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Occupational Morbidity And Associated Risk Factors Among Agricultural Workers In India: Insights From Coimbatore And Beyond

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Abstract
Agriculture is central to rural life in India, providing jobs for over 40% of the workforce and supporting nearly 70% of rural families. Even though agricultural workers play a key role in food production and the rural economy, they are among the most at-risk groups, facing high rates of illness and injury. This review synthesizes research and evidence from Coimbatore to highlight the health issues and risk factors that impact these workers. Common issues include joint and muscle pain, breathing problems, skin conditions, pesticide poisoning, heat stress, and diseases spread by water or insects. These health challenges are made worse by poverty, gender inequality, poor sanitation, and limited access to healthcare. Climate change and environmental damage add to these risks, making life even harder for this already vulnerable group. National policies have helped improve rural health through better sanitation, housing, and primary care, but the specific health needs of agricultural workers are still not well addressed in policy. Brazil and Vietnam demonstrate practical approaches to integrating agricultural health into rural healthcare. There is a clear need for coordinated, gender-aware, and climate-adapted actions to protect the health of India's agricultural workers, who are vital to the country's food supply and rural economy.
Keywords: *Agricultural workers; Occupational health; Pesticide exposure; Musculoskeletal disorders; Climate change; Rural health; Coimbatore; India*

INTRODUCTION

Agriculture has long served as the foundation of India's socio-economic landscape, deeply influencing livelihoods, cultural practices, and national progress. Despite the rapid expansion of industry and the service sector, agriculture today remains a primary source of employment for over 40% of the country's workforce and sustains nearly 70% of rural households, either directly or indirectly (1,2). India stands among the world's leading producers of key crops such as rice, wheat, pulses, cotton, and sugarcane. The nation also boasts the largest cattle population worldwide and leads in milk production (3,4). Yet, the sector's contribution to the national Gross Domestic Product (GDP) has fallen below 15%, signalling a structural transformation toward other areas of the economy (5). Nevertheless, agriculture's role in ensuring food security, providing rural employment, and supporting livelihoods remains indispensable (6).

Small and marginal farmers comprise almost 86% of all agricultural landholdings, often working on less than two hectares of land (7). Because they rely on manual labor and have limited access to machinery, credit, irrigation, and market support, their work is very labour-intensive (8). Many agricultural workers come from economically disadvantaged backgrounds and perform physically demanding jobs, including sowing, weeding, spraying pesticides, harvesting, and caring for cattle. Without clear safety regulations, they face many health risks, including musculoskeletal pain, respiratory diseases, pesticide poisoning, and heat-related illnesses (9,10).

Socio-economic vulnerabilities, alongside occupational exposures, significantly influence health outcomes. Agricultural workers often face poverty, limited literacy, inadequate sanitation, and restricted healthcare access, all of which increase the risk of untreated morbidity and chronic disability (11,12). Research from rural India, including Tamil Nadu, Rajasthan, and Punjab, consistently demonstrates a high prevalence of work-related morbidity, with women and elderly workers disproportionately affected (13,14). Women workers, in particular, bear both domestic and agricultural responsibilities, which further elevates their risk of musculoskeletal disorders, reproductive health issues, and psychosocial stress (15).

Environmental changes have made health challenges worse for this workforce. Changes in climate, such as higher temperatures, unpredictable rainfall, droughts, and floods, have reduced agricultural productivity and led to increased health problems, including heat stress, dehydration, and diseases like malaria and dengue (16,17). Areas like Coimbatore, which rely on both traditional and modern farming, are particularly at risk. Studying these regions locally is crucial for understanding the specific health issues arising from their unique environment and economy (18).

Several national initiatives have contributed to improvements in rural health at the policy level. Programs such as the National Rural Health Mission (NRHM), Swachh Bharat Abhiyan (Gramin), and Pradhan Mantri Awas Yojana (PMAY-Gramin) have expanded sanitation coverage, strengthened rural healthcare delivery, and improved housing quality (19, 20). Despite these advances, the occupational health needs of agricultural workers remain insufficiently addressed. Key areas, such as pesticide safety training, ergonomic interventions, the provision of personal protective equipment, and climate-adapted health strategies, receive minimal policy attention (21). In comparison, countries such as Brazil and Vietnam have successfully integrated agricultural worker health into their rural healthcare systems, providing potential models for India (22,23).

