

Analysis of the Use of Personal Protective Equipment (PPE) and Its Implications for Farmers in Nigeria

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Abstract

Occupational hazards in the agricultural sector, have posed serious risks to both workers' lives and agricultural productivity. Personal Protective Equipment (PPE) is essential for safeguarding farmers' health, safety and well-being. However, only a few studies in Nigeria have specifically examined the challenges that small and medium scale farmers face when adopting PPE for agrochemical use. This paper interrogates the challenges that small and medium scale farmers face in adopting PPE for agrochemical use and the health implications of their inability or failure to adequately make use of PPE when handling agrochemicals. In other words, the paper examines the barriers to PPE use among these farmers, utilizing secondary data while being guided by the Fundamental Cause Theory. The paper underscores the need for increased awareness of the health risks associated with agrochemical usage in farm management. The paper concludes that the socio-economic status of farmers, has a significant effect on the use of PPE, and consequently affects the health status of the farmers in different ways. The paper recommends targeted interventions by both governmental and non-governmental organizations through a comprehensive education on the need for the use of PPE, good regulatory measures, as well as the alleviation of poverty among rural farmers through financial assistance, among others, to ensure that they can afford necessary safety equipment to mitigate the health risks associated with agrochemical usage.

Keywords: Agrochemicals; Health Hazards; Personal Protective Equipment; Small scale Farmers

Introduction

The agricultural sector has become the second largest occupation the world over with the potential to stimulate economic growth and provide livelihoods. The sector comprises crop production, livestock, forestry, and fisheries. In Nigeria, for example, the crop production sector has remained the most significant driver of the other sub-sectors, thus accounting for 91 percent of agricultural sector growth in the third quarter of 2021 (NBS, 2022). In fact, the majority of agricultural practices are conducted by small holder farmers who operate at subsistence level. The farming system in Nigeria has also evolved from traditional to conventional farming practices, resulting in the dependence on the use of agrochemicals (Olowogbo, Fakayode, Jolaiya, & Oke, 2013).

The use of agrochemicals, has become an integral part of modern farming practices, dating back to the 1940s when the first pesticides were manufactured (Bertomev-Sanchez, 2019). Agrochemical usage saw a significant boost during the 1960s' Green Revolution, which relied on science and technology to increase food production and ensure food security through pest control, weed management, and enhanced soil fertility (Sheahan, Barrett & Goldavale (2017). However, the intensive use of agrochemicals has raised serious public health and environmental concerns.

According to Lari, Yamagani, Pandyan, Vanka, Naidu, Kumar, Jee, & Jonnalagadda, (2023), pesticide exposure has been linked to acute and chronic health issues, including morbidities and mortalities, making it a pressing public health issue. Farming, despite its critical role in global food production, has remained one of the most hazardous occupations. Damalas and Hasheem (2010), report that it is frequently associated with high rates of occupational injuries and illnesses. This is particularly evident in developing countries, where a significant proportion of the global health burden related to pesticide exposure is concentrated (Demi & Sicchia, 2021). Unsafe farming practices, such as the improper or insufficient use of Personal Protective Equipment (PPE), further exacerbate these risks. Ndayambaje, Amuguni, Coffin-Schmitt, Sibbo, Ntawubizi, & Van-Wormer, (2019) and Joko, Dewanti, & Dangiran, (2020), have noted that the health risks faced by farmers in these regions stem largely from inadequate adoption of safety measures, including PPE, when handling agrochemicals.

Consequent upon the significance of the agricultural sector, and the attempt to boost agricultural productivity via the use of agrochemicals, the sector has indeed, been fraught with occupational hazards as farmers are frequently exposed to pesticides during preparation

and application, which have been linked to various chronic health conditions, including neurological disorders, cancers, and metabolic syndromes like diabetes and obesity (Garrigu, Laurent, Berthet, Colosio, Jas, Leteureurs, Jackson, Jouzel, Samuel, Lebailly, Galey, Goutille, & Judo, 2020); Lari et al., 2023). Despite the recognized health risks, the adoption of PPE has remained limited due to factors such as cost, discomfort, lack of awareness, and cultural misconceptions (Okoffo, Mensah, & Fosu-Mensah, 2016).

