

Occupational Health Challenges and Intervention Gaps in Saudi Arabia: A Systematic Review of Evidence and Practice

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Abstract Objectives: There is a growing body of literature on occupational health of Saudi Arabia, but there is a lack of evidence regarding the interventions either implemented/proposed and the outcomes effectiveness. **Methods:** We performed a systematic search within PubMed, Scopus, Web of Science and Google Scholar (2018-2023) according to PRISMA guidelines. We included studies that examined occupational health problems and the related interventions/effectiveness that were implemented or suggested within the context of Saudi Arabia. **Results:** Following removal of duplicates and screening for resulting data extraction, 15 studies met inclusion criteria. Most studies evaluated cross-sectional data (~80%) with a high predominance of the healthcare sector. Common challenges included musculoskeletal disorders, psychological stresses and occupational infections. Intervention effectiveness was measured in a few studies, but ergonomic and disease-prevention strategies were the most frequently described. **Conclusion:** There is considerable disparity between occupational health challenges identified and rigorously evaluated interventions in Saudi Arabia, particularly in high-risk sectors such as construction and manufacturing. Longitudinal and experimental designs should be valuable in future research.

Key Words Occupational Health, Workplace Interventions, Saudi Arabia, Ergonomics, Occupational, Disease Prevention

INTRODUCTION

Workplace hazards can lead to various health challenges which can be minor bruises or can be more severe leading to permanent disabilities and fatalities among workers in the manufacturing sector [1]. This has become a global concern since about 40 to 50 percent of the industrial workforce is exposed to various health challenges arising from the workplace. Saudi Arabia for example recorded some of the highest fatal accidents and fatalities in the construction sector globally. Based on a study of the safety performance of Saudi Arabia's private construction sector, few workers in the study sample used Personal Protective Equipment (PPE) [2]. Occupational hazards impact negatively on the safety and health of workers and hinders organizational effectiveness [3]. These hazards can be short-term or long-term. Short-term risks may include physical injuries, while long-term risks may be an increased risk of developing diseases like respiratory illnesses, heart disease or cancer. In general, adverse health effects associated with short-term risks are reversible while those caused by long-term risks are irreversible.

Globally, a range of occupational health interventions have been implemented. These interventions are well-organized programs that target changing attitudes and behaviors in order to benefit both businesses and their workforces. Interventions can accomplish its objectives by reducing workplace stressors (primary intervention), increasing employee benefits (secondary intervention), or tackling the detrimental effects of stressors on employees, such as health issues (tertiary intervention) [4,5] model of occupational health interventions (Figure 1), which is a series of ongoing planning, implementation and assessment phases, describes how occupational health interventions are executed. The National Institute for Occupational Safety and Health (NIOSH) in the United States of America executes research and investigations to address health and safety challenges that arises from the workplace. The EU-OSHA also plays an identical function in the European Union (EU). These Occupational Safety and Health Administration (OSHA) establishes guidelines and enforcement standards which serves as interventions to avoid sickness and injuries at work [6].

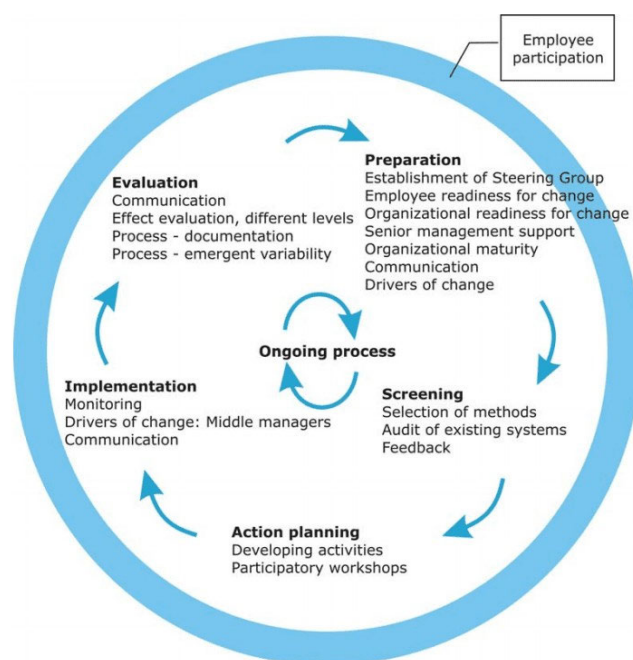


Figure 1: Occupational Health Interventions Model (Adopted from [5])