In this context, this narrative review synthesizes evidence on morbidity patterns and associated risk factors among agricultural workers in India, with a particular focus on the Coimbatore district. This review examines the relationships among occupational hazards, socioeconomic determinants, and environmental stressors to identify policy gaps and recommend gender-sensitive, climate-resilient, and locally adaptable health interventions to protect the well-being of India's agricultural workforce.

METHODOLOGY

This paper employs a narrative review methodology, drawing on evidence from published research articles, government reports, and international policy documents regarding the health of agricultural workers in India. The literature was primarily identified through systematic searches of PubMed, Google Scholar, and Scopus using keywords including agricultural workers, occupational health, morbidity, pesticide exposure, and India.

Studies published within the last two decades were prioritized, although earlier research was included when relevant. The review emphasizes findings from Tamil Nadu and Coimbatore to provide regional perspectives. Thematic synthesis was used to analyse morbidity patterns and the occupational, socioeconomic, and environmental factors that affect these patterns.

DISCUSSION

Agricultural workers remain one of the most vulnerable occupational groups in India, facing a wide range of health problems that are shaped by their working environment, socio-economic status, and broader environmental change. This review synthesises available evidence on morbidity patterns, risk factors, and policy responses, while also drawing lessons from global experiences to inform future directions.

Morbidity Patterns among Agricultural Workers

Agricultural workers face numerous occupational hazards that can lead to a range of health issues. Research from India often points to musculoskeletal disorders, respiratory illnesses, skin conditions, issues related to pesticides, mental health concerns, and infectious diseases as the main causes of poor health in this group. As Joseph et al. (9) note, these problems often occur together, making life even harder for workers and their families.

Musculoskeletal Disorders

Musculoskeletal disorders represent the most frequently reported form of morbidity among agricultural workers. Sharma et al. (11) identify repetitive bending, squatting, and prolonged manual labour as key factors predisposing workers to chronic back pain, joint stiffness, and repetitive strain injuries. Prevalence studies conducted by Ramesh and Krishnan (12) in Tamil Nadu and Singh et al. (13) in Rajasthan indicate that up to 70% of workers experience musculoskeletal pain, particularly during transplanting and harvesting activities. These disorders reduce productivity and, as highlighted by Nair et al. (14), may result in long-term disability, thereby increasing economic vulnerability for affected households.

Respiratory Illnesses

Respiratory morbidity remains a significant occupational health concern. Kumar et al. (15) reported elevated rates of asthma and chronic bronchitis among paddy field workers. Similarly, Patel et al. (16)

identified a higher prevalence of chronic obstructive pulmonary disease (COPD) among cotton farmers. Inhalation of pesticide aerosols frequently induces acute respiratory symptoms. According to Das and Mehta (17), repeated exposure to these aerosols can lead to the development of chronic respiratory diseases.

Dermatological Conditions

Dermatological conditions are prevalent among workers exposed to pesticides and fertilizers. Verma et al. (18) reported dermatitis and eczema as frequent complaints, while Subramanian and Iyer (19) described acute rashes and skin irritation among pesticide sprayers. Devi and George (20) identified women agricultural workers as a group with increased vulnerability, attributed to their frequent engagement in manual weeding and harvesting.

Pesticide-Related Health Effects

Lal et al. (21) described acute pesticide poisoning symptoms, including nausea, dizziness, and blurred vision. Chronic exposure has been associated with neurological and respiratory diseases as well as cancer (22). These health risks are not confined to specific regions. Jeyaratnam (23) identified acute pesticide poisoning as a major global health problem, and London and Bailie (24) highlighted weak surveillance as a persistent challenge in developing countries. Faria et al. (25) documented respiratory impacts of pesticide exposure in Brazil. Furthermore, Wesseling et al. (26) and Arcury and Quandt (28) emphasised the disproportionate risks faced by agricultural workers in low- and middle-income countries. Srinivasan and Kumar (14) reported high pesticide-related morbidity during spraying seasons in Coimbatore, with unsafe handling practices and limited protective equipment identified as key contributors (13,29).