PPE, which includes items like long-sleeved clothing, gloves, goggles, hard hats, and boots, is critical for minimizing farmers' exposure to agrochemical hazards. The proper use of PPE can prevent direct contact with harmful chemicals through oral, dermal, or inhalation exposure (Yarpuz-Bozdogan, 2018). Besides, education and training on the use of PPE have been identified as essential strategies for reducing the health risks associated with agrochemical use. However, non-compliance with PPE guidelines often results in injuries, illnesses, or even fatalities among farmers (James, Ogle-Mustafa, & Chichester, 2023).

It is against this background, that this paper, examines the various challenges preventing the use of PPE by farmers, such as poor access to information, limited financial resources, ignorance and poor perception of PPE, absence of government regulatory policy, among others, and the implications for farmers, especially, their health status with a view to providing policy recommendations; as these challenges remain crucial to safeguarding the physical, mental, and social well-being of farmers, and ensuring sustainable agricultural practices among farmers in Nigeria. Secondary data such as academic journals, periodicals and policy briefs were sourced and reviewed for this study.

Clarification of Concepts:

Agrochemicals

Agrochemicals are substances used in agriculture to control harmful agents such as insects and weeds and to improve crop and livestock productivity. According to Omari (2014), agrochemicals are chemically synthesized compounds designed to enhance agricultural productivity by controlling pests, diseases, and other detrimental factors. Common examples include herbicides, insecticides, and fungicides, which are primarily utilized to increase yields by minimizing crop losses during both the pre-harvest and post-harvest stages.

Agrochemicals can be classified into agents that destroy, repel, or mitigate pests, each having unique modes of action. Their use contributes to increased productivity, helping to meet global food demand and lowering food prices. Agrochemicals also ensure that agricultural

goods are free from pest contamination, which is essential for consumer safety. However, the use of agrochemicals requires specialized skills to handle the diverse range of chemical products safely. Despite their benefits, agrochemicals still pose significant health risks.

Personal Protective Equipment (PPE)

Afrad et al. (2020) define PPE as any equipment or clothing worn to protect individuals from health hazards. PPE serves to protect the body and reduce the severity of injuries during hazardous agricultural tasks, particularly those involving pesticides. Examples of PPE include hand gloves, hard hats, chemically resistant boots, safety goggles, face shields, respirators, and long-sleeved clothing. These items are designed to address specific risks: for instance, gloves and long-sleeved shirts prevent dermal exposure to agrochemicals, while respirators protect the lungs from inhaling toxic fumes. However, it is important to note that PPE does not eliminate hazards; it only reduces the risks associated with exposure to harmful substances.

Theoretical Framework:

The Fundamental Cause Theory which guides this study is rooted in the Marxist/Conflict Theory, which examines structural inequalities that favour the bourgeoisie against the proletariat. These inequalities are evident in resource distribution, which impacts access to health and safety measures, particularly for underprivileged groups. Bruce G. Link and Jo Phelan formally developed the theory in 1995, emphasizing the persistent relationship between socioeconomic status (SES) and health outcomes. They posit that SES acts as a “fundamental cause of disease” by influencing access to essential resources such as wealth, knowledge, skills, power, and social connections. These resources enable individuals to avoid disease and its consequences, while addressing multiple risk factors that vary over time (Link & Phelan, 1995). For instance, individuals with higher SES are better equipped to access protective measures and adopt healthy behaviours, resulting in persistent health disparities across different contexts and eras.

The theory rests on several assumptions. First, it argues that inadequate social factors, particularly SES, serve as fundamental causes of disease due to their role in providing access to critical resources. These resources are transportable across contexts, allowing individuals with higher SES to adapt more effectively to changing health risks. Second, SES influences multiple risk factors and disease outcomes, highlighting the persistent nature of health inequalities. Third, the theory asserts that preventable diseases are more strongly associated

with SES since individuals with greater resources can proactively safeguard their health. These assumptions underscore the systemic nature of health disparities, illustrating how individuals with lower SES face heightened risks and poorer health outcomes due to limited access to vital resources and preventive measures (Phelan et al., 2004).

