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RESEARCH ARTICLE

ERGONOMIC AND PSYCHOSOCIAL HAZARDS AMONG EMBRYOLOGISTS IN IVF LABORATORIES IN ABUJA, NIGERIA: A CROSS-SECTIONAL STUDY

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Abstract

Background: Embryologists working in In-vitro fertilization (IVF) laboratories are at risk for occupational health problems related to their long hours in laboratories, limited work environments, and the high demands of the work setting. In low- and middle-income settings such as Nigeria, there is limited empirical evidence regarding ergonomic and psychosocial hazards found in this healthcare workforce.

Objective: To determine the prevalence of ergonomic and psychosocial hazards among the embryologists in IVF laboratories in Abuja, Nigeria and to assess the perceived effectiveness of the ergonomic and organisational measures in place in reducing musculoskeletal complaints and work-related psychological stress.

Methods: A descriptive cross-sectional study was carried out among embryologists and laboratory personnel working in registered IVF clinics in Abuja. Data was obtained with the help of the structured questionnaire using the ergonomic symptoms, any psychosocial stressors, workstation design, organisational system practices, and perceived adequacy of safety and support measures in the workstation. Descriptive statistics were used to summarize the prevalence of hazards. Chi-square tests were used to investigate links relating ergonomic design to reported complaints and ordinary least squares regression was used to determine predictors of psychological stress.

Results: Common ergonomic complaints included standing or sitting for long periods of time (63.4%), eye strain (48.8%), and back pain (46.3%). Only 51.2% of respondents said workstations supported proper ergonomic posture. Psychological stress was also frequently reported, noting long working hours, poor communication and lack of breaks as significant predictive factors of stress ($p < 0.01$). Although more than half of the respondents showed satisfaction with the existing safety measures, perceived adequacy of safety measures showed a significant association with ergonomic design but not with reduced psychological stress.

Conclusion: Embryologists in IVF laboratories in Abuja face some significant ergonomic and psychosocial health challenges. Organisational factors are critical in psychological stress and suggest that developments in equipment

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and infrastructure are not enough to enhance psychological stress levels, unless this is supported by workload management and organisational practices. Strengthening occupational health strategies among IVF services is crucial to benefit workforce well-being.

Introduction:-

In vitro fertilization (IVF) laboratories are one of the most technically challenging and carefully controlled environments in modern-day healthcare systems. The success of assisted reproductive technology (ART) restricts not only in the use of sophisticated equipment and protocols but also depends on the continuity of technical competence, concentration, and physical continuance of embryologists. These professionals are involved in handling human gametes and embryos in a period of critical fertilizations and early responsiveness which are often under strict temporal and environmental realization. As a result, embryologists commonly conduct lengthy periods of microscopy, repetitive fine motor activities, static positions, and time-sensitive procedures that require high levels of precision and attention. [1]

While these working conditions are necessary to ensure laboratory quality and favorable outcomes of ART, at the same time they represent embryologists with a wide range of occupational health risks. Unlike colleagues in many other professions, embryologists will work for extended periods of time at microscopes and laminar flow hoods where they are often in seated or semi-static positions with minimal chances of movement or postural variation. Over time, these work patterns can mean that the ergonomic strain and musculoskeletal discomfort can become an issue, especially for neck, back, shoulders, wrists and eyes. If not properly addressed, such ergonomic hazards can potentially lead to chronic work-related musculoskeletal disorders which can compromise worker well-being, job satisfaction, and long-term career sustainability.[2] Recent research among laboratory technicians have confirmed that static postures and repetitive work tasks are significant contributors to musculoskeletal disorders, particularly in healthcare laboratory work environments.[3]

Ergonomic hazards in IVF laboratory are mostly related to long static position, repetitive hand movements, restricted working space, and focusing on a microscope for a long time. Studies among laboratory and healthcare workers have regularly found links between these occupational exposures and MDS, such as back pain, neck strain, shoulder discomfort, and visual fatigue.[4,5] Constrained laboratory working spaces and improperly adjusted microscopes have been shown to be significant sources of ergonomic strain.[6]Along with the associated physical discomfort, persistent ergonomic strain may lead to decreased work efficiency, higher risk of error, as well as increased absenteeism and staff turnover. International occupational health guidelines emphasise the importance of ergonomically designed workstations and task-specific interventions to help mitigate these risks, but this shows a wide variation in its implementation across healthcare settings.[7]