Mental Health and Psychosocial Stress

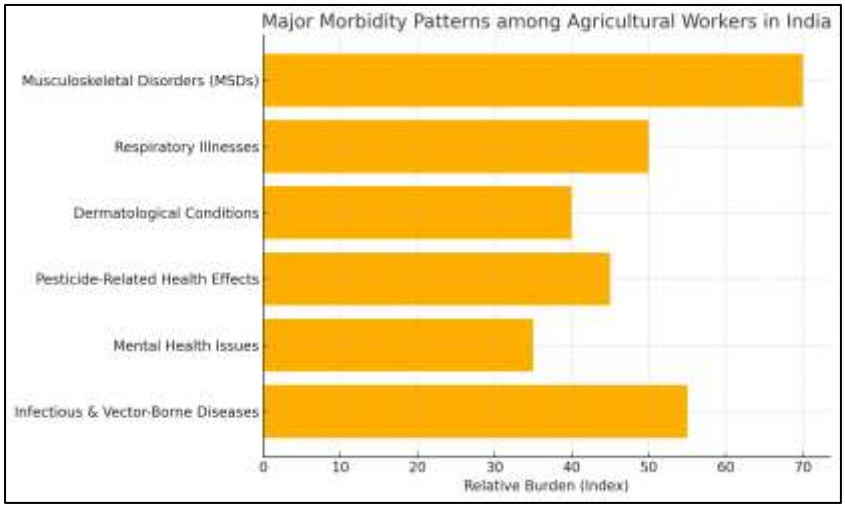
Mental health is an often-overlooked dimension. According to Rao and Patel (25), debt, crop failures, and economic instability contribute to high levels of anxiety and depression among agricultural workers. Women experience additional stress due to dual domestic and farm roles, as highlighted by Lakshmi et al. (26). The stigma around mental health and limited rural mental health services exacerbate this burden (27).

Infectious and Vector-Borne Diseases

Infectious diseases also remain prevalent. Gupta et al. (28) reported high rates of diarrhoeal illnesses due to poor sanitation, while Prasad and Sen (29) noted seasonal outbreaks of malaria and dengue in farming communities. Workers in livestock handling are additionally at risk of zoonotic infections such as leptospirosis and brucellosis, as shown by Thomas and Reddy (30).

These factors highlight the urgent need for comprehensive occupational health strategies.

Category	Common Causes	Typical Morbidity
Musculoskeletal Disorders (MSDs)	Repetitive bending, heavy loads, awkward posture, lack of mechanisation	Back pain, joint stiffness, repetitive strain injuries
Respiratory Illnesses	Dust, smoke, pesticide aerosols, cotton farming, paddy fields	Asthma, bronchitis, COPD, wheezing, breathlessness
Dermatological Conditions	Direct contact with chemicals, contaminated water, prolonged sun exposure	Dermatitis, eczema, fungal infections, sunburns
Pesticide-Related Health Effects	Acute poisoning during spraying; chronic exposure to residues	Nausea, dizziness, neurological issues, cancers
Mental Health Issues	Debt, crop failure, unstable income, dual workload (esp. women)	Anxiety, depression, fatigue, stress disorders
Infectious & Vector-Borne Diseases	Poor sanitation, unsafe water, stagnant fields, animal handling	Diarrhoea, cholera, malaria, dengue, leptospirosis



Risk Factors and Determinants of Morbidity

The health challenges of agricultural workers are shaped by a web of interconnected determinants. These can be broadly classified into occupational, socio-economic, gender-related, and environmental factors. Each category interacts with the others, magnifying the vulnerability of this population. A clear understanding of these determinants is crucial for designing effective interventions. Table 1 summarizes the primary determinants and their corresponding health outcomes.