The Fundamental Cause Theory has practical applications in understanding health disparities and designing interventions to address them. It highlights how SES influences the health challenges faced by specific groups, such as farmers. For example, Small and Medium Scale farmers often lack access to personal protective equipment (PPE) and adequate knowledge about agrochemical hazards, resulting in greater exposure to health risks. The theory underscores the need for systemic interventions, such as education programs and subsidized safety tools, to reduce these disparities. Moreover, it informs public health strategies that target preventable diseases by addressing the social determinants of health and ensuring equitable resource distribution (Clouston & Link, 2021).

A key strength of the Fundamental Cause Theory is its comprehensive framework, which links structural inequalities to health outcomes. By focusing on SES, the theory remains relevant to evolving health risks and provides actionable insights for reducing disparities. It also emphasizes prevention by addressing preventable diseases through improved access to resources. However, the theory is not without its limitations. Critics argue that it narrowly focuses on SES, overlooking individual-level factors such as cognitive abilities and behaviours. For instance, Gottfredson (2004) suggested that the theory should expand to include individual cognitive capabilities, which play a significant role in health decision-making. Additionally, Riley (2020) has critiqued the theory for assuming that health inequalities stem solely from social stratification, neglecting other determinants such as biological or environmental factors. Despite its limitations, the Fundamental Cause Theory provides a valuable lens for analysing the health challenges faced by SMS farmers. It explains how SES shapes access to resources, protective measures, and knowledge, thereby influencing their health outcomes. The theory also sheds light on the mechanisms through which improved SES—such as through subsidies or training programs—can mitigate health risks by addressing systemic barriers.

Discussion

The Rationale behind the Use of Personal Protective Equipment among Farmers in Nigeria

Joshua (2016) has noted that elemental sulphur dusting, one of the earliest known pesticides, was used in ancient Mesopotamia approximately 4,500 years ago. By the 15th century, toxic chemicals such as arsenic, mercury, and lead were applied to crops to kill pests. The 17th century saw the development of nicotine sulphate from tobacco leaves as an insecticide. In the 19th century, natural pesticides like pyrethrum, derived from chrysanthemums, and rotenone, sourced from tropical plants, became widely known. Hence, the importance of recognizing and adhering to PPE requirements, as outlined on pesticide labels, cannot be overstated. These labels, for example, serve as crucial guides, detailing necessary safety precautions. As such, farmers' literacy and positive attitudes toward understanding and following these instructions are vital for ensuring compliance.

Jallow et al. (2017), emphasize that the use of PPE and adherence to safe practices depend on various factors, including farmers' knowledge of pesticide hazards, their understanding of equipment usage, and their beliefs about the risks of pesticide exposure. Similarly, Hashemi et al. (2012) identify perceived risks and social factors as significant barriers to the adoption of PPE, while Sharifzadeh et al. (2017) highlights the low levels of PPE knowledge and compliance in underdeveloped countries. The lack of awareness often leads to unsafe handling practices, increasing the likelihood of exposure to pesticide hazards.

However, according to the Food and Agriculture Organization (2022), farmers are often resource-poor and reliant on underdeveloped technologies, which perpetuate the cycle of poverty. Similarly, the World Bank (2016) highlights that, farmers in sub-Saharan Africa, including Nigeria, lack access to modern agricultural tools and techniques, which has continued to increase their vulnerability to various risks, including health hazards.

