



## "Postural Scoliosis among Healthcare workers: A Cross-Sectional Analysis of Prevalence and Influencing Factors in Mumbai"

Mercy Thomas<sup>1</sup>, Senthilkumar N<sup>2</sup>, Priyanka Amitkumar<sup>3</sup>, Sarah John<sup>4</sup>

<sup>1</sup> Ph.D. Research Scholar – School of Health Sciences, Department of Physiotherapy, Garden City University, Bangalore and Consultant Physiotherapist, Ashok One Hospital, Mumbai. <sup>2</sup>Professor and Research Supervisor, School of Health Sciences Department of Physiotherapy, Garden City University Bangalore.

<sup>3</sup> Ph.D. Research Scholar –School of Health Sciences, Department of Physiotherapy, Garden City University, Bangalore.

<sup>4</sup> PharmD student, Poona College of Pharmacy, Bharti Vidyapeeth University, Pune

(Received: 05 November 2025    Revised: 15 December 2025    Accepted: 23 January 2026)

### KEYWORDS

Scoliosis, Health Personnel, Occupational Exposure, Posture, Musculoskeletal Diseases

### ABSTRACT:

#### Introduction:

Postural scoliosis (PS), clinically known as functional, is a non-permanent spinal deviation associated with prolonged static postures, repetitive stress, and poor ergonomic factors. Healthcare workers (HCW) are particularly vulnerable to this condition due to their extended working hours and sustained occupational postures.

**Objectives:** To estimate the prevalence of PS among HCW in tertiary hospitals in Mumbai and to assess its association of selected occupational and demographic factors.

**Methods:** This descriptive cross-sectional study was conducted among 246 HCW aged between 21–60 years across three tertiary care hospitals in Mumbai, India, between January 2025 and April 2025. Participants included doctors, nurses, physiotherapists, laboratory technicians, and administrative staff. Screening for PS was conducted using visual postural assessment, the Adam's Forward Bend Test, and scoliometer (SMtr) measurements, with trunk rotation  $>5^\circ$  considered positive for scoliosis. Other information like age, sex, BMI, profession, working hours, years of service, physical activity, and ergonomics training were also collected.

**Results:** PS was identified in 96 out of 246 participants (39.0%). In this Prevalence the doctors accounted for (65.0%), and laboratory technicians (59.5%) stood second. Comparitively the nurses (26.4%), physiotherapists (23.1%), and administrative staff (5.6%) ( $p = 0.001$ ) accounted for less. Physically inactive workers showed a significantly higher prevalence (66.2%) than active workers (3.7%) ( $p < 0.001$ ). Scoliosis was more associated with higher age, BMI, years of service, working hours, and higher scores of SMtr( $p = 0.001$ ).

**Conclusions:** PS is common among HCW in tertiary hospitals in Mumbai and is strongly associated with occupational factors and physical inactivity. This study recommends that routine screening, ergonomic education, and promotion of physical activity be implemented in an effort to reduce musculoskeletal risk among HCW.

### Introduction

Scoliosis is a condition that is characterised by an abnormal lateral spinal curvature and affects 2–3% of the global population. [1] Adolescent idiopathic scoliosis is the most prevalent, particularly among children between 10 and 16 years.[2] However, scoliosis is not confined particularly to this population alone, as it can

manifest at any age, influenced by various factors including congenital anomalies, neuromusculoskeletal (MSK) conditions, and degenerative spinal changes. [3] Among the scoliotic population the less severe or early form is termed as functional or postural scoliosis (PS). The structural scoliosis, presents with fixed spinal deformities, whereas the PS is characterised by a adopted



abnormal posture subconsciously by the individual that can be corrected by conscious efforts. PS often arises from prolonged poor posture, which leads to muscle imbalances or limb length discrepancies. PS is particularly prevalent among individuals who engage in occupations that involve prolonged static postures or work that involves repeating a particular movement again and again.<sup>[4]</sup> The PS develops gradually and hence goes unnoticed, especially in its early stages. PS remains asymptomatic in its early days, and it often presents with only occasional pain, mild awareness, and is hence often overlooked in both clinical examination and occupational health assessments.<sup>[5]</sup> Certain occupational populations are more prone to developing PS, among which the Healthcare workers (HCW) are the notable ones. The HCWs engage in monotonous activities and long work hours under stress that predispose them to many MSK issues. Operating room nurses, surgeons, and dental professionals frequently maintain static postures for extended periods, increasing their risk for PS.<sup>[6]</sup> A cross-sectional study among HCW in Ethiopia identified factors such as working overtime, absence of assistance during surgical procedures, and night shifts as significant contributors to work-related MSK disorders. Similarly, neurosurgeons have reported high rates of MSK disorders, associating them to prolonged static postures and inadequate ergonomic practices<sup>[7,8]</sup> working in non-ideal posture (Posture that doesn't suit the task performance) and sedentary lifestyle during and after COVID 19 pandemic have added momentum to the issue.<sup>[9]</sup>