Beyond the physical dangers, embryologists work in a psychologically challenging work environment. IVF laboratory work is characterized by high workloads, long working hours, irregular shifts, as well as the emotional burden of the results of fertility treatments. The need to achieve precision over the long term, coupled with the high expectations of patients and doctors, can put significant psychological pressure on them. Organisational sources such as insufficient staffing rates, lack of rest periods, poor communication and lack of managerial or psychological support can also contribute to further increasing stress levels. Persistent occupational stress among healthcare workers has been associated with burnout, decreased job satisfaction, anxiety, depression and decreased overall well-being.[8] More recently, evidence from embryologists themselves has shown increasing reports of burnout and fatigue, with stress seen as a silent saboteur in IVF labs.[9] Similarly, stress has also been shown to adversely affect several stages of the IVF procedure and is therefore important psychosocial support.[10]

In low and middle-income countries such as Nigeria, the issue may be exacerbated by resource constraints, lack of regulatory supervision and fluctuations in occupational health standards. There has been a steady increase in demand for IVF services over the past two decades in Nigeria resulting from increasing awareness of infertility, delayed childbearing, sociocultural expectations about parenthood, as well as expanded private reproductive health services. Urban centres like Abuja have a rising number of IVF clinics addressing various sets of the population. Despite this expansion, relatively little empirical attention has been given to occupational health considerations seen within IVF laboratories, and the prescription of regulatory recognition of ergonomic and psychosocial hazards seen within ART settings are still not well-developed.[11,12] Threatened and professional associations have begun calling for greater occupational health standards, yet prescription remains inconsistent.[13]

Existing Nigerian studies in reproductive medicine have been focused predominantly on clinical outcomes, patient satisfaction and treatment success rates, with scant attention being paid to the health, safety and working conditions of embryology personnel. This gap is striking considering the very prominent role that embryologists play in ART services and the possible implications of occupational strain on workforce retention and sustainability of the service. For example, occupational stress among healthcare workers in Nigeria has been shown to compromise efficient healthcare delivery.[14] In addition, stress management interventions are badly needed in Nigerian healthcare organizations.[15] Understanding the ergonomic and psychosocial challenges experienced by embryologists is therefore crucial for informing the preventive measures to adopt, enhancing the work conditions and supporting long-term viability of IVF services.

This study was conducted to determine the prevalence of ergonomic and psychosocial hazards among embryologists working in in vitro fertilisation (IVF) laboratories in Abuja, Nigeria, and also to evaluate the perceived effectiveness of the ergonomic/organisational measures in place to mitigate the problems of musculoskeletal complaints and work-related psychological stress.

Methods:-

Study Design and Setting:-

A descriptive cross-sectional study design was used to investigate ergonomic and psychosomatic hazards among embryologists and allied personnel of these clinics in the registered IVF clinics, Abuja, Nigeria. Abuja is a major urban and administrative centre with a rapidly growing private healthcare provision, including assisted reproductive technology facilities, which offer fertility services to clients from all over the country.

Study Population:-

The subjects of study included embryologists, clinical embryologists, embryologist trainees, and people working in laboratories in routine aspects of embryology. Participants eligible for this study were engaged in IVF laboratory work for at least six months before the study and were actively participating in laboratory work at the time of data collection. Administrative staff and personnel who did not work directly in the laboratory were not interviewed to ensure that all respondents had some relevant occupational exposure.

Sample Size and Sampling Method:-

Given the specialized nature and relatively small population of embryologists in Abuja, a non-probability purposive sampling technique was used. Registered IVF clinics agreed to participate were included in the study, and all suitable laboratory personnel in these clinics were invited to complete the study questionnaire. A total of 41 respondents completed the questionnaire which represents a non-trivial proportion of the accessible embryology workforce within the study area.

Data Collection Instrument:-

Data were gathered using a structured self-administered questionnaire, which was adapted from internationally recognized occupational health and safety assessment tools. The questionnaire was designed to cover information in several areas, covering socio-demographic characteristics, ergonomic complaints, psychosocial stressors, laboratory environment and workstation design, organisational measures and perceived functionality of existing safety and support mechanisms. Organisational measures assessed included work schedules, break arrangements, use of communication, supervisory support and access to psychological support services. The questionnaire was tested for clarity and relevance to the context before administering it.