Besides, the health implications of agrochemicals exposure, according to Al-Dawood et al (2023), include severe headaches, dizziness, skin and eye irritation, coughing and rhinitis. Similarly, Kousse et al (2023) reports leukaemia and brain tumours as the effects of the exposure of agrochemicals. Besides risks are found to affects thyroid dysfunction among the young age children because synthesis altered the metabolism of thyroid hormone (Ibhazehiebo&Koibuchi, 2014); (Marwanto, Setiani&Suhartono , 2018). Thus, good health of farmers, aid economy growth and enhance quality life; however, poor health status of

farmers, and their vulnerability to health challenges, deter livelihood and the general health status of the society at large.

Similarly, unprotected use of chemicals pose severe threats to human health and the environment, making it a critical public health concern, thus Personal Protective Equipment (PPE) has remained an essential tool in mitigating these risks by reducing the harmful effects of agrochemical exposure through the adoption of protective behaviours. According to Carpenter et al. (2002), PPE is specifically designed to reduce the risks associated with hazardous farming activities. Consequently, the question that comes to mind is: what are the challenges in the effective use of PPE, despite all the effort and strategies to avert the various health hazards and encourage farmers to use PPE in Nigeria?

Challenges to the Effective use of Personal Protective Equipment among Farmers in Nigeria

Despite the various efforts made on the safe use of agrochemicals, and crucial guides detailing reasons for the use, and necessary precautions and preventive measures to adopt against exposure to agrochemicals, the use of Personal Protective Equipment (PPE) has not been effective. Below are some of the factors that have been found to pose challenges to the effective use of Personal Protective Equipment (PPE) among farmers in Nigeria.

Level of Poverty among Farmers in Rural Communities in Nigeria

Nigeria's agricultural sector is heavily influenced by socio-economic factors that shape farmers' access to essential resources and safety measures. Poverty, which has affected approximately 63 percent of the Nigerian population (National Bureau of Statistics [NBS], 2022), contributes significantly to the difficulties faced by SMS farmers. The World Bank (2014) further emphasizes that poverty is directly linked to the country's inability to unlock the full potential of its agricultural sector. This situation is compounded by economic policies such as the removal of petroleum subsidies and the unification of the naira, which have further pushed millions of Nigerians into extreme poverty (Iroayan, 2024). Poverty and low socio-economic status (SES) have far-reaching implications, especially for farmers' health and safety.

Research by Javeria et al. (2023) and O'Donnell (2020) suggest that individuals with low SES face poorer health outcomes, as they have limited access to health services and are less able to afford protective measures, such as personal protective equipment (PPE). In

agricultural settings, the use of agrochemicals to control pests and weeds poses significant health risks. However, the ability of farmers to protect themselves through the proper use of PPE is often hindered by their low SES. Those with higher SES, on the other hand, are better positioned to access health services and preventive measures, reducing their exposure to health risks associated with agrochemical use (Darin-Mattson, Fors & Kareholt, 2017).

Poor Access to Information on Effective use of Personal Protective Equipment among Rural Farmers in Nigeria

Access to information is another critical factor influencing farmers' adoption of safety measures. As such; Modirwa (2019) argues that empowering farmers through adequate information can significantly enhance their productivity and health outcomes. Unfortunately, SMS farmers in Nigeria often face barriers to accessing information due to their limited SES. Many instructional materials on agrochemical use, including safety measures, are often in English and are not easily accessible to farmers with low level of education (Modirwa, 2019).

Furthermore, the channels through which farmers receive information—such as media outlets—tend to favour those with higher SES, leaving SMS farmers at a disadvantage. This information gap exacerbates the challenges SMS farmers face in understanding the health risks associated with agrochemicals and the importance of using PPE. Without proper knowledge, farmers are less likely to invest in PPE, even though these measures are essential for their protection against health hazards. According to Phelan, Link, and Tehranifar (2010), individuals with lower social status are more vulnerable to health challenges because they lack the resources to afford protective measures, including PPE.