Aim and Significance

The aim of this study is to identify published literatures that assess occupational health challenges. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) strategy was adopted and the detailed evaluation of the literature's quality criteria, together with the logical extraction and synthesis of the findings. The tools for quality assessment and data extraction, as well as the standards used to combine the evidence, were described in depth. Following the findings, results and in-depth discussion was made and a recommendation for future perspective was proffered as it relates to Saudi Arabia [7-9].

While the number of publications addressing occupational health topics in Saudi Arabia continues to grow, there is currently no systematic synthesis of evidence concerning both the spectrum of occupational health problems and reported interventions implemented across various sectors. Current studies are either fragmented, focused on certain sectors, or predominantly observational and therefore not directly understandable by policymakers and decision-makers on a national level. As a result, this systematic review seeks to fill the gap by reviewing and summarizing the occupational health challenges and interventions/strategy reported in Saudi Arabia.

METHODS

Study Design and Reporting Standards

This systematic review was performed following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. It was a methodologically systematic process to identify, assess and summarize evidence on occupational health problems and intervention gaps in Saudi Arabia.

Search Strategy

We conducted a comprehensive systematic literature search across four electronic databases (PubMed, Scopus, Web of Science and Google Scholar; the last search was conducted through October 2023). Search was conducted on studies from January 2018 to October 2023.

Search strategy was designed based on three primary concepts: (1) occupational settings, (2) health conditions and (3) interventions or preventive measures (4) the geographic filter "Saudi Arabia". We used Boolean operators (AND, OR) to narrow the search (Table 1).

Adapted the search strategy accordingly for each database. In addition, reference lists of relevant studies were screened manually to identify more eligible studies (Table 2).

Eligibility Criteria

For synthesis process, reported interventions and strategies were classified according to implementation and evaluation status. Studies categorized as (A) implemented and evaluated intervention, where study provide evidence that the intervention had been implemented and assessed (B), implemented but inadequately evaluated intervention and (C) proposed and recommended strategies.

Selection Criteria

Studies were selected via predetermined inclusion and exclusion criteria.

Inclusion Criteria:

- Studies conducted in Saudi Arabia
- Studies addressing occupational health challenges
- Studies reporting implemented interventions or proposed strategies
- Original research articles
- English language studies published from 2018 to 2023

Table 1: Search String across all Databases

Database	Search string	Date searched	Date limit
PubMed	("occupational health" OR "workplace hazards" OR "occupational disease") AND ("intervention" OR "ergonomics" OR "prevention") AND ("Saudi Arabia")	October 2023	January 2018 to October 2023
Google Scholar	"occupational health" OR "workplace hazards" OR "occupational disease" AND "intervention" OR "ergonomics" OR "prevention" AND "Saudi Arabia"	October 2023	January 2018 to October 2023
We of Science	("occupational health" OR "workplace hazards" OR "occupational disease") AND ("intervention" OR "ergonomics" OR "prevention") AND ("Saudi Arabia")	October 2023	January 2018 to October 2023
Scopus	("occupational health" OR "workplace hazards" OR "occupational disease") AND ("intervention" OR "ergonomics" OR "prevention") AND ("Saudi Arabia")	October 2023	January 2018 to October 2023