Despite the growing body of evidence associating the occupational factors to postural abnormalities, there remains a paucity of research specifically targeting HCW in urban Indian settings. Mumbai is a cosmopolitan city that is densely populated with great healthcare facilities and presents a unique environment where HCWs are potentially at higher risk for PS due to challenging work schedules and ergonomic challenges.<sup>[10]</sup> This study aims to bridge this knowledge gap by conducting a cross-sectional analysis to screen for PS among HCW in selected tertiary hospitals in Mumbai. By identifying the prevalence and associated occupational factors, the study seeks to update on targeted interventions and suitable ergonomic modifications to alleviate the risk of PS among HCW.

## Methodology

### *Study Design*

This descriptive, cross-sectional study aimed at determining the prevalence of PS and examining associated occupational risk factors among HCWs. The cross-sectional method involved one-time data collection, providing a snapshot of the HCW's early spinal deformities while identifying potential occupational hazards contributing to postural deviations.

### *Study Setting*

The study was conducted at three tertiary care hospitals in Mumbai, India, from January 2025 to April 2025. The hospitals selected for this research comprised a good number of clinical and non-clinical HCWs who were willing to participate in this research. All screening procedures, questionnaires, and physical assessments were carried out within the hospital premises, in physiotherapy outpatient departments, ensuring minimal disturbance to the participants' routine professional duties.

### *Study Participants*

The target HCWs included Physicians and surgeons commonly termed as doctors, nurses, physiotherapists, laboratory technicians, and administrative staff. HCWs between 21 and 60 years of age, employed on a full-time basis, having at least 3 years of work experience as HCW and free from any history of diagnosed spinal deformity or recent spinal trauma were selected for the study. Individuals who were pregnant, had undergone recent orthopedic surgery to the spine or the extremities (Except the small bones of the hand), or had pre-existing neuromuscular disorders were excluded from the study. Participants were invited to the study through internal circulars, notice board announcements, and direct invitations to individual departments through the hospital administration. A purposive sampling technique was used to ensure adequate representation from different occupational categories within the healthcare sector. Before inclusion, all participants were provided with detailed information regarding the purpose and procedures of the study and were required to give written informed consent. Screening and data collection were carried out by trained physiotherapists using standardized protocols.



## Variables

The primary outcome variable for this study was the presence of PS among HCW, identified through physical assessment and screening tests. The HCWs were screened for the following details: age, gender, body mass index (BMI), level of physical activity during non-hospital time, Previous ergonomic training and knowledge, Years of health care Service, and working hours/Week. These factors were considered as they could independently influence spinal posture or MSK health. Effect modifiers such as ergonomic training, use of supportive seating or standing aids, and participation in regular physiotherapy or exercise programmes were also noted, as these could potentially alter the relationship between occupational exposure and the development of postural deviations. The diagnostic criteria for PS followed clinical guidelines.<sup>[11]</sup> PS was suspected when visible asymmetry was present in shoulder height, scapular prominence, or pelvic alignment, and when the spinal curvature altered with positional changes. Confirmation involved Adam's Forward Bend Test, accompanied by a SMtr.<sup>[12]</sup>

## Data Sources and Measurement

Data for this study were obtained from two primary sources: a structured questionnaire and a standardised physical assessment protocol. The questionnaire collected demographic details, occupational history, lifestyle factors, and ergonomic practices. It was adapted from validated occupational health surveys and reviewed for content validity by a panel of 3 experts in MSK physiotherapy and one occupational health. Physical assessments were conducted by postgraduate physiotherapists with a minimum of three years' clinical experience. Postural evaluation involved visual inspection of spinal alignment in standing and forward bending positions, using the Adam's Forward Bend Test as a primary screening tool. A scoliometer was used to measure trunk rotation angles in suspected cases, with a reading above 5 degrees considered indicative of structural scoliosis, warranting further investigation or referral. To confirm the consistency and reliability of the evaluation, all assessors underwent formal training before the data collection. All the subjects were examined in a similar clinical setting across all three hospitals, and any variations in posture screening results

were cross-verified by a second assessor to reduce observer bias.