Poverty among Farmers in Rural Communities in Nigeria

A financial constraint is another significant challenge for SMS farmers when it comes to adopting health and safety measures. Many SMS farmers struggle with limited financial resources, which have restricted their ability to invest in PPE, training, and other safety measures (Brown & Garcia, 2021). This is particularly problematic in the agricultural sector, where farmers often operate with tight budgets and must prioritize immediate operational needs over long-term safety investments. Brown and Garcia (2021) explore how perceived high costs associated with safety measures discourage SMS farmers from adopting PPE. The initial investment in safety equipment, along with ongoing costs for maintenance and training, can be seen as prohibitive, especially for small-scale farmers who operate on narrow profit margins. Consequently, many farmers may prioritize short-term cost savings over the

long-term benefits of safety measures, which can increase their vulnerability to health hazards.

Absence of Government Regulatory Frameworks

Regulatory challenges also hinder the effective use of PPE among SMS farmers. Williams and Jones (2019), highlight how ambiguous regulatory frameworks and complex compliance requirements create significant barriers for SMEs in the agricultural sector. In Nigeria, many SMS farmers struggle to navigate the complex regulations surrounding agrochemical use, including safety protocols and PPE requirements. The lack of clear and consistent guidelines on agrochemical handling and the storage of PPE have contributed to non-compliance with safety standards. Furthermore, weak enforcement of regulatory standards has exacerbated the problem. Inadequate penalties for non-compliance and the absence of rigorous enforcement mechanisms have also created an environment where safety measures are often viewed as optional rather than mandatory (Williams & Jones, 2019). The regulatory leniency, in fact, has lead SMS farmers to neglect the use of PPE has further jeopardized their health and safety.

Ignorance and misperception of Agrochemical and use of PPE among Farmers in Nigeria

In addition to financial and regulatory barriers, psychological factors also play a role in SMS farmers' willingness to adopt safety measures. Miller and Clark (2017) examine psychological barriers such as complacency, risk perception, and lack of safety awareness, which hinder adherence to safety protocols in agrochemical handling. Farmers who perceive agrochemicals as less hazardous may be less likely to use PPE, while those who are complacent due to long-term exposure to agrochemicals may become desensitized to the risks. Moreover, a lack of safety awareness is a significant psychological barrier. Many farmers have limited knowledge of the potential health risks associated with agrochemical exposure and may not fully understand the importance of PPE. However, Miller and Clark (2017) suggest that addressing these psychological barriers requires ongoing education and training, as well as a cultural shift toward prioritizing safety over productivity.

Implications of the Challenges in the Effective use of Personal Protective Equipment for Farmers in Nigeria

The implications of the challenges regarding the effective use of Personal Protective Equipment (PPE) by famers, from all indications, strongly revolve around internal health issues among famers, and public health challenges for the society at large. As these

challenges persist, farmer's health will continue to worsen. The employment of Personal Protective Equipment (PPE) to reduce the broad health hazards of agricultural pesticide exposure will continue to remain a priority for famers in Nigeria.

Thus PPE has become a significant safety shield that has helped farmers avoid health hazard risks associated with the use of agrochemicals (Sooktanlou&Allayari, 2021). For example, Ekmekci and Yaman (2024) posit that farming is a highly risky occupational that exposes individuals to a number of work related accident and health issues yearly. The implication of this is that, potential farmers may not want to venture into agricultural practices as a result of the potential health hazards of agrochemicals to famers.

Another implication is economic leakage. The increasing level of body infections and hard earned income of farmers will be used in treating infections/diseases that would have been avoided by taking precautionary measures such as the use PPE by famers. This is why Yarpuz-Bozdogan (2018), reports that there is a high increase in the trend of pesticides exposure infection among the farm-workers due to lack of safety behavior, especially the non- compliance to PPE. As such, Joko et al. (2020) attributes lack of awareness and improper perception of the influence of the safety behavior among farmers; while Ali et al. (2020) have added that unintended application error and low quality use among farmers have been responsible for the health hazards of agrochemicals. Fizulmi and Agustina (2024), suggest that nose mark must be changed in every 8 hours, because if worn for long, the filtered particles will accumulates on the nose mask and consequently prevent a optimal functioning of human body system, but because of poor sanitation system farmers have adopted has also contributed to the health hazard associated with the use of agrochemicals.