Table 1. Risk factors and determinants of morbidity among agricultural workers

Determinant	Key Risk Factors	Associated Health Outcomes
Occupational	Heavy physical workload, repetitive strain, pesticide exposure, unsafe equipment use	Musculoskeletal disorders, acute and chronic pesticide poisoning, injuries
Socio-economic	Poverty, low literacy, limited healthcare access, informal labour without social protection	Delayed diagnosis, untreated chronic diseases, malnutrition, higher overall morbidity
Gender-related	Women face dual burden of domestic and farm work, higher exposure to manual weeding, reproductive health risks	Musculoskeletal pain, fatigue, anaemia, reproductive complications, mental stress
Environmental/Climate	Rising temperatures, erratic rainfall, floods, vector proliferation, poor sanitation and water quality	Heat stress, dehydration, malaria, dengue, diarrhoeal diseases, worsening chronic illness

Occupational Determinants

Agricultural labour involves long hours of repetitive manual tasks, heavy physical strain, and unsafe handling of chemicals. As Joseph et al. (11) noted, prolonged bending, squatting, and lifting heavy loads predispose workers to musculoskeletal disorders. Pesticide exposure is another critical determinant. Lal et al. (21) described how acute pesticide poisoning presents with neurological and gastrointestinal symptoms, while chronic low-level exposure has been linked to respiratory illness, endocrine disruption, and certain cancers (22). Injuries from hand tools, farm machinery, and accidental falls also add to the occupational health burden, as noted by Ramesh and Krishnan (12). The absence of personal protective equipment (PPE) and inadequate training in safe practices, as highlighted by Menon et al. (24), further compounds these risks.

Socio-Economic Determinants

Socioeconomic disadvantage has a significant impact on both exposure to occupational risks and health outcomes. Agricultural workers frequently belong to low-income households with limited financial

security. Poverty restricts access to healthcare and nutritious food, thereby perpetuating poor health. Singh and Banerjee (13) noted that limited literacy among rural workers reduces awareness of occupational hazards and delays health-seeking behaviour. Informal employment contracts often result in a lack of insurance, compensation, or social protection, which increases vulnerability to catastrophic health expenditures as described by Sharma and Gupta (19). Gupta et al. (28) found that poor housing and sanitation, prevalent in rural areas, further increase the risk of water-borne and vector-borne diseases.

Gender-Related Determinants

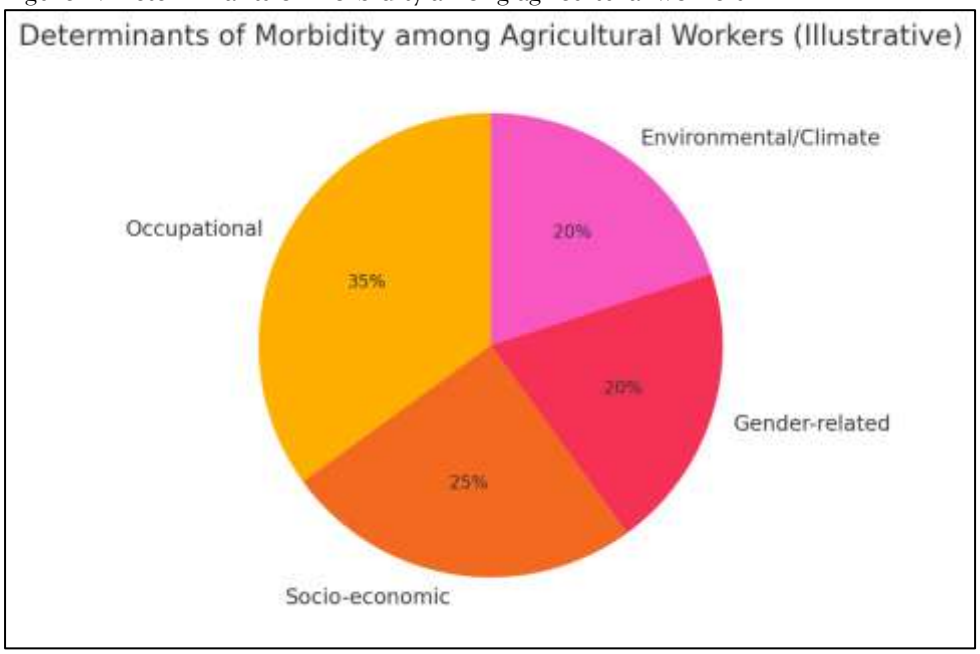
Gender has a significant influence on health outcomes, particularly within the agricultural sector. Women represent a substantial proportion of the agricultural workforce and frequently perform physically demanding tasks such as transplanting, weeding, and harvesting. Devi and George (20) report that these activities increase the risk of dermatological and musculoskeletal disorders, further intensified by the dual responsibilities of work and household management. Hurst et al. (27) further argued that agricultural workers worldwide, particularly women, often lack adequate recognition in policy despite being central to sustainable agricultural development. Lakshmi et al. (26) identified additional reproductive health risks for women agricultural workers, including anaemia, menstrual disorders, and adverse pregnancy outcomes, which are aggravated by inadequate nutrition and pesticide exposure. Furthermore, psychosocial stress is heightened among women due to persistent gender inequities and societal expectations.