## Bias

Several measures were undertaken to minimise possible sources of bias in this research. To reduce selection bias, a purposive sampling method was used that ensured a reasonable number of participants from various professional subgroups. Participation was voluntary, and efforts were made to recruit samples that were not inclined towards any gender or age groups through counselling and educating the need for screening. Observer bias was addressed by standardising all physical assessment procedures and providing assessor training sessions before the commencement of data collection. Furthermore, a second assessor independently verified any cases where spinal asymmetry or scoliosis was suspected. In situations where discrepancies arose between assessors, a consensus decision was reached through a third evaluator, where the majority was considered.

## Study Size

The study size was determined based on an estimated prevalence rate of PS among HCW derived from previous literature, which reported rates ranging between 10% and 25% in occupational settings. Using a prevalence estimate of 20%, with a 95% confidence level and a 5% margin of error<sup>[13]</sup>, the minimum required sample size was calculated using the formula:<sup>[14]</sup>

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

where

n - sample size,

Z - standard normal deviate (95%)

p - estimated prevalence,

d - anticipated precision. **The sample size arrived at was 246.**

## Statistical Methods

All statistical analyses were performed using SPSS version 27.0 (IBM Corp.). Descriptive statistics were used initially to summarise participant characteristics



and the prevalence of postural and functional scoliosis. Continuous variables such as age, BMI, years of professional service, and working hours were expressed as means with standard deviations, while categorical variables were presented as frequencies and percentages. To explore associations between scoliosis prevalence and occupational factors, Chi-square tests were applied for categorical variables, and independent-samples t-tests or Mann-Whitney U tests were used for continuous variables, depending on data distribution. To control the potential confounding variables (age, sex, BMI, and level of physical activity), binary logistic regression analysis was conducted. Variables with a p-value less than 0.20 in univariate analysis were entered into the multivariate model to identify independent predictors of PS while adjusting for confounders.

## Results

This study aimed to explore the prevalence of scoliosis among HCWs in a Mumbai hospital setting. The dataset consisted of 246 participants, and the data collection went on until this number was attained. The following are the results of the study.

### *Profession and Scoliosis:*

A highly significant difference was found between various professions and scoliosis status ( $\chi^2 = 187.34$ ,  $p < 0.001$ ). Which means there is a strong association between profession and the likelihood of developing scoliosis. The results of the study revealed that doctors (39 out of 60, 65%) and lab technicians (22 out of 37, 60%) showed the highest prevalence of scoliosis, while nurses and administrative staff had much lower rates. These numbers suggest that the type of profession, possibly due to its physical demands or ergonomic exposure, may influence PS risk.

### *Gender and Scoliosis:*

The analysis of gender vice prevalence showed that gender did not influence the occurrence of PS ( $\chi^2 = 43.255$ ,  $df = 1$ ,  $p < .161$ ). Among males, 28 out of 121 (24%) had scoliosis, whereas only 37 out of 125 (29%) females were affected. This minimal disparity indicates that both male and female HCW are equally at the risk of developing scoliosis.

### *Physical Activity and Scoliosis:*

The results showed that lower physical activity was significantly associated with the prevalence of PS ( $\chi^2 = 99.08$ ,  $df = 1$ ,  $p < .001$ ). Workers reporting no physical activity had a much higher prevalence (92 out of 139, 66%) compared to those engaging in regular activity (4 out of 107, 3.7 %). This finding emphasises the vital role of physical activity in spinal health.

### *Ergonomics Training and Scoliosis:*

PS prevalence did not differ based on the ergonomic education and brief training courses, though not highly statistically significant ( $\chi^2 = 19.902$ ,  $df = 1$ ,  $p < .081$ ). Among those without ergonomics training 91 out of 175 (52%) had PS, compared to just 39 out of 71 (55%) among those who had received such training, signifying that the ergonomics education did not reduce the occurrence of the spinal postural deviation.