Another implication is that there will be low productivity as a result of high morbidity and mortality rates among famers, when a significant number of farmers are continually exposed to agrochemical exposure. This why the International Labor Organization(ILO) (2013) as cited in Fitzulmi and Agustina (2024) reports that annually 25 million farm-workers experience pesticides poisoning, resulting in 180,000 deaths in the rural area in developing countries.

Another implication is that, farmers are continually experience external and internal body damage insidiously, as such, Raini (2007), notes that, pesticides enter the human body in several ways, namely, through the skin, breathing, or mouth. Pesticides that enter through the mouth and eyes will be absorbed immediately and continue as long as the pesticides are still

on the skin. Absorption speed varies by body part and the level of toxicity of the agrochemicals. The transfer of pesticide residues from one part of the body to another is effortless. Besides, residues can move from the hands to the sweaty forehead or genital area. In this part, the absorption rate of deposition is very high; and oral exposure as well can result in severe or even death, if pesticides are ingested. Also, in a study conducted by Amilia, Joy and Sunardi (2016), they reported that 75 percent of farmers in Parongpong District, West Bandung, in Indonesia have health problems such as nausea, vomiting, dizziness, and itching on the skin. Ramadhaningtiyas, Dewi and Sugihardjo (2021) have also reported that farmers have a serious potential danger to exposure and poisoning of pesticides due to non-application of occupational health safety (PPE) which its usage is still low.

Another implication is that farmers are continually plagued by terminal and degenerative diseases, given the prolonged exposure to agrochemicals. In this regard, Baldi et al. (2013) and Laurent et al. (2016), report that there is a linkage between chronic illness and exposure of agriculture pesticides such as several neurological illnesses and some cancers, Parkinson's disease, prostate cancer, malignant non-Hodgkin lymphoma, including multiple myeloma; while Ramadhaningtiyas et al (2021), have added that farmers who do not use PPE when spraying pesticides often experience serious health complaints such as poisoning.

Conclusion

Factors responsible for the inability to recognise and imbibe safety measures by farmers in Nigeria, regarding the use of Personal Protective Equipment (PPE) are multifaceted. The failure or inability stems from socio-economic, financial, regulatory, and psychological factors that hinder the adoption of safety measures. Poverty, limited access to information, financial constraints, ambiguous regulations, and psychological barriers such as lack of awareness or perceived negligence contribute significantly to the underutilization of PPE. Consequently, these issues not only compromise the health and safety of farmers, but also undermine the overall productivity and sustainability of farmers. The paper concludes that, there is a critical need for a healthy and safe working environment for farm workers, to enhance their performance and contribute to farmers' livelihood and effectively enhance economic development of the society at large. This is because without proper attention to health and safety, the goals of sustainable development may become difficult to realize. As such, it is imperative to timely address the underlying causes of the challenges in order to foster a culture of safety and improve the occupational conditions of farmers in Nigeria.

Recommendations

To overcome the obstacles identified in this study, the following policy recommendations are proposed:

- i. There is an urgent need for relevant government agencies to educate farmers about the risks associated with their occupation. Awareness campaigns should focus on the dangers of neglecting PPE use and the long-term benefits of adopting safety practices. Efforts should also be made to highlight the benefits of safe work practices, which will not only reduce the incidence of farm accidents, but also improve overall productivity. This is because, demonstrating how effective safety measures are, can enhance the work environment and encourage more widespread adoption and usage of PPE among farmers.
- ii. A strong emphasis should be placed on the development of risk evaluation and prevention strategies, while farmers should be encouraged to conduct regular risk assessments and implement safety protocols to minimize hazards and ensure their well-being.
- iii. A robust regulatory framework that prioritizes occupational health and safety should be developed. Such a framework would provide guidelines for safety, thus making the integration of safety practices into daily operations more seamless and effective.
- iv. Financial and technical assistance should be provided to SMS farmers to help them acquire PPE and embrace safety measures. This support could come in the form of subsidies, low-interest loans, or partnerships with safety equipment providers.

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