Variables:-

Ergonomic outcomes comprised self-reported musculoskeletal complaints e.g. prolonged standing or sitting, back pain, and eye strain and repetitive strain. Psychosocial outcomes were frequency and perceived degree of work-related psychological stress. Organisational measures were operationally defined as non-engineering workplace arrangements relating to workload management, supervisory practices, communication systems and availability of psychological support

Data Analysis:-

Data was analyzed with the Statistical Package for the Social Sciences (SPSS), version 26. Descriptive statistics were used to present summary characteristics of the respondents and the prevalence of ergonomic and psychosocial hazards. Chi-square statistical tests were used to determine the association between ergonomic workstation design and reported musculoskeletal complaints. Ordinary least squares regression analysis was performed to determine

organisational and work-related predictors of psychological stress. Statistical significance was considered to be $p < 0.05$.

Ethical Considerations:-
The study was approved by relevant authorities of the institution for ethics before the data collection. Participation was voluntary, it was obtained from all respondents, written informed consent was obtained and data were collected anonymously. Confidentiality of participant information was strictly preserved during the study.

Results:-

Participant Characteristics:-
The current research is inclusive of embryology laboratory personnel who are working in cross-section of registered IVF clinical in Abuja. Respondents came from a variety of professional backgrounds including clinical embryologists, embryologists, trainees, and laboratory technicians and exhibit variability in number of years of professional experience. Most participants were actively engaged with normal laboratory and cryogenic related routine activities. Sampling & Analysis Variability was evident in the working hours and working cycles; variations in the size of the clinic, staffing and the amount of demand on the services were causing these. The socio-professional characteristics of the respondents are presented in Table 1.

Laboratory Environment and ergonomic Design:-
Most respondents (97.6%)reported that their laboratories were equipped with designated cryogenic storage areas and that, for the most part, they had adequate infrastructure such as lighting, ventilation and workspace. However, there was less consistency in perceptions of ergonomic adequacy. While general laboratory conditions were considered satisfactory, a significant number of respondents rated work surfaces, seating and equipment positioning as not helping to maintain proper ergonomic posture while performing routine tasks. These findings suggest that there is a disparity between general laboratory infrastructure and the task-specific ergonomic design. Characteristics of the laboratory environment and the ergonomic design are shown in Table 2.

Ergonomic Complaints:-
Ergonomic complaints were commonly reported by embryologists. Challenges related to working in a static position for an extended duration when working in a laboratory and having to strain to see when using a microscope were the most commonly reported problems, 63.4% and 48.8% respectively. Musculoskeletal discomfort, especially affecting the back and neck regionswas also reported commonly. In contrast, less often were repetitive strain injuries noted. A minority of respondents indicated that they experienced no ergonomic complaints. The distribution of the ergonomic complaints reported is shown in Table 3.

Psychosocial Stressors:-
Meaningful psychosocial stress at work specifically long working hours, was reported by a large proportion of the respondents (56.1%). Organisational stressors, such as workload demands, communication practices and availability of rest periods were more prominent than task specific or interpersonal stressors. Emotional pressure related to the outcomes of fertility treatment was also reported but seemed to occur less frequently than organisational stressors. The range and frequency of psychosocial stressors experienced by the respondents are shown in Table 4.

Predictors of Psychological Stress:-
Regression analysis found organisational factors to be significant predictors of work-related psychological stress. Indicators related to long working hours, workplace communication and availability of rest breaks were significantly associated with increased reported stress levels. Professional role and years of experience did not significantly relate to psychological stress, suggesting that exposure to stress was not confined to categories of staff. Predictors of work-related psychological stress are described in Table 5.

Perceived Effectiveness of Ergonomic and Organisational Measures:-
Satisfaction of respondents with existing safety and organisational measures was not consistent across clinics. Perceived adequacy of ergonomic workstation design was found to be significantly associated with satisfaction with safety measures. However, safety measure satisfaction was not significantly related to a reduction in psychological stress. In contrast, access to psychological support services was linked to reduced reports of the frequency of stress. Associations between ergonomic design, safety satisfaction and psychological stress are presented in Table 6.