Table 2: Search Terms for Literature Search

Search Terms	
Occupation terms	Workplace, company, hospitals, construction company/work, worker, white collar worker, office, computer office, call center or call centre, office worker, telemarketing, engineer, government, health worker, universities, researcher, student, classroom, lecturer, police, scientist, military.
Health challenges terms	Arm injuries, leg injuries, cancer, tendonitis, heart failure, neck injuries, pneumonia, muscle weakness, asthma, wrist injuries, forearm injuries, "sprains and strains," tuberculosis, soft tissue injuries, tendon injuries, tennis elbow, nerve compression syndromes, radiculopathy, ulnar nerve compression syndrome, muscular diseases, carpal tunnel syndrome, chronic obstruction pulmonary disease, thoracic outlet syndrome, heart attack, lower extremity/AND pain, heart diseases, upper extremity/AND pain.
Intervention terms	Human engineering, human factor, ergonomics, primary interventions, secondary interventions, tertiary interventions, intervention studies, anthropometry
Saudi Arabia terms	Saudi Arabia, Kingdom of Saudi Arabia, KSA, Saudi workers

Table 3: Screening Questions and Responses for Level 1 that Led to Excluding Certain Articles

Question	Response
Level 1a	
Was there an intervention/Strategy (implemented/proposed/recommended)?	No
Was there an occupational health challenge?	No
Was the intervention related to occupational health challenges in Saudi Arabia?	No
Level 1b	
Was the publication peer reviewed?	No
Written in English Language?	No
Was there a control group?	No
Was individual health data provided?	No
Workers' compensation data only?	Yes
Post only study?	Yes

Exclusion Criteria:

- Studies conducted outside Saudi Arabia
- Studies Other Than Occupational Health Studies
- Introduction: Review articles, Editorials, Conference papers, Commentaries
- Studies with limited methodological detail or outcome data

Study Selection Process

Information on all retrieved records was exported to reference management software which helped to identify and remove duplicated records before screening. Study selection was performed in several steps according to PRISMA. It was done (initially) in the screening of titles and abstracts to exclude studies with clear irrelevance. Thereafter, full-text articles were screened for eligibility based on the inclusion and exclusion criteria.

Methodological quality assessment of the studies that met the eligibility criteria. Finally, out of the 850 articles reviewed, 185 were excluded for not being relevant to occupational health, 170 because they did not include data on an intervention or strategies, 310 for non-Saudi populations, 75 studies with insufficient methodology and 85 were non-original studies (Figure 2).

Data Extraction

Standardization of the data extraction form was done across the above studies. Two authors screened the data independently and the following variables were recorded: author, year, study design, sector or industry, details of participants, type of occupational health challenge, details of intervention or strategy, outcome measures and main findings. Aiming to reduce bias, consistent extraction criteria will be applied to all included studies (Table 3).

Quality Assessment

The methodological quality of observational studies included in this research was assessed using key methodological aspects such as study design, participant selection, data collection, outcomes selection, statistical analysis and reporting.

Each criterion was scored as 1 (Yes or (unclear), with maximum score of 10. Based on score, data classified into high (8-10 points), moderate (5-7) and low quality (0-4). The final synthesis only included those studies that met the predetermined quality criteria (Table 4).

Data Synthesis

A meta-analysis was not possible due to heterogeneity in study designs, populations and outcome measures. As a result, it was necessary to employ a narrative synthesis approach.

