded study identifiers. Participation was entirely voluntary, and patients retained the right to withdraw at any stage without any impact on their medical care. Authorization for data access and recruitment was secured from the heads of the relevant clinical and radiology departments. MRI examinations were performed on a 1.5 Tesla Philips system following a standardized lumbar spine protocol. Imaging sequences included sagittal T1-weighted (T1W), T2-weighted (T2W), T2W short tau inversion recovery (STIR), and T2W myelographic views. In cases where neoplastic or inflammatory pathology was suspected, additional contrast-enhanced T1W and gradient echo (GRE) sequences were acquired. All MRI scans were interpreted on Picture Archiving and Communication System (PACS) workstations by the principal investigator alongside two consultant radiologists. Any discrepancies in interpretation were resolved through consensus discussion. Data were systematically recorded on predesigned proformas bearing anonymized study IDs, and the forms were meticulously checked for completeness and internal consistency before analysis. Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 26.0. Descriptive statistics such as means and standard deviations were computed for quantitative variables, whereas categorical data were summarized using frequencies and percentages. The chi-square test was applied to assess associations between categorical variables, with statistical significance determined at a p-value less than 0.05. Results were displayed in tabular and graphical formats to facilitate interpretation.

RESULTS

A total of 225 patients were included in the study, comprising 111 (49.3%) males and 114 (50.7%) females. The highest proportion of participants, 74 (32.9%), were between 51 and 60 years of age, followed by 60 (26.7%) aged 31–40 years and 54 (24.0%) aged 41–50 years. Most participants were married, accounting for 198 (88.0%), while only 27 (12.0%) were single. In terms of occupation, housewives represented the largest group at 106 (47.1%), followed by business professionals (16.0%) and those employed in other occupations (20.4%). The majority of the population resided in rural areas, 137 (60.9%), and a substantial number lived in joint families, 161 (71.6%). Regarding body mass index (BMI), 83 (36.9%) were categorized as obese, 58 (25.8%) as overweight, 80 (35.6%) had a healthy weight, and 4 (1.8%) were underweight. Pain characteristics revealed that most patients experienced radiating pain, 176 (78.2%), while 49 (21.8%) reported localized pain. A gradual onset of pain was documented in 136 (60.4%) individuals, with the right side being most frequently affected, 86 (38.2%), followed by bilateral involvement, 79 (35.1%). The predominant pain quality was aching in 120 (53.3%) patients, whereas 74 (32.9%) reported burning-type pain. Regarding associated factors, bending was identified as the most common aggravating factor in 58 (25.8%) cases, followed by sitting in 46 (20.4%) and combined bending and sitting in 35 (15.6%). Alleviating factors most frequently reported were walking in 47 (20.9%) patients, sitting in 43 (19.1%), and lying down in 33 (14.7%), suggesting movement-related relief in a significant number of cases. Associated symptoms were notable in a large proportion of patients, with numbness reported by 103 (45.8%) and tingling by 43 (19.1%). Thirty-four (15.1%) experienced both symptoms, while 45 (20.0%) reported no associated sensory complaints. Pain exacerbation during lifting of heavy objects was reported by 89 (39.6%), whereas 136 (60.4%) did not experience worsening pain with such activity. Severe pain leading to difficulty in walking was observed in 167 (74.2%) individuals, while 58 (25.7%) were able to ambulate despite discomfort. When categorized by pain duration and intensity, most participants reported moderate pain (63.6%), followed by severe (23.6%) and mild pain (12.9%).

Gender-based comparison revealed significant differences in several parameters. Radiating pain was more frequent in females (90.4%) compared to males (65.8%) ($p = 0.000$). The aching quality of pain predominated among males (64.9%) but was less prevalent among females (42.1%) ($p = 0.000$), whereas burning pain was more frequent in females (47.4%) than in males (18.0%). Alleviating factors also varied significantly by gender ($p = 0.04$), with walking and sitting being more commonly reported by males. Severity of pain in months demonstrated a strong association with gender ($p = 0.000$), where moderate pain predominated among females, while males experienced milder forms. No statistically significant differences were observed between genders regarding associated symptoms ($p = 0.4$) or pain exacerbation during lifting heavy objects ($p = 0.4$). MRI analysis of the lumbar spine revealed several degenerative and structural abnormalities among the study participants. The most frequently observed pathology was *degenerative disc disease (DDD)*, identified in 89 (39.6%) patients, often presenting with disc dehydration and reduced disc height on T2-weighted imaging. *Disc herniation* was observed in 63 (28.0%) patients, predominantly involving the L4–L5 and L5–S1 intervertebral levels, frequently correlating with radicular pain patterns. *Lumbar spondylosis*, characterized by osteophytic lipping and facet joint arthropathy, was noted in 41 (18.2%) patients, more prevalent among those above 50 years of age. *Spinal canal stenosis* was present in 19 (8.4%) individuals, while *spondylolisthesis* and *vertebral compression fractures* were detected in 8 (3.6%) and 5 (2.2%) patients, respectively. Additionally,