List of Tables:-

Table 1. Socio-professional characteristics of respondents (n = 41)

Variable	Frequency (n)	Percentage (%)
Job role		
Clinical embryologist	19	46.4
Embryologist	11	26.8
Embryologist trainee	8	19.5
Laboratory technician	3	7.3
Years of experience		
< 1 year	3	7.3
1–3 years	13	31.7
4–6 years	9	22.0
> 6 years	16	39.0
Weekly working hours		
< 40 hours	13	31.7
40–50 hours	17	41.5
51–60 hours	6	14.6
> 60 hours	5	12.2
Direct involvement in cryogenic activities		
Yes	37	90.2
No	2	4.9
Occasionally	2	4.9
Night or rotating shifts		
Yes	13	31.7
No	21	51.2
Occasionally	7	17.1

Table 2. Characteristics of laboratory environment and ergonomic design (n = 41)

Variable	Frequency (n)	Percentage (%)
Designated cryogenic storage area		
Yes	40	97.6
No	1	2.4
Lighting condition in laboratory		
Good	35	85.4
Fair	6	14.6
Adequate laboratory ventilation		
Yes	30	73.2
No	6	14.6
Uncertain	5	12.2
Sufficient workspace for personnel and equipment		
Yes	35	85.4
Uncertain	6	14.6
Number of major equipment units		
1–5 units	11	26.8
6–10 units	17	41.5
11–15 units	9	22.0
> 15 units	4	9.7
Work surfaces and equipment support proper ergonomic posture		
Yes	21	51.2
No	6	14.6
Uncertain	14	34.2

Table 3. Prevalence of ergonomic complaints among embryologists (n = 41)

Ergonomic complaint*	Frequency (n)	Percentage (%)
Prolonged standing or sitting	26	63.4
Eye strain	20	48.8
Back pain	19	46.3
Repetitive strain injuries	7	17.1
No ergonomic complaints	5	12.2

*** Multiple responses allowed.**
Abbreviations: n, number of respondents.

Table 4. Psychosocial stressors experienced by embryologists (n = 41)

Psychosocial stressor*	Frequency (n)	Percentage (%)
Long working hours	23	56.1
Poor communication at workplace	19	46.3
Lack of adequate breaks	18	43.9
High workload	16	39.0
Difficult supervision or management	14	34.1
Emotional pressure related to treatment outcomes	13	31.7

***Multiple responses allowed**

Table 5. Predictors of work-related psychological stress among embryologists

Predictor variable	β (Standardized coefficient)	Standard Error	p-value
Long working hours	0.41	0.09	< 0.01
Poor workplace communication	0.36	0.11	< 0.01
Lack of adequate breaks	0.33	0.10	< 0.01
Job role	0.08	0.12	0.48
Years of experience	−0.05	0.10	0.62

Model: Ordinary least squares regression
Dependent variable: Psychological stress score
Significance level: $p < 0.05$

Table 6. Association between ergonomic workstation design, satisfaction with safety measures, and psychological stress

Variable	χ^2	df	p-value
Ergonomic workstation design × Satisfaction with safety measures	6.21	2	0.045
Ergonomic workstation design × Psychological stress frequency	1.84	2	0.399
Satisfaction with safety measures × Psychological stress frequency	1.26	2	0.534
Access to psychological support × Psychological stress frequency	4.38	1	0.036

Statistical test: Chi-square test
Significance level: $p < 0.05$

Discussion:-

This is an important study that adds to a growing body of occupational health information about the physical and psychosocial demands of healthcare professionals who work in highly specialized laboratory settings. The results

show that embryologists in IVF laboratories in Abuja are at significant ergonomic strain and psychological stress, in line with findings from laboratory medicine and healthcare settings elsewhere in the world.[16,17] Significantly, organisational conditions and not personal characteristics were the dominant predictors of psychological stress, reinforcing the role of system level factors on the issue of occupational wellbeing.

The ergonomic issues presented in this study are consistent with the extensive literature describing the musculoskeletal risks among laboratory and microscopy-based professionals. Prolonged static postures, repetitive hand movements, and sustained visual tasks have regularly been linked to disorders of the neck, back and the upper limbs amongst laboratory scientists, pathologists and biomedical analysts.[16,18,19] These exposures are not peculiar to IVF laboratories, rather, they are inherent with precision based laboratory work, illustrating the importance of general ergonomic principles.