Environmental and Climate-Related Determinants

Environmental exposures are increasingly recognised as critical determinants of morbidity. Climate variability, including rising temperatures, erratic rainfall, and extreme weather events, exacerbates health risks. Prasad and Sen (29) noted that stagnant water in irrigated fields increases mosquito breeding, which in turn leads to the transmission of malaria, dengue, and chikungunya. Ramanathan et al. (16) documented how rising heat levels increase the incidence of heat stress, dehydration, and exhaustion during peak agricultural seasons. The World Health Organization (30) has stressed that agricultural populations are among the most climate-sensitive groups, with vulnerability assessments showing increased risks of heat-related and vector-borne illnesses under climate change scenarios. Poor access to safe drinking water and inadequate sanitation further increased the prevalence of diarrheal diseases and typhoid, as observed by Gupta et al. (28). Environmental degradation, including soil contamination and unsafe pesticide disposal, also contributes to long-term health hazards for farming communities, as highlighted by Thomas and Reddy (30).

Figure 1 illustrates the relative contributions of various determinants to overall morbidity burden.

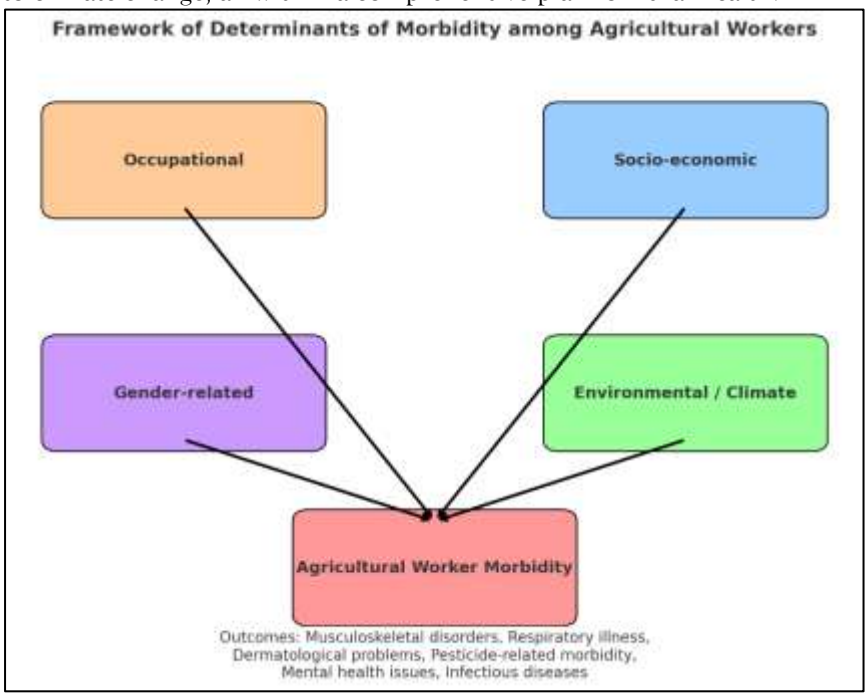
Figure 1. Determinants of morbidity among agricultural workers



Synthesis

Overall, these factors indicate that agricultural health problems are caused by factors beyond just workplace risks. They result from a mix of poverty, gender inequality, and environmental challenges. As

Morgan and Williams (22) point out, focusing solely on job safety is insufficient. Health strategies must address workplace safety, reduce poverty, promote gender equality, and support communities in adapting to climate change, all within a comprehensive plan for rural health.