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inflammatory or infective changes such as *spondylodiscitis* were observed in 4 (1.8%) participants. The majority of these abnormalities were found in overweight or obese individuals, and degenerative changes were more common in the older age group (51–60 years). These findings underscore the high prevalence of degenerative spinal pathology as a primary etiological factor for low back pain among patients undergoing MRI evaluation at the study center.

Table 1: Shows the Demographic Characteristics of the Patients

Variables	Categories	Frequency	Percent
Gender	Male	111	49.3
	Female	114	50.7
Age Group	20 - 30	37	16.4
	31 - 40	60	26.7
	41 - 50	54	24.0
	51 – 60	74	32.9
Marital Status	Single	27	12.0
	Married	198	88.0
Occupation	Housewife	106	47.1
	Student	16	7.1
	Business	36	16.0
	Other	46	20.4
	Teacher	9	4.0
	Labor	6	2.7
	Driver	6	2.7
Residency	Urban	88	39.1
	Rural	137	60.9
Family Type	Nuclear	64	28.4
	Joint	161	71.6
BMI	Under Weight	4	1.8
	Healthy Weight	80	35.6
	Over weight	58	25.8
	Obese	83	36.9

Table 2: Showing the Pain Characteristic of the Patients

Variables	Categories	Frequency	Percent
Site of Pain	Localized	49	49.3
	Radiated	176	50.7
Onset of pain	Gradual	37	16.4
	Sudden	60	26.7

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Variables	Categories	Frequency	Percent
Side of Back Effected	Right	27	12.0
	Left	198	88.0
	Both		
	No		
Quality of Pain	Aching	106	47.1
	Burning	16	7.1
	Both	36	16.0
	No	46	20.4

Table 3: Showing the Associated Factors with Low Back Pain

Variables	Categories	Frequency	Percent
Aggravating Factors	Bending	58	25.8
	Sitting	46	20.4
	Standing	16	7.1
	Bending, Sitting	35	15.6
	Bending, Standing	14	6.2
	Sitting, Standing	21	9.3
	Bending, Sitting, Standing	35	15.6
Total		225	100
Alleviating Factors	Walking	47	20.9
	Sitting	43	19.1
	Laying Down	33	14.7
	Walking, Sitting	33	14.7
	Walking, Laying Down	34	15.1
	Sitting, Laying Down	18	8.0
	Walking, Sitting, Standing	15	6.7
	No	2	0.9
Total	225		

Table 4: Showing the Associated Symptoms of the Patients

Variables	Categories	Frequency	Percent
Associated Symptoms	Tingling	43	19.1
	Numbness	103	45.8
	Both	34	15.1
	No	45	20.0

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Variables	Categories	Frequency	Percent
Pain Exaggerated by Lifting Heavy Objects	Yes	89	39.6
	No	136	60.4
Walking	Yes	167	74.2
	No	58	25.7
Severity of Pain (In Months)	Mild	29	12.9
	Moderate	143	63.6
	Severe	53	23.6
Total		225	100

Table 5: Cross Tabulation of the Gender of the Patients with the Demographic Factors

Gender				
	Male	**Female**		
Site of Pain	N (%)	N (%)	P-Value	Total
Localized	38	11	0.000	49
Radiated	73	103		176
Quality of Pain				
Aching	72	48	0.000	120
Burning	20	54		74
Both	06	5		11
No	13	7		20
Alleviating Factors				
Walking	25	22	0.04	47
Sitting	29	14		43
Laying Down	18	15		33
Walking, Sitting	11	22		33
Walking, Laying Down	15	19		34
Sitting, Laying Down	8	10		18
Walking, Sitting, Standing	5	10		15
No	0	2		2
Associated Symptoms				
Tingling	27	16	0.4	43
Numbness	41	62		103
Both	18	16		34
No	25	20		45
Pain Exaggerated by Lifting Heavy Objects				