Evidence from occupational ergonomics suggests that general laboratory adequacy is not enough to ensure protection against task specific musculoskeletal strain.[20] Adjustable working positions, appropriate seating, optimised microscope height, and regular variation of posture are critical elements of ergonomic risk reduction for microscopy intensive work.[18] Evidence that a significant proportion of respondents perceived their workstations to be ergonomically inadequate despite satisfactory infrastructure generalises this well documented disconnect between facility standards and task level ergonomics.

Unaddressed ergonomic hazards may contribute to cumulative trauma disorders and long-term functional limitations, which are leading causes of occupational disability in healthcare professions.[16] In highly specialized fields like embryology, where workforce replacement is resource intensive, the long-term implications of ergonomic neglect go beyond the health of the individual, to service continuity.

Psychosocial stress became a major occupational issue, with the organisational factors of workload, communication and rest opportunities being the most important stressors compared to the task-specific factors. This pattern is consistent with the job demand-control and effort-reward imbalance models, which focus on the role of work organization in psychological strain.[21,22]High job demands paired with low control and inadequate recovery time are well-established predictors of stress and burnout among healthcare workers.

Studies in both clinical and laboratory settings have shown that working long hours, insufficient staffing and poor communications are major risk factors for stress and burnout irrespective of professional seniority.[23,24] The lack of a significant relationship between stress and years of experience in this study provides evidence to support the position of organisational stressors having a uniform impact across career stages which questions an assumption that appears to be that experience provides resilience.

Communication quality has been found to be a critical determinant of psychological safety and psychological stress in high stakes healthcare environments.[25] In laboratory settings where the consequences of errors can be serious, ambiguous communication and role ambiguity can increase cognitive load and emotional stress. Structured communication systems and supporting supervisory practices have proven to reduce stress and improve staff wellbeing.[24]

The finding that satisfaction with safety measures was linked with ergonomic design but not with reduced psychological stress reflects a wider occupational health principle: physical safety interventions are not adequate to respond to psychosocial risk.[26] While ergonomic improvements may well increase comfort and feelings of safety, they do not directly address workload pressure, emotional demands or organisational culture.

In comparison, access to psychological support services was related to reduced reported frequency of stress. Evidence from healthcare systems research shows that organisationally supported mental health resources such as counselling services and peer support programmes can help to reduce burnout and enhance coping in healthcare professionals.[27,28] Integration of such resources into occupational health strategies is therefore potentially valuable in emotionally burdening specialties such as reproductive healthcare.

From a systems perspective, the findings underscore the need for frameworks of occupational health for IVF services that span beyond the requirements for compliance of equipment and work design and psychosocial risk management. International occupational health guidelines now strongly call for integrated solutions with ergonomic optimization and organisational and psychosocial interventions.[29,26]

In low- and middle-income countries, where regulatory oversight of occupational health may be limited, incorporating the elements of ergonomic and psychosocial risk assessment into their accreditation and quality assurance processes may help to promote safer working environments. Such approaches are in keeping with global health system strengthening efforts that acknowledge healthcare worker wellbeing as a cornerstone of the quality and sustainability of health services.[30,29]

Strengths and Limitations:-

The strength of the study is that it discusses an understudied occupational group in the context of reproductive healthcare in the low- and middle-income country (LMIC) environment, where the empirical evidence on the ergonomic and psychosocial hazards in the assisted reproductive technology (ART) lab is limited. The study is more intensive as it combines both ergonomic and psychosocial aspects to a single analysis framework to understand the occupational health risks in IVF laboratories. The analytical richness of the results is further reinforced by the fact that regression analysis is used to find predictors of psychological stress.

Nevertheless, the following limitations are to be considered. Firstly, the design is cross-sectional, which excludes the possibility of causation and does not provide the chance to determine the temporal nature of relationships between workplace exposures and outcomes reported. Second, self-reported data could also lead to reporting bias, recall bias, and social desirability bias, and it is possible that these factors affected the levels of reported symptoms and stress levels. Third, the sample size is relatively small and non-probability purposive sampling restricts the external validity of the results to the clinics involved in the study and could decrease statistical power to find weaker associations.