Policy Landscape and Gaps

India's flagship programmes such as the National Rural Health Mission (NRHM), Swachh Bharat Abhiyan (Gramin), and Pradhan Mantri Awas Yojana (PMAY-Gramin) have improved rural health indicators, but their impact on agricultural workers' occupational health remains indirect. Sharma and Gupta (19) noted that NRHM has strengthened general rural healthcare, while Menon et al. (20) observed sanitation gains under Swachh Bharat. Housing improvements under PMAY were also documented by Sen (21). However, none address pesticide safety, ergonomic risks, or climate-related health challenges specific to agricultural labour.

The National Occupational Health and Safety Policy (NOHSP) was intended to standardise workplace safety. Yet, as Morgan and Williams (20) argue, agriculture has largely been excluded. Internationally, the International Labour Organization (31) has identified agriculture as one of the most hazardous sectors, recommending comprehensive occupational safety measures, while the Food and Agriculture Organization (32) has emphasised that protecting farm worker health is central to sustainable agricultural systems.

Table 2 highlights the scope and limitations of these national programmes in relation to agricultural worker health.

Table 2 provides an overview of the scope and specific limitations of key national programmes addressing the health of agricultural workers.

Table 2. National programmes and their relevance to agricultural health

Policy / Programme	Primary Focus	Relevance to Agricultural Workers	Key Gaps
National Rural Health Mission (NRHM)	Strengthening rural healthcare delivery, maternal and child health, immunisation	Improves general access to healthcare in villages	No focus on occupational health hazards like pesticides or ergonomic risks
Swachh Bharat Abhiyan (Gramin)	Universal sanitation, eradication of open defecation	Better sanitation reduces water- and vector-borne diseases among farm workers	Does not address farm-specific hazards such as agrochemical exposure

Pradhan Mantri Awas Yojana (PMAY-Gramin)	Provision of pucca housing for rural households	Improves living environment and protection against climatic stressors	Does not integrate occupational health or worker protection measures
National Occupational Health and Safety Policy (NOHSP)	Establishing workplace health and safety standards	Recognises need for occupational health protection	Excludes informal agricultural labour, weak enforcement mechanisms

Although these programmes yield some indirect benefits, they do not constitute a comprehensive occupational health framework for agricultural workers. The absence of coordination among the health, labour, and agriculture ministry's exacerbates fragmented implementation. Addressing this gap requires robust surveillance systems, broader social security coverage, and the integration of occupational health services into rural healthcare delivery.

Comparative Approaches to Integrating Occupational Health in Rural Health Systems

Brazil and Vietnam offer practical models of integrating occupational health into primary care. Paim et al. (22) described Brazil's Family Health Strategy, where multidisciplinary teams and community health agents conduct outreach, home visits, and preventive education, including identification of occupational risks. Nguyen et al. (23) reported that Vietnam's commune health stations embed occupational health into routine services such as maternal and chronic disease care, enabling low-cost screening and risk assessment.

For India, these experiences are highly relevant. As Morgan and Williams (19) note, India's PHC and ASHA networks are extensive but underutilised for occupational health. By adapting lessons from Brazil's proactive outreach and Vietnam's integration of occupational screening into routine care, India can address gaps in its current approach.

Middle-income countries have developed practical strategies for integrating occupational health into rural health systems. For example, Brazil's Family Health Strategy (FHS), as described by Paim et al. (22), serves as a foundational model for primary care in rural settings. This programme utilizes multidisciplinary teams, including doctors, nurses, and community health agents, each assigned to specific catchment areas. Through regular home visits, health education, and preventive outreach, these teams facilitate early detection of occupational risks such as pesticide exposure, heat stress, and musculoskeletal strain. The FHS also connects health interventions with social protection measures, promoting a comprehensive approach to rural health. Community engagement and intersectoral collaboration within this model have played a critical role in reducing healthcare barriers for agricultural workers.

Vietnam provides a further example of effective integration. Nguyen et al. (23) report that commune health stations incorporate occupational health activities into routine services. These clinics conduct workplace risk assessments, perform periodic screenings for pesticide-related symptoms, and provide health education on ergonomics and chemical safety. Integrating occupational health with maternal and child health and chronic disease programs increase participation, reduces stigma, and broadens service coverage. Training frontline staff in occupational history-taking and basic screening has been sufficient to extend protection to informal agricultural workers with minimal additional investment.