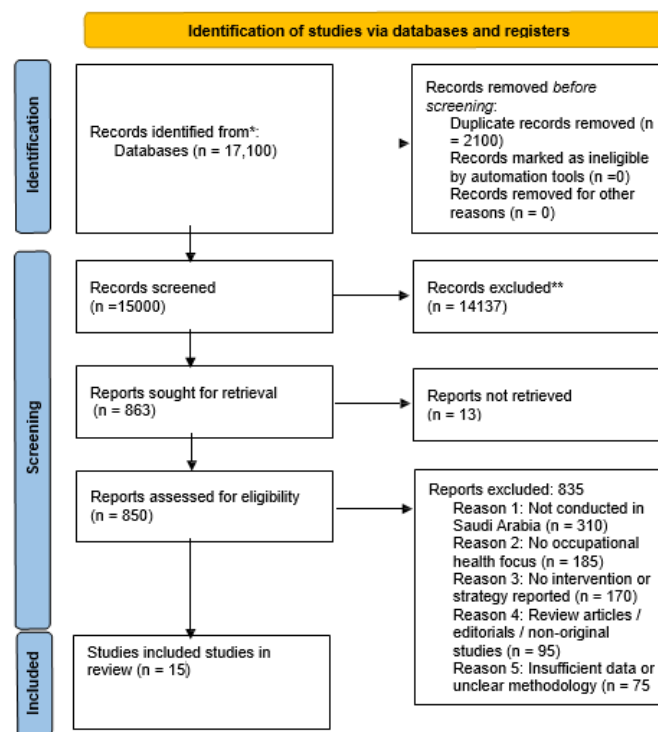


Figure 2: Flowchart of the Included Studies

Table 4: Questions for Quality Assessment

Was the study's goal or question made clear?
Was the main hypothesis presented clearly?
Were occupational health challenges documented?
Was the study focused on Saudi?
Were health guidelines and requirements documented?
Was the method of the intervention described?
Any proof that the intervention was carried out?
Was documentation made on the effect(s) of the interventions on specific workplace hazards?

Results were categorized by the following thematic areas:

- Types of occupational health challenges
- Reported strategies (Proposed/implemented/ recommended)
- Industry or sector distribution

We classified intervention strategies into three broad categories:

- Ergonomic interventions/strategies
- Occupational disease prevention strategies
- Multifaceted or policy-level interventions

Because true interventional studies are few, both implemented interventions and proposed or reported strategies were synthesized (Table 5).

Outcome Measures

Of the interest among the key outcomes were:

- Varieties and frequency of occupational health problems

Table 5: Questions for Data Extraction

Establish the research question.
Define the main hypothesis.
List any more hypothesis not covered in question #2.
Include the year the work was published as well as the last name of the first author.
Mention the region where the review was conducted.
In what sector or industry was the study conducted?
Describe the participant classifications and job titles that were used in the study.
Describe the study's inclusion and exclusion criteria.
What research design was used?
What sort of occupational health problems did the study look at?
How many months, days, or hours did the intervention last?
Outline the strategy (implemented/evaluated, proposed/recommended)
Was it confirmed that the intervention lessened the health issue?
When did the confirmation take place after the intervention/Strategy?
Describe the metrics used to assess the health challenges.
Check the sort of analysis used to measure the intervention's observed effect.
Describe the observed intervention effect for each desired outcome.

- Please read our cookie policy for more information or to acquire the information. Evidence of effectiveness (where available)
- Challenge and the intervention distribution by sector
- Secondary outcomes included circumstances where there were gaps in intervention implementation and research in various industries

Risk of Bias Consideration

Bias was assessed during the study selection and quality phases. The most common threats were selection bias, reporting bias and dominance of cross-sectional design, which does not allow causal inference.

We minimized bias by applying standardized inclusion criteria, performing structured data extraction and using validated quality assessment tools.

RESULTS

Study Selection

About 17100 records were screened against pre-determined inclusion/exclusion criteria. Fifteen thousand records were kept for title and abstract screening after removing duplicates and conducting an initial screening. After removing 14,137 undesired records at the Level 1a screening, 863 articles were identified and assessed for eligibility.

Among 863 articles screened at the full-text screening (Level 1b), 13 articles were excluded based on inclusion and exclusion criteria and the 850 studies were evaluated for their final screening. Furthermore, total 835 studies with incomplete methodology, irrelevant intervention/workers and irrelevant outcomes were excluded. An overall 15 studies were included in the final systematic review.

Descriptive Statistics

The intervention took place in some of the workplaces listed in the reviewed articles, with most of the interventions taking place in the health sector. The interventions were grouped into two with a total of 14 studies under the health sector and 1 under the manufacturing sector as shown in Table 6. The following shows how frequently the industry was represented across the 15 intervention (proposed/recommended) assessments (both high- and low-quality studies are included); a study focused on low back pain among healthcare workers and this was placed under the health care sector [10]. Another study focused on the Saudi Health Council and Saudi Ministry of Health's assessment of the recent issue affecting the nursing profession in the country and this was grouped under the health care sector [11]. A study by [12] was also on low back pain among medical professionals, hence it was placed under the health care sector. In addition, another study was focused on clinical laboratory workers and it was also placed under the health care sector [13] categories all other studies were under the health care sector category but for one of the studies which was on placed under the manufacturing sector [14],

which was focused on personal protective equipment use and occupational exposures in small industries in Saudi Arabia.