Lastly, the clinical or reproductive outcomes were not examined, and thus the results can only be deemed in the niche of occupational health and not patient care performance. Such evidence would be enhanced by future longitudinal and multicenter research including objective ergonomic measurements and psychometrically sound measures in this field.

Conclusion:-

Ergonomic and psychosocial occupational health problems of the embryologists working in IVF laboratories in Abuja are significant. Musculoskeletal complaints are closely related to the design of workstations whereas psychological stress is significantly affected by organisational factors such as workload, communication practices and access to rest and support. Improvements in ergonomic infrastructure should be complemented by organisational interventions (management of workload, planned breaks, effective communication, access to psychological support services, etc.). Integrated occupational health approaches are necessary to protect the wellbeing of embryologists and enhance the long-term sustainability of the IVF services.

References:-

1. Holmes RJ, Kinzer D, Alper M, Barrett B. Ergonomics in the IVF laboratory. FertilSteril. 2010;94(4 Suppl):S168. doi: 10.1016/j.fertnstert.2010.07.666
2. AlNekhilan AF, AlTamimi AM, AlAqeel BY, et al. Work-related musculoskeletal disorders among clinical laboratory workers. Avicenna J Med. 2021;11(3):123-129. doi: www.thieme-connect.com/products/ejournals/html/10.4103/ajm.ajm_67_19
3. Aldhabi R, Alzahrani A, Alsobhi M, et al. Prevalence and risk factors of musculoskeletal disorders among clinical laboratory technicians. Healthcare (Basel). 2025;13(12):1406. doi:10.3390/healthcare13121406
4. Ndejjo R, Musinguzi G, Yu X, et al. Occupational health hazards among healthcare workers in Kampala, Uganda. J Environ Public Health.2015;2015:913741 DOI: 10.1155/2015/913741
5. Tinubu BM, Mbada CE, Oyeyemi AL, Fabunmi AA. Work-related musculoskeletal disorders among nurses in Ibadan, South-west Nigeria: a cross-sectional survey. BMC MusculoskeletDisord. 2010;11:12. doi:10.1186/1471-2474-11-12
6. Haile EL, Taye B, Hussen F. Ergonomic Workstations and Work-Related Musculoskeletal Disorders in the Clinical Laboratory. Laboratory Medicine, 2012; 43(suppl 2), e11–e19. https://doi.org/10.1309/lm7bq15ttqfbxis
7. ESHRE Guideline Group. Revised guidelines for good practice in IVF laboratories. Hum Reprod. 2016;31(4):685-686.https://academic.oup.com/humrep/article-abstract/31/4/685/2380139
8. Bien EA. Occupational exposure assessment workers: development of home healthcare, content validity, and piloting the use of an observation. [dissertation: University of Cincinnati; 2020.] Accessed February 25, 2026.