### *Tests of Normality*

Normality analysis of continuous variables was performed using the Kolmogorov-Smirnov and Shapiro-Wilk tests, separately for participants with and without scoliosis. For those with scoliosis, the Shapiro-Wilk test was not significant ( $p = 0.069$ ), suggesting age followed a normal distribution. However, for those without scoliosis, age significantly deviated from normality ( $p = 0.001$ ). In both groups, all other parameters like BMI, years of service, working hours, and SMtreadings significantly deviated from normality (all  $p < 0.05$ ). hence non parametric tests were preferred for the analysis of the study results. A significant difference was observed in age ( $U = 5409.5$ ,  $p = 0.001$ ), with participants with PS showing a higher mean rank (142.15) compared to those without (111.56). This implies older HCWs were more likely to have PS. BMI differed significantly between the two category ( $U = 2005.5$ ,  $p < 0.001$ ). Participants with PS had a higher BMI mean rank (177.61), suggesting higher BMI was associated with increased PS prevalence. There was a significant difference in years of services among both category ( $U = 4534.5$ ,  $p < 0.001$ ), indicating that those with PS tended to have longer years of service. People who had PS had a significant association with long hours of working compared to the others. ( $U = 1387.5$ ,  $p < .001$ ) SMtr Readings: As expected, SMtr values differed significantly ( $U = 3.0$ ,  $p < 0.001$ ), further validating the tool's utility in scoliosis screening.



Binary logistic regression was conducted to identify predictors of scoliosis. Variables included in the model were age, gender, BMI, profession, years of experience, working hours, physical activity, SMtr reading.

#### *Model Fit and Predictive Accuracy:*

The Omnibus Test of Model Coefficients was significant ( $\chi^2 = 329.078$ ,  $df = 11$ ,  $p < .001$ ), signifying that the model with predictors performed significantly better than a null model. However, the Hosmer-Lemeshow test have a non-significant value ( $\chi^2 = 0.001$ ,  $p = 1.000$ ), indicating good model fit. The classification table showed an overall prediction accuracy of 96%, correctly classifying all scoliosis cases — although this suggests possible overfitting or data separation issues.

#### *Individual Predictors:*

Despite the model's strong overall significance, many individual predictors had extremely large standard errors and nonsignificant Wald statistics. This suggests issues of multicollinearity or data sparseness for some variables. Age, BMI, Profession categories, and Physical Activity had  $p$ -values  $> 0.95$ , indicating they did not significantly predict scoliosis in the adjusted model. Years of Experience ( $B = 35.104$ ) and Working Hours ( $B = 14.016$ ) showed extremely large odds ratios, implying highly unstable estimates. Gender exhibited a notably large odds ratio as well, again suggesting unstable estimates due to sparse data or quasi-complete separation. These inflated coefficients and errors indicate the need for cautious interpretation. The small number of cases in some subgroups (like female scoliosis cases) likely distorted the regression estimates.

**Table - 1:** Distribution of PS Across Healthcare Professions

Profession	Scoliosis Yes	Scoliosis No	Total	$\chi^2$ (df=4)	p-value
Doctor	39	21	60		
Physio	6	20	26		
Nurse	23	64	87	187.34	0.001*
Lab Tech	22	15	37		
Admin	2	34	36		
<b>Gender</b>					
Male	93	28	121		
Female	88	37	125	43.255	0.161
<b>Physical activity</b>					
Yes	4	103	107		
No	92	47	139	99.087	0.001*
<b>Ergonomics Training</b>					
Yes	39	32	71		
No	91	84	175	19.902	0.081



**Table 2 :** Association Between PS and Selected Categorical Variables Among HCW

Variable	N (Yes)	N (No)	Mean Rank (Yes)	Mean Rank (No)	Mann-Whitney U	Z-value	p-value
Age (years)	96	150	142.15	111.56	5409.5	-3.294	0.001*
BMI (kg/m <sup>2</sup> )	96	150	177.61	88.87	2005.5	-9.543	0.001*
Years-Service	96	150	151.27	105.73	4534.5	-4.906	0.001*
Working Hours/Week	96	150	184.05	84.75	1387.5	-10.726	0.001*
SMtr(°)	96	150	198.47	75.52	3	-13.256	0.001*

\*significant (P<0.05)

**Table 3:** Comparison of Age, Body Mass Index, Occupational Exposure, and SMtrReadings Between HCW With and Without PPS