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Gender				
	Male	**Female**		
Yes	51	38	0.4	89
No	60	76		136
Severity of Pain in Months				
Mild	22	7	0.000	29
Moderate	64	79		143
Severe	24	143		53

Table 6: Distribution of MRI Findings Among Patients with Low Back Pain

MRI Findings	Frequency (n)	Percentage (%)
Degenerative Disc Disease (DDD)	89	39.6
Disc Herniation (L4–L5, L5–S1)	63	28.0
Lumbar Spondylosis	41	18.2
Spinal Canal Stenosis	19	8.4
Spondylolisthesis	8	3.6
Vertebral Compression Fracture	5	2.2
Spondylodiscitis / Infection	4	1.8
Total	225	100

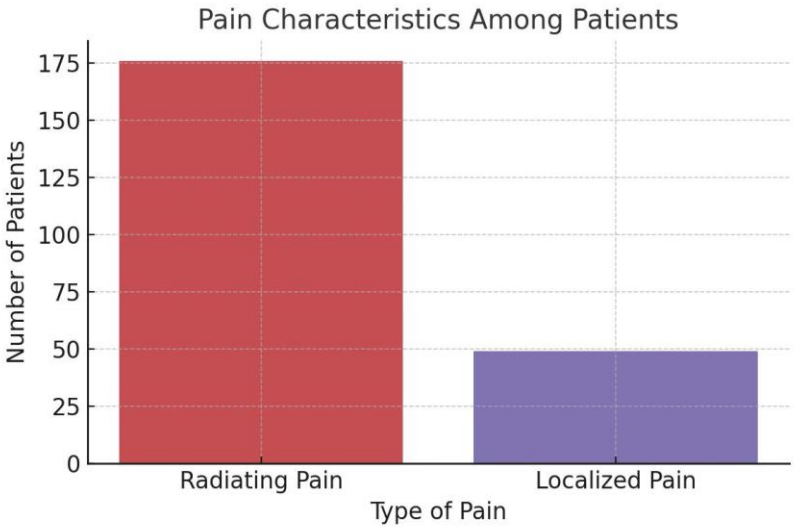


Figure 2Pain Characteristics Among Patients

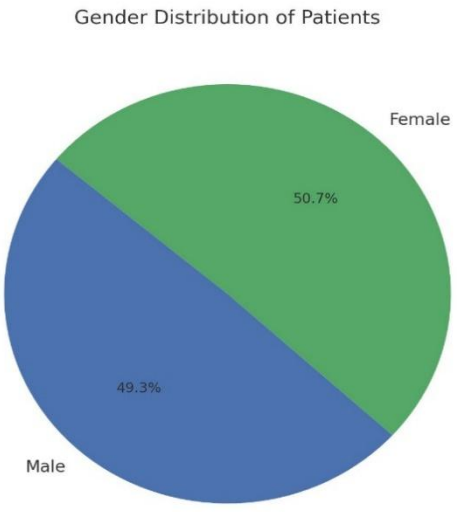


Figure 2 Gender Distribution of Patients

DISCUSSION

The present study investigated the demographic and clinical risk factors associated with low back pain (LBP) in patients undergoing lumbar spine MRI at a tertiary care hospital in Pakistan. The findings demonstrated a higher prevalence of LBP among women,

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individuals aged 51–60 years, housewives, rural residents, those living in joint family systems, and participants with obesity. These demographic patterns are consistent with previously documented global and regional research, indicating that female gender, advancing age, and increased body mass index (BMI) are significant contributors to the onset and persistence of LBP (6,7). The greater incidence of LBP among women supports existing epidemiological evidence suggesting gender-based physiological and occupational influences. Hormonal fluctuations, reduced muscle mass, and the repetitive bending and lifting tasks involved in domestic work predispose women to chronic musculoskeletal strain (8,9). Similar findings from South Asian cross-sectional studies reported that housewives are at an elevated risk of LBP due to non-ergonomic household activities performed without mechanical support or posture awareness (10). The predominance of cases in the 51–60-year age bracket corresponds with the well-established progression of degenerative changes in the lumbar spine, such as disc desiccation, osteoarthritic facet degeneration, and vertebral endplate alterations, which collectively contribute to both specific and non-specific LBP (11,12). Obesity emerged as a prominent risk factor, reflecting the mechanical and biochemical burden of excessive adiposity on spinal structures. The increased axial loading, coupled with inflammatory adipokine activity, accelerates disc degeneration and impairs spinal stability, thereby heightening susceptibility to pain (13,14). This association has been consistently highlighted in systematic reviews, which demonstrate a clear dose-response relationship between BMI and chronic LBP. Rural residency and joint family living further intensified LBP prevalence, likely due to occupational factors such as agricultural labor, repetitive lifting, and limited ergonomic education in rural populations (15). Moreover, cultural norms in joint families often distribute physically demanding chores disproportionately to women, perpetuating strain and functional disability.