Data Extraction and Quality Assessment

The tool used in the data extraction through iteration to make sure that all the relevant areas of the context, usefulness of evaluation and nature of intervention (implemented/evaluated, proposed/recommended) was captured. Many of the information extracted from the individual studies were presented in a summary table of this systematic review. The tool used for quality assessment went through minor revision in the stage of testing. The quality assessment tool was found to be within reviewer consistency. In the area of quality assessment evaluation, a few high-quality interventions were observed, some were of medium quality while the none was of included study was low quality as seen in Table 6. This is not a surprise as many of the studies had their primary focus on identifying the occupational health challenges within the workforce in the country. Many of the studies were focused on the intervention associated with effective it will be on the identified challenge. Only a few studies were focused on the resource implications of the intervention.

Evidence Synthesis

Two industries were identified with a few intervention types mentioned, in some of the identified intervention, there were more studies under the high quality. In total, two industry - intervention types of strata with a good number of sufficient high and medium quality study in order to have substantial evidence were used. While Table 6 above shows a summary of the synthesis findings, Table 7 shows the identified intervention findings that were extracted for each of the studies (implemented/evaluated, proposed/recommended).

Characteristics of Included Studies

In all, the final synthesis included 15 studies. Fourteen studies focused on the healthcare setting and only one focused on the manufacturing sector. The distribution reflects the concentration of available research evidence and avoid interpretations as indicating a greater occupational health burden in healthcare compared with other sectors.

Table 6: Studies Included in the Evidence Synthesis

Industry and type of intervention	Study reference	Study quality
Healthcare		
Ergonomics interventions	[10]	High
Ergonomics interventions	[11]	High
Ergonomics interventions	[12]	High
Occupational disease prevention interventions	[15]	Medium
Ergonomics interventions	[16]	High
Occupational disease prevention and injury prevention interventions	[13]	High
Ergonomics interventions	[17]	Medium
Ergonomics interventions	[18]	High
Occupational disease prevention interventions	[19]	High
Occupational disease prevention interventions	[20]	High
Multifaceted interventions	[21]	High
Ergonomic and other MSK injury prevention	[14]	High
Multifaceted interventions	[22]	Medium
Ergonomics interventions	[23]	Medium
Ergonomics interventions	[24]	High

Table 7: Description of Interventions used in 15 Studies for Evidence Synthesis, Sorted by Intervention