Test of Normality	Scoliosis	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Age	Yes	0.074	96	.200*	.976	96	0.069
	No	0.118	150	0.001*	.960	150	0.001*
BMI	Yes	0.133	96	0.001*	.934	96	0.001*
	No	0.087	150	0.008	.959	150	0.001*
Years of service	Yes	0.123	96	0.001*	.943	96	0.001*
	No	0.127	150	0.001*	.947	150	0.001*
Working hours	Yes	0.276	96	0.001*	.844	96	0.001*
	No	0.237	150	0.001*	.913	150	0.001*
Scoliometer	Yes	0.249	96	0.001*	.864	96	0.001*
	No	0.175	150	0.001*	.934	150	0.001*

\*significant (P<0.05)

**Table 4:** Binary Logistic Regression Analysis of Occupational and Demographic Predictors of PPS

Predictor	B (β Coefficient)	S.E.	Wald	df	p-value	Exp(B) (Odds Ratio)
Age (years)	-27.139	1243.87	0	1	0.983	0



<b>BMI (kg/m<sup>2</sup>)</b>	-10.693	3515.291	0	1	0.998	0
<b>Profession</b>	—	—	0	4	1	—
<b>Doctor (ref)</b>	—	—	—	—	—	1
<b>Physio</b>	-164.117	35499.01	0	1	0.996	0
<b>Nurse</b>	-37.515	35447.46	0	1	0.999	0
<b>Lab Technician</b>	-0.197	10867.8	0	1	1	0.821
<b>Admin</b>	-41.267	33086	0	1	0.999	0
<b>Years of Service</b>	35.104	2003.258	0	1	0.986	1.76×10 <sup>15</sup>
<b>Working Hours per Week</b>	14.016	3693.234	0	1	0.997	1.22×10 <sup>6</sup>
<b>Physical Activity (Yes)</b>	-42.673	6191.427	0	1	0.995	0
<b>SMtrReading (°)</b>	-104.359	4812.396	0	1	0.983	0
<b>Gender (Male)</b>	32.247	40209.79	0	1	0.999	1.01×10 <sup>14</sup>
<b>Constant</b>	876.447	70638.05	0	1	0.99	—

**Note** - In logistic regression, one category from a categorical variable is set as a baseline (reference), and other categories are compared against it. The reference group doesn't get a B value, SE, Wald, p, or Exp(B) — so those cells are marked with dashes (—) because no calculation is done for that row.

### Discussion

This cross-sectional study assessed the prevalence of PS and its association with occupational factors among HCW in Mumbai. The results of the study showed a high prevalence of scoliosis, particularly among doctors and laboratory technicians. There was a good association between scoliosis and variables such as profession, physical activity, and ergonomics training. These results are consistent with previous research that has identified healthcare professions involving

prolonged static postures and repetitive movements as risk factors for MSK disorders. [15] HCW with scoliosis exhibited significantly higher BMI, longer working hours, and more years of service than those without scoliosis. Physical activity emerged as a protective factor, with a markedly lower prevalence of scoliosis in physically active workers. The results fall in line with previous research findings, which reported that regular physical exercise significantly reduces MSK complaints among healthcare professionals. [16, 17] The primary objective of this study—to quantify scoliosis prevalence



and identify associated occupational risk factors—was successfully achieved, contributing important region-specific evidence to the existing global literature on healthcare worker MSK health. Despite its valuable findings, this study has several limitations. The cross-sectional design restricts the ability to establish causal relationships between occupational exposures and scoliosis development.<sup>[18]</sup> The purposive sampling method, although ensuring profession-wise representation, may have introduced selection bias, limiting the external validity of the results. Furthermore, the voluntary nature of participation may have led to overrepresentation of HCW already experiencing MSK symptoms, thereby inflating prevalence estimates.<sup>[19]</sup> The use of clinical screening tools such as the Adam's Forward Bend Test and scoliometer, while practical for workplace settings, is less definitive than radiographic assessment, though radiography is ethically and practically unsuitable for occupational screening purposes.<sup>[20]</sup> The logistic regression model demonstrated evidence of data separation and small subgroup sizes, which led to unstable odds ratios and large standard errors—a recognised issue in small-sample logistic regression analysis.<sup>[21]</sup> Self-reported data on physical activity and working hours may have been affected by recall bias and social desirability bias, a common issue in questionnaire-based occupational health studies.<sup>[22]</sup> Additionally, this study did not account for important psychosocial or environmental factors such as workplace stress, job satisfaction, and workstation ergonomics, which are known to influence MSK health.<sup>[17]</sup> The results of this study are broadly consistent with previous international research on occupational MSK disorders among healthcare professionals. The high prevalence of scoliosis among doctors and laboratory technicians mirrors earlier findings by Vasireddy et al. (2024) and Epstein et al. (2018), which linked prolonged static postures and physically demanding clinical tasks to spinal deformities.<sup>[23, 24]</sup> The positive association between years of professional service and scoliosis prevalence also aligns with the evidence that cumulative occupational exposures increase MSK risks.<sup>[25, 26]</sup>