The reported pain profiles—predominantly radiating, gradual in onset, and aching in quality—correspond well with MRI findings of degenerative disc disease, nerve root compression, and facet joint arthropathy, all of which are established pathophysiological correlates of mechanical LBP (16). The identified aggravating and relieving factors, with bending and prolonged sitting as exacerbating elements and walking as a relieving activity, align with mechanical instability and dynamic spinal load patterns described in prior research (17). Neurological manifestations such as numbness and tingling further reflect radicular involvement secondary to disc herniation or foraminal narrowing, paralleling MRI-documented nerve compression syndromes (18,19). The considerable number of patients reporting difficulty walking underscores the significant functional impairment caused by LBP, especially in chronic and degenerative cases. Gender-based variations in pain perception and distribution, particularly the higher proportion of radiating and burning pain in females, may relate to biological and psychosocial factors influencing nociceptive processing and pain reporting (20). Such findings highlight the importance of considering gender-specific diagnostic and therapeutic strategies for LBP management. The study's results align with previous multicenter investigations that identified physical occupational load, high BMI, and advanced age as universal determinants of LBP (21). Furthermore, South Asian research emphasizes unique sociocultural determinants—such as domestic workload and limited ergonomic literacy—that may amplify LBP prevalence beyond what is observed in Western cohorts (22,23).

Clinically, the implications of these findings are substantial. Early identification of high-risk individuals, particularly middle-aged women and rural workers, can inform targeted preventive interventions, including ergonomic education, postural training, and community-based rehabilitation programs. Incorporating weight management initiatives and awareness campaigns into public health strategies could further mitigate chronic pain progression and reduce unnecessary diagnostic imaging for non-specific LBP. The integration of evidence-based triage protocols may help optimize MRI referrals and resource allocation in tertiary care centers. The present study possesses several strengths, including its comprehensive demographic profiling and the integration of MRI-based diagnostic data, which collectively enhance the understanding of LBP etiology in the regional population. However, certain limitations must be acknowledged. The cross-sectional design precludes causal inference between demographic factors and imaging findings, and the single-center setting may restrict external validity. Additionally, the absence of statistical correlation between MRI abnormalities and demographic or clinical parameters limits the ability to delineate predictive associations. Future longitudinal or multicenter studies should incorporate regression-based analyses to explore these relationships and to assess the long-term functional outcomes associated with specific radiological patterns. Overall, this study contributes valuable evidence highlighting the interplay of demographic, occupational, and radiological factors influencing LBP in Pakistani patients. By contextualizing these findings within broader global data, it underscores the urgent need for preventive occupational health measures and standardized diagnostic frameworks tailored to regional healthcare contexts.

CONCLUSION

In conclusion, the study demonstrates that low back pain is closely associated with key demographic and lifestyle factors, including female gender, older age, obesity, rural residency, and household-related occupational strain. These findings reaffirm the multifactorial

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nature of low back pain and emphasize the significance of both physiological and environmental determinants. The results underscore the pressing need for proactive strategies such as ergonomic education, weight management, and workplace modifications aimed at prevention and early intervention. By identifying vulnerable populations, this research contributes to more targeted public health initiatives and highlights the importance of integrating preventive approaches into routine healthcare practices to reduce the growing burden of low back pain.

AUTHOR CONTRIBUTION

Author	Contribution
Ayesha Malik	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Abdul Salam	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Rukhsana Nasim	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Sobia Wali Muhammad	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Malika Uzma	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Abdul Wadood*	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Abdul Hadi	Contributed to study concept and Data collection Has given Final Approval of the version to be published

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