Intervention/Strategy Description	Author, Year	Quality Rating	Occupational Problem	Intervention/strategy Description	Study Design	Outcome type	Effectiveness evidence	Implementation status	Prevention Type
Ergonomics	[10]	High	Low back pain associated with frequent lifting, work-related stress and lack of job satisfaction	Stress reduction, counseling, and policies to improve jobs satisfaction were recommended	A cross-sectional study	Self-reported symptoms	No intervention effectiveness evaluated	Proposed/Recommended	Primary
Ergonomics	[11]	High	Nursing workforce shortage, turnover maldistribution, work environment and workforce challenges	Nursing workforce policy/reform opportunity including education, workforce planning Retention and localization strategies	Quasi-Experimental Within subjects	Policy/workforce outcomes	No intervention effectiveness evaluated	Proposed policy opportunities	Primary
Ergonomics	[12]	High	Low backpain and associated occupational risk factor	Ergonomically safe working condition and regular physical exercise were recommended	A cross-sectional survey	Self-reported symptoms	No intervention effectiveness evaluated	Proposed/Recommended	Primary
Occupational disease prevention strategy	[15]	Medium	Psychological diseases during COVID-19, particularly among health workers	Psychological treatment allocation and mental health support were recommended	A cross-sectional study	Self-reported symptoms	No intervention effectiveness evaluated	Proposed/Recommended	Secondary
Ergonomics strategy	[16]	High	Low backpain associated with physical workload	Ergonomic /preventive measures may be considered based on identified risk factor	A cross-sectional study	Self-reported symptoms	No intervention effectiveness evaluated	Proposed/Recommended	Primary
Occupational disease prevention and injury prevention strategy	[13]	High	Occupational infection and needlestick injury	Biosafety /infection control and needlestick prevention devices were recommended	A survey-based study design	Workplace injury/occupational health outcomes	No intervention effectiveness evaluated	Proposed/Recommended	Primary
Ergonomics strategy	[17]	Medium	Work related musculoskeletal disorder, insufficient ergonomic practice	Application of ergonomic principles and improved ergonomic practices were recommended	A cross-sectional study design	Self-reported symptoms	No intervention effectiveness evaluated	Recommended	Secondary
Ergonomics strategy	[18]	High	Musculoskeletal disorders, ergonomic awareness, workload issue	Application and teaching of dental ergonomics were recommended	A survey-based study design	Knowledge/awareness + self-reported symptoms	No intervention effectiveness evaluated	Recommended	Primary
Occupational disease prevention interventions	[19]	High	Ebola-related infection control/PPE competency	Simulation-based Ebola PPE training program	A quasi-experimental study	Objective performance/competency outcomes	Evidence of improvement	Implemented and evaluated	Primary
Occupational disease prevention strategy	[20]	High	COVID-19 related concerns perceptions and attitudes among HCWs	Infection control/ government response and psychological support measures discussed	A cross-sectional study	Knowledge/perception/attitude outcomes	No intervention effectiveness evaluated	Not implemented	Primary
Multifaceted interventions	[21]	High	Workplace violence against nurses	Workplace violence prevention measures awareness were suggested as preventive strategies	A cross-sectional study	Workplace injury/self-reported	No intervention effectiveness evaluated	Recommended	Primary
Ergonomic and other injury prevention	[14]	High	Occupational physical, chemical and accidental exposure	PPE use, hand hygiene and occupational safety	A descriptive survey study	Occupational exposure	No intervention effectiveness evaluated	Recommended	Primary
Multifaceted strategy	[22]	Medium	TB-related knowledge gap, attitude and infection prevention practices	Periodic TB education program /training and multifaceted TB interventions were recommended	A cross-sectional study	Knowledge/awareness/attitude outcomes	No intervention effectiveness evaluated	Recommended	
Ergonomics strategy	[23]	Medium	COVID-19 related anxiety, depressive symptoms, psychological distress	Psychological counselling and support system were recommended	A cross-sectional study	Self-reported symptoms	No intervention effectiveness evaluated	Recommended	
Ergonomics strategy	[24]	High	Burnout score and work related factors	Work hour limitation and attention to high burnout training program	A cross-sectional study	Occupational outcomes	No intervention effectiveness evaluated	Recommended	

The majority of studies were cross-sectional ($n = 10$), with a smaller proportion employing quasi-experimental ($n = 2$) or survey methodologies ($n = 3$). More than half of the study populations were healthcare workers, mostly nurses, dentists, laboratory technicians and physicians, as would be expected from available literature, as study subjects working in industrial sectors were limited.

Perceptive of each Study were also Identified

The perspective adopted in each study was recognized in this investigation. This idea relates to the analysis' evaluation of the costs and effects of each stakeholder. The perspectives of the company or firm, the employee, the system and society are among the potential viewpoints. In terms of the viewpoint adopted in the studies, the majority adopted the perspective of the organization, some adopted a systemic viewpoint and others adopted a societal viewpoint.

The study listed out and reported a range of intervention types. The intervention/strategy types were of three different types: ergonomic intervention, multifaceted intervention and occupational disease prevention interventions. Among the three interventions, the most common identified was the ergonomic intervention followed by the occupational disease prevention intervention then lastly the multifaceted intervention. Some types of intervention was noticed to be mostly associated to a particular section. For example, the ergonomic intervention was mostly identified in the healthcare sector in this study.

Occupational Health Challenges

Musculoskeletal disorders, psychological stress, occupational infections and work-related injuries to the lower limb were the most prevalent occupational health problems." Low Back Pain (LBP) (the most prevalent musculoskeletal disorder) was the most common complaint amongst healthcare professionals.