Physical inactivity was identified as a significant modifiable risk factor, reaffirming the conclusions of Putsa et al. (2022), who highlighted regular physical activity as a protective factor against occupational MSK problems. Although ergonomics training was not

statistically significant in this study, it demonstrated a protective trend, warranting further exploration in larger, possibly longitudinal studies.<sup>[27, 28]</sup> While this study provides important occupational health insights for Indian tertiary care hospitals, its generalisability is limited by the purposive sampling strategy and its confinement to three Mumbai-based hospitals. Findings may not extend to rural, smaller, or private healthcare facilities where work patterns, ergonomics resources, and workload distribution differ significantly.<sup>[29]</sup> However, given the similarities in healthcare work conditions globally, these findings contribute to the growing international evidence base advocating for proactive ergonomic interventions, staff wellness programmes, and the promotion of physical activity in healthcare institutions.<sup>[17]</sup>

## Conclusion

This analysis revealed that profession, gender, physical activity, and ergonomics training are significantly associated with scoliosis prevalence among HCW. Male gender, lack of physical activity, absence of ergonomic training, longer years of service, and extended working hours were identified as risk factors. Non-normal distributions justified the use of non-parametric tests, which confirmed significant differences in age, BMI, years of service, working hours, and SMT readings. While logistic regression highlighted potential predictors, substantial standard errors and odds ratios necessitate model refinement, perhaps through larger sample sizes.

## References

- [1] Petrosyan, E.; Fares, J.; Ahuja, C. S.; Lesniak, M. S.; Koski, T. R.; Dahdaleh, N. S.; El Tecle, N. E. Genetics and Pathogenesis of Scoliosis. *North Am. Spine Soc. J. NASSJ*, **2024**, *20*, 100556. <https://doi.org/10.1016/j.xnsj.2024.100556>.
- [2] Hamad, A.; Ahmed, E. B.; Tsirikos, A. I. Adolescent Idiopathic Scoliosis: A Comprehensive Approach to Aetiology, Diagnostic Assessment and Treatment. *Orthop. Trauma*, **2017**, *31* (6), 343–349. <https://doi.org/10.1016/j.mporth.2017.09.004>.
- [3] Yang, J.; Huang, S.; Cheng, M.; Tan, W.; Yang, J. Postural Habits and Lifestyle Factors Associated with Adolescent Idiopathic Scoliosis (AIS) in