These examples show that India faces both opportunities and urgent challenges. Brazil's approach highlights the value of reaching out to communities, while Vietnam shows that it is possible to add new services at a low cost. India already has a strong rural healthcare system through its Primary Health Centres and the ASHA network. Still, as Morgan and Williams (19) point out, these programs focus on general health and do not address specific risks like pesticide exposure, physical strain, or illnesses related to climate. By learning from Brazil and Vietnam, India could move from broad rural health efforts to a more focused strategy that better protects agricultural workers.

Table 3. Comparative approaches to occupational health in agriculture

Aspect	**Brazil – Family Health Strategy (FHS)**	**Vietnam – Commune Health Stations**	**India – Current Approach**

Service delivery model	Multidisciplinary teams supported by community health agents; proactive home visits and outreach (Paim et al. (22))	Local health stations integrate occupational health into routine care (Nguyen et al. (23))	PHCs and ASHAs focus on maternal, child, and general health (Morgan and Williams (19))
Key occupational activities	Identification of risks (pesticides, heat stress, musculoskeletal strain) during routine visits	Screening for pesticide exposure, ergonomic risks, and chronic conditions	Acute illness management only; no structured occupational risk screening
Strengths	Strong community linkage; preventive focus; intersectoral coordination	Low-cost integration into existing services; high participation	Large rural health network; community trust in ASHAs
Limitations	Requires sustained financing and team-based structure	Dependent on staff training and resource allocation	Lack of occupational health integration; fragmented responsibility between ministries
Lessons for India	Expand ASHA outreach for occupational risk detection and use mobile health teams	Train PHC staff in occupational health screening and referral	Incorporate occupation-specific modules into existing rural healthcare

Implications for Practice and Policy

The reviewed evidence underscores the urgent need for India to incorporate occupational health into its rural healthcare system. Joseph et al. (9) identified that agricultural workers experience both occupational and infectious diseases, which are often overlooked by formal health structures. Furthermore, Paim et al. (22) found that community outreach effectively reduces access barriers, and Nguyen et al. (23) demonstrated that integrating basic occupational screening into existing services is a cost-effective approach. These findings suggest that Primary Health Centres (PHCs) and Accredited Social Health Activists (ASHAs) in India may be involved in education, screening, and referral activities. Achieving this integration will require coordinated efforts across sectors and strong policy support.

Limitations

This review is subject to several limitations. The narrative approach does not employ systematic inclusion and exclusion criteria, which can potentially introduce selection bias. Most available evidence on agricultural health in India is cross-sectional and region-specific, which limits its generalizability. Underreporting of occupational illness is prevalent due to inadequate surveillance systems and limited healthcare access in rural areas. Furthermore, evidence from Coimbatore is limited and primarily based on small-scale studies.

Recommendations

Integrating occupational health into India's rural healthcare system requires a comprehensive strategy. Primary Health Centres and frontline workers must be trained to identify and manage prevalent occupational diseases. Community outreach should prioritise education on safe pesticide use, ergonomic practices, and mental health. Implementing seasonal screening camps during high-risk periods, such as spraying and harvesting, will enable early detection and timely intervention. Policy frameworks should incorporate a gender-sensitive perspective that addresses the dual workload and reproductive health needs of women agricultural workers. Climate-resilient measures, such as early warning systems for heat stress and enhanced vector control, are crucial to protect farming communities from the escalating impacts of environmental change.

CONCLUSION

Agricultural workers constitute a critical component of India's rural economy, yet their health is insufficiently protected. This review identifies a broad morbidity profile among this population, including musculoskeletal, respiratory, dermatological, pesticide-related, and infectious diseases. These health challenges are exacerbated by socioeconomic disadvantage, gender inequity, and the impacts of climate change. Although national programmes have contributed to improvements in sanitation, housing, and

general healthcare, they do not adequately address the occupational health risks specific to agricultural work. Evidence from Brazil and Vietnam indicates that integrating occupational health services into primary care systems is both practical and effective. Without the adoption of similar strategies in India, the health of agricultural workers is likely to remain neglected, with negative consequences for productivity and rural development.

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