Reported Intervention Strategies

Interventions were classified into three categories based on the primary objective and principal mechanism:

Ergonomic Interventions

The commonest type of intervention was ergonomic strategies. These involved workplace adaptation, redistribution of confounding workload, ergonomic correction training, physical therapy and physiotherapy assistance and the application of ergonomic rule principles in work and clinic. Most of these interventions were implemented to prevent the development of musculoskeletal strain of the health care professionals.

Occupational Disease Prevention Strategies

The interventions were intended to prevent occupational injuries, infections, injuries, hazardous exposure through safety measures such as infection control protocols, biosafety trainings, vaccination awareness programs and needle- stick injury prevention measures.

These interventions occurred predominantly in the hospital and laboratory environments.

Multifaceted and Policy-Level Interventions

They defined as intervention involving two or more intervention components or intervention primarily targeting organizational, institutional workforce or policy level changes.

Fewer studies reported combined or system-level interventions, including:

- Workplace violence prevention policies
- Burnout reduction programs
- Work-hour regulation strategies
- Educational and behavioral training programs

The interventions focused on these organizational and behavioral risk factors.

Spread of Interventions across Sectors

Most of the interventions were done in the health sector and little evidence is provided on those done in manufacturing or industrial settings. Most research about ergonomic interventions was focused on the clinical setting, particularly in nurses and dental professionals. Occupational disease identification strategies were more feasibly reported in lab and hospital-based studies compared to field studies.

Evidence of Intervention Effectiveness

Only a small number of studies examined intervention effectiveness (implemented/evaluated, proposed/recommended interventions) based on pre-post or quasi-experimental designs.

Only one quasi experimental stud (6.7%) reported improvements between baseline and follow-up. Outcomes reported across included studies were categorized according to their nature and methods of measurement, including knowledge, awareness, self-reported symptoms, workplace injury, occupational health outcomes. These outcomes categorizes were interpreted separately and were not considered equivalent evidence of intervention effectiveness, particularly when derived from cross sectional or survey based design. In general, data do support the potential beneficial effect of the interventions, but inferences are hampered by the high proportion of observational study designs within this field (Table 7).

DISCUSSION

The central idea of this study was to identify published articles that assess occupational health challenges and intervention either implemented/proposed in Saudi Arabia. The research question was stated as thus: "What are the prominent occupational health challenges and interventions in Saudi Arabia?" The study was able to focus the response to this query into two clusters of industry intervention and possible effects. The remaining studies that emanated from the general search lacked sufficient evidence due to their

small size, poor quality and lack of relevance to the suggested research issue. Existing studies are fragmented, sector-specific and predominantly observational, limiting their utility for national-level policy and intervention planning. Due to occupational interventions suggested outcomes, the systematic review started by filling the gap that was in the literature. The findings of this study give a lot of values to workplace practice and other policy makers who may be interested in finding out the type of intervention that may be associated with improvement and also the kind of resources that will be needed to execute such intervention. This study aims to systematically synthesize evidence on occupational health challenges and identify gaps between reported risks and interventions and its effective improvement in Saudi Arabia. Numerous studies used a cross-sectional study design to evaluate the efficacy and proposed/commended. When determining the impact of the assessment, the procedures were not restricted to contextual considerations. This study attributed changes in outcome that occurred after the intervention's implementation.

Future Perspective

Recommendations below are divided into evidence-supported recommendations, directly informed by findings from the studies that are included and broader policy and research recommendations, which reflect on the implication of identified evidence gaps and the broader occupational-health context.

Evidence-Supported Recommendation

The availability of survey design methods within the review reflects the difficulty that involves undertaking intervention in a work setting. This review also found out that one of the less frequently considered item was less productivity which can be associated with time spent off work or due to disability. Ensuring the well-being of employees, improving productivity and fostering sustainable economic growth are essential aspects of occupational health. Saudi Arabia's various health challenges encompass workplace accidents, occupational diseases, work-related stress and inadequate safety regulations. To address these challenges and promote a safer and healthier workforce, Saudi Arabia must adopt a comprehensive forward-looking approach. Regular inspections and monitoring should be implemented to ensure adherence.