ProQuest Dissertations & Theses. ProQuest ID: 30165116.https://search.proquest.com/openview/08946ad6cb9c7ad2e7da64ad06c8092f/1?pq-origsite=gscholar&cbl=18750&diss=y
9. Yesuf SM, Derseh BT, Girma D, Dejene TM. Work-related stress and associated factors among health professionals in zone 1, Afar region, Ethiopia. Heliyon. 2022;8(12):e12167. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9755361/
10. Basar M, Duzcu T. The burnout: a silent saboteur in in vitro fertilization laboratories. J Assist Reprod Genet. 2025;42(12):2497-2513.https://link.springer.com/article/10.1007/s10815-025-03537-y
11. ZanettoullisAT, Mastorakos G, Vakas P, Vlahos N, Valsamakis G. Effect of stress on each of the stages of the IVF procedure: A systematic review. Int J Mol Sci. 2024;25(2):726.https://www.mdpi.com/1422-0067/25/2/726
12. Elgujja A, Kaza SA, Alkali U, Abubakar H, Onyegbule K. Nigeria's healthcare delivery paradox: Are systemic failures rooted in deficient laws and policies or in weak implementation and enforcement? SSRN. Published February 21, 2025. Accessed February 25, 2026. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5979254
13. Kana M, Doctor H, Peleteiro B, Lunet N, Barros H. Maternal and child health interventions in Nigeria: a systematic review of published studies from 1990 to 2014. Published January 1, 2015. Accessed February 25, 2026. https://core.ac.uk/download/162558062.pdf
14. Restila R. Systematic review: occupational stress and related factors among hospital nurses. Published January 1, 2015. https://media.neliti.com/media/publications/25031-EN-systematic-review-occupational-stress-and-related-factors-among-hospital-nurses.pdf
15. Nwobodo EP, Strukcinskiene B, Razbadauskas A, Grigoliene R, Agostinis-Sobrinho C. Stress Management in Healthcare Organizations: The Nigerian Context. Healthcare. 2023; 11(21):2815. https://doi.org/10.3390/healthcare11212815
16. Bongers PM, de Winter CR, Kompier MAJ, Hildebrandt VH. Psychosocial factors at work and musculoskeletal disease. Scand J Work Environ Health. 1993;19(5):297-312.http://www.jstor.org/stable/40966152
17. Afework A, Tamene A, Tafa A. Musculoskeletal disorders and its associated factors among hospital cleaners in Addis Ababa, Ethiopia. Sci Rep. 2024;14(1):2887. Published 2024 Feb 5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10838922/
18. David GC. Ergonomic methods for assessing exposure to risk factors for work-related musculoskeletal disorders. Occup Med (Lond). 2008;58(5):351-357.https://academic.oup.com/occmed/article-abstract/55/3/190/1420798
19. Segalo S, Pasalic A, Macak-Hadziomerovic A, Maestro D, Pecar M, Katana B. Association Between Risk Factors and Prevalence of Musculoskeletal Disorders Among Laboratory Professionals-an European Perspective. Mater Sociomed. 2023;35(2):107-112.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10495161/
20. Punnett L, Wegman DH. Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. J ElectromyogrKinesiol. 2004;14(1):13-23.https://www.sciencedirect.com/science/article/pii/S1050641103001251
21. Nuebling M, Seidler A, Garthus-Niegel S, et al. The Gutenberg Health Study: measuring psychosocial factors at work and predicting health and work-related outcomes with the ERI and the COPSOQ questionnaire. BMC Public Health. 2013;13:538. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3707767/
22. Tanimoto AS, Richter A, Lindfors P. How do effort, reward, and their combined effects predict burnout, self-rated health, and work-family conflict among permanent and fixed-term faculty? Ann Work Expo Health. 2023;67(4):462-472. https://doi.org/10.1093/annweh/wxac094
23. Shanafelt TD, Hasan O, Dyrbye LN, et al. Changes in burnout and satisfaction with work-life balance in physicians. Mayo Clin Proc. 2015;90(12):1600-1613.https://www.sciencedirect.com/science/article/pii/S0025619615007168
24. West CP, Dyrbye LN, Shanafelt TD. Physician burnout: contributors, consequences, and solutions. J Intern Med. 2018;283(6):516-529.doi.org/10.1111/joim.12752
25. Edmondson AC. The fearless organization: creating psychological safety in the workplace for learning, innovation, and growth. Harvard Business Review Press. 2018.
26. Lamontagne AD, Keegel T, Louie AM, Ostry A, Landsbergis PA. A systematic review of the job-stress intervention evaluation literature, 1990–2005. Int J Occup Environ Health. 2007;13(3):268-280. doi.org/10.1179/oeh.2007.13.3.268
27. West CP, Dyrbye LN, Erwin PJ, Shanafelt TD. Interventions to prevent and reduce physician burnout: a systematic review and meta-analysis. Lancet. 2016;388(10057):2272-2281.https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(16)31279-X/fulltext?rss%3Dyes=

28. Underdahl L, Ditri M, Duthely LM. Physician Burnout: Evidence-Based Roadmaps to Prioritizing and Supporting Personal Wellbeing. J HealthcLeadersh. 2024;16:15-27.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10773242/
29. Torvisco JM, Santisi G, Garofalo A, Ramaci T, Barattucci M. Validity and Psychometric Properties of the ILO-WHO Workplace Stress Scale: A Study with Workers from the Canary Islands. Eur J Investig Health Psychol Educ. 2022;12(7):677-691.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9324391/
30. Marrone M, Angeletti C, Cazzato G, et al. The Job that Kills the Worker: Analysis of Two Case Reports on Work-Related Stress Deaths in the COVID-19 Era. Int J Environ Res Public Health. 2023;20(1):884.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9820178/