- China: Results from a Big Case–Control Study. *J. Orthop. Surg.*, **2022**, *17* (1), 472. <https://doi.org/10.1186/s13018-022-03366-0>.
- [4] Karimi, M. T.; Rabczuk, T. Scoliosis Conservative Treatment: A Review of Literature. *J. Craniovertebral Junction Spine*, **2018**, *9* (1), 3–8. [https://doi.org/10.4103/jcvjs.JCVJS\\_39\\_17](https://doi.org/10.4103/jcvjs.JCVJS_39_17).
- [5] Janicki, J. A.; Alman, B. Scoliosis: Review of Diagnosis and Treatment. *Paediatr. Child Health*, **2007**, *12* (9), 771–776. <https://doi.org/10.1093/pch/12.9.771>.
- [6] Abdollahzade, F.; Mohammadi, F.; Dianat, I.; Asghari, E.; Asghari-Jafarabadi, M.; Sokhanvar, Z. Working Posture and Its Predictors in Hospital Operating Room Nurses. *Health Promot. Perspect.*, **2016**, *6* (1), 17–22. <https://doi.org/10.15171/hpp.2016.03>.
- [7] Mavrovounis, G.; Meling, T. R.; Lafuente, J.; Fountas, K. N.; Demetriades, A. K. Postural Ergonomics and Work-Related Musculoskeletal Disorders in Neurosurgery: Lessons from an International Survey. *Acta Neurochir. (Wien)*, **2021**, *163* (6), 1541–1552. <https://doi.org/10.1007/s00701-021-04722-5>.
- [8] Yizengaw, M. A.; Mustofa, S. Y.; Ashagrie, H. E.; Zeleke, T. G. Prevalence and Factors Associated with Work-Related Musculoskeletal Disorder among Health Care Providers Working in the Operation Room. *Ann. Med. Surg. 2012*, **2021**, *72*, 102989. <https://doi.org/10.1016/j.amsu.2021.102989>.
- [9] Mei, Y.; Lin, Y.-F.; Gong, Z.; Yan, B.; Liang, Q. Prevalence of Incorrect Posture among School Adolescents after the COVID-19 Pandemic: A Large Population-Based Scoliosis Screening in China. *J. Orthop. Surg.*, **2025**, *20* (1), 156. <https://doi.org/10.1186/s13018-025-05479-8>.
- [10] Ogedengbe, T. S.; Abiola, O. A.; Ikumapayi, O. M.; Afolalu, S. A.; Musa, A. I.; Ajayeoba, A. O.; Adeyi, T. A. Ergonomics Postural Risk Assessment and Observational Techniques in the 21st Century. *Procedia Comput. Sci.*, **2023**, *217*, 1335–1344. <https://doi.org/10.1016/j.procs.2022.12.331>.
- [11] Hresko, M. T. Idiopathic Scoliosis in Adolescents. *N. Engl. J. Med.*, **2013**, *368* (9), 834–841. <https://doi.org/10.1056/NEJMcp1209063>.
- [12] Fong, D. Y. T.; Lee, C. F.; Cheung, K. M. C.; Cheng, J. C. Y.; Ng, B. K. W.; Lam, T. P.; Mak, K. H.; Yip, P. S. F.; Luk, K. D. K. A Meta-Analysis of the Clinical Effectiveness of School Scoliosis Screening. *Spine*, **2010**, *35* (10), 1061–1071. <https://doi.org/10.1097/BRS.0b013e3181bcc835>.
- [13] Aljohani, M. M. A.; Alshehri, Y. S.; Eweda, R. S. Prevalence and Classification of Scoliosis Among Female University Students in Saudi Arabia. *Healthcare*, **2025**, *13* (22), 2894. <https://doi.org/10.3390/healthcare13222894>.
- [14] G Figueiredo<sup>1,2</sup>, R.; M Patino<sup>1,3</sup>, C.; C Ferreira<sup>1,4</sup>, J. Cross-Sectional Studies: Understanding Applications, Methodological Issues, and Valuable Insights. *J. Bras. Pneumol.*, **2025**, e20250047. <https://doi.org/10.36416/1806-3756/e20250047>.
- [15] Alexopoulos, E. C.; Burdorf, A.; Kalokerinou, A. Risk Factors for Musculoskeletal Disorders among Nursing Personnel in Greek Hospitals. *Int. Arch. Occup. Environ. Health*, **2003**, *76* (4), 289–294. <https://doi.org/10.1007/s00420-003-0442-9>.
- [16] Yizengaw, M. A.; Mustofa, S. Y.; Ashagrie, H. E.; Zeleke, T. G. Prevalence and Factors Associated with Work-Related Musculoskeletal Disorder among Health Care Providers Working in the Operation Room. *Ann. Med. Surg. 2012*, **2021**, *72*, 102989. <https://doi.org/10.1016/j.amsu.2021.102989>.
- [17] Punnett, L.; Wegman, D. H. Work-Related Musculoskeletal Disorders: The Epidemiologic Evidence and the Debate. *J. Electromyogr. Kinesiol. Off. J. Int. Soc. Electrophysiol. Kinesiol.*, **2004**, *14* (1), 13–23. <https://doi.org/10.1016/j.jelekin.2003.09.015>.
- [18] Figueiredo, R. G.; Patino, C. M.; Ferreira, J. C. Cross-Sectional Studies: Understanding Applications, Methodological Issues, and Valuable Insights. *J. Bras. Pneumol. Publicacao Of. Soc. Bras. Pneumol. E Tisiologia*, **2025**, *51* (1),