The findings of this review reflect worldwide patterns, with musculoskeletal disorders and occupational stress continuing to represent pre-eminent workplace health challenges. Conversely, Despite the oil and gas and construction and manufacturing sectors that are known to be associated with major occupational risks, are heavily emphasized, the healthcare sector kept dominating in the research field in Saudi Arabia.

Broader Policy and Research Recommendations

In addition, investing in research and data collection is crucial to identify emerging occupational health risks and

guide evidence-based interventions. Collaborating with national and international academic institutions can facilitate knowledge sharing and foster innovative approaches to occupational health management. Also, promoting a culture of health and safety within organizations is vital. This entails launching awareness campaigns, providing training programs and encouraging employee engagement in health initiatives. Employers should prioritize workplace ergonomics, mental health support and regular health screenings. Addressing emerging concerns such as occupational stress and work-life balance is also crucial.

Developing flexible work policies, promoting employee well-being programs and offering resources for stress management can contribute to creating a healthier work environment.

Research Design Recommendation

Study designs for future research must be proper for the occupational setting and intervention to be assessed. Randomized Controlled Trials (RCTs), which may include cluster RCTs, could offer solid evidence on the effectiveness of interventions, when feasible. Where randomization is impractical, unethical or operationally difficult, however, prospective cohort studies, controlled before-after studies and interrupted time-series analyses, or other quasi-experimental or cluster-based designs, should be considered.

Ethics Explicitly

Randomized designs may be impractical in an occupational context due to ethical concerns, practical constraints, organizational policies and the ability to deny workers useful interventions.

Limitations

This review has several limitations. First, most of the studies included were observational, which limits inference of causal relationships between interventions and outcomes. Quality assessment Second, the search of English-language publications may have missed evidence published in languages other than English. Third, heterogeneity across study designs, populations and outcome measures impeded a possible meta-analysis. Finally, despite the extensive search, publication bias could not be ruled out. Furthermore, workplace health policies in Saudi Arabia are supported by national strategies of occupational health that can be aligned with global frameworks like those promoted by the World Health Organization (WHO).

In this systematic review, a considerable burden of occupational health problems in Saudi Arabia observed, the most commonly challenges were musculoskeletal disorders, psychological stress and occupational infections (mainly in the healthcare sector). A diverse set of intervention strategies were reported with a primary emphasis on ergonomic interventions, occupational disease prevention and policy-level strategies, which were identified in the review. Nevertheless, the dominance of observational study designs weakens the evidence on the effectiveness of these strategies.

CONCLUSION

The evidence from this systematic review shows that the issue is related to occupational health and has been reported in various occupational environments in Saudi Arabia, but the evidence is mostly limited to the healthcare sector. The studies included in this review showed a variety of occupational health outcomes, including psychosocial issues, burn out, occupational exposures and other occupational health risks. The quality and applicability of conclusions are however limited by the small number of eligible studies, differences in study designs, outcome measures and the predominance of observational studies.

It is important to note that this review does not indicate that the evaluation of occupational-health interventions is lacking throughout Saudi Arabia, but rather a gap in research and evidence. There are few studies targeting the effectiveness of interventions, which makes the selection of the most effective, feasible and sustainable interventions in different occupational settings difficult and challenging. Future studies should therefore proceed to rigorously assess occupational-health interventions with study designs that are suitable for the occupational context that would involve RCTs, or cluster RCTs if available, prospective cohort, controlled before-after and interrupted time-series designs and other appropriate quasi-experimental designs.

In addition, incorporating more information regarding occupations that are underrepresented in the literature and making certain that occupational health outcomes are consistently reported could help to build the evidence base and facilitate the creation of context-specific occupational-health policies and interventions in Saudi Arabia.

Author Contributions

“Conceptualization, SA and SABM.; Methodology, YA, AZ; Validation, AZ and YA.; Writing-original draft preparation, AA,SA.; Writing-review and Editing, AA and YA.; Visualization, AA.; Supervision, SABM and SA. The authors confirm that no paper mill and artificial intelligence was used.

Data Availability

All data are with in manuscript and supplementary data files.

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Conflicts of Interest

The authors declare no conflict of interest.

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