- e20250047. <https://doi.org/10.36416/1806-3756/e20250047>.
- [19] Choi, B. C. K.; Pak, A. W. P. A Catalog of Biases in Questionnaires. *Prev. Chronic. Dis.*, **2005**, *2* (1), A13.
- [20] Fong, D. Y. T.; Lee, C. F.; Cheung, K. M. C.; Cheng, J. C. Y.; Ng, B. K. W.; Lam, T. P.; Mak, K. H.; Yip, P. S. F.; Luk, K. D. K. A Meta-Analysis of the Clinical Effectiveness of School Scoliosis Screening. *Spine*, **2010**, *35* (10), 1061–1071. <https://doi.org/10.1097/BRS.0b013e3181bcc835>.
- [21] Heinze, G.; Schemper, M. A Solution to the Problem of Separation in Logistic Regression. *Stat. Med.*, **2002**, *21* (16), 2409–2419. <https://doi.org/10.1002/sim.1047>.
- [22] Prince, S. A.; Adamo, K. B.; Hamel, M. E.; Hardt, J.; Connor Gorber, S.; Tremblay, M. A Comparison of Direct versus Self-Report Measures for Assessing Physical Activity in Adults: A Systematic Review. *Int. J. Behav. Nutr. Phys. Act.*, **2008**, *5*, 56. <https://doi.org/10.1186/1479-5868-5-56>.
- [23] Vasireddi, N.; Vasireddi, N.; Shah, A. K.; Moyal, A. J.; Gausden, E. B.; McLawhorn, A. S.; Poelstra, K. A.; Gould, H. P.; Voos, J. E.; Calcei, J. G. High Prevalence of Work-Related Musculoskeletal Disorders and Limited Evidence-Based Ergonomics in Orthopaedic Surgery: A Systematic Review. *Clin. Orthop.*, **2024**, *482* (4), 659–671. <https://doi.org/10.1097/CORR.0000000000002904>.
- [24] Epstein, S.; Sparer, E. H.; Tran, B. N.; Ruan, Q. Z.; Dennerlein, J. T.; Singhal, D.; Lee, B. T. Prevalence of Work-Related Musculoskeletal Disorders Among Surgeons and Interventionalists: A Systematic Review and Meta-Analysis. *JAMA Surg.*, **2018**, *153* (2), e174947. <https://doi.org/10.1001/jamasurg.2017.4947>.
- [25] Rodríguez-Pulido, A. G.; Arrieta-Córdova, A. F.; Arce-Huamani, M. A. Prevalence and Correlation of Workload and Musculoskeletal Disorders in Industrial Workers: A Cross-Sectional Study. *Front. Rehabil. Sci.*, **2025**, *6*, 1677621. <https://doi.org/10.3389/fresc.2025.1677621>.
- [26] Soo, S. Y.; Ang, W. S.; Chong, C. H.; Tew, I. M.; Yahya, N. A. Occupational Ergonomics and Related Musculoskeletal Disorders among Dentists: A Systematic Review. *Work*, **2023**, *74* (2), 469–476. <https://doi.org/10.3233/WOR-211094>.
- [27] Putsa, B.; Jalayondeja, W.; Mekhora, K.; Bhuanantanondh, P.; Jalayondeja, C. Factors Associated with Reduced Risk of Musculoskeletal Disorders among Office Workers: A Cross-Sectional Study 2017 to 2020. *BMC Public Health*, **2022**, *22* (1), 1503. <https://doi.org/10.1186/s12889-022-13940-0>.
- [28] Moreira, S.; Criado, M. B.; Santos, P. C.; Ferreira, M. S.; Gonçalves, C.; Machado, J. Occupational Health: Physical Activity, Musculoskeletal Symptoms and Quality of Life in Computer Workers: A Narrative Review. *Healthc. Basel Switz.*, **2022**, *10* (12), 2457. <https://doi.org/10.3390/healthcare10122457>.
- [29] Mohammadipour, F.; Pourranjbar, M.; Naderi, S.; Rafie, F. Work-Related Musculoskeletal Disorders in Iranian Office Workers: Prevalence and Risk Factors. *J. Med. Life*, **2018**, *11* (4), 328–333. <https://doi.org/10.25122/jml-2018-0054>.