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Improving personal protective equipment awareness among rural farmers in Indonesia: An evaluation of community-based education in Kampung Beru Hamlet

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ABSTRACT

Despite growing concerns over occupational health, the improper use of personal protective equipment (PPE) among pesticide-exposed farmers remains a critical challenge, particularly in rural areas. Previous interventions often lacked sustained impact and contextual engagement. This study aimed to evaluate the effectiveness of an educational program designed to improve PPE awareness and use among farmers in Dusun Kampung Beru, Indonesia. Using a quantitative approach with the Asset-Based Community Development (ABCD) method, eleven local farmers participated in a structured intervention involving a pre-test, a post-test I during the second community-based learning session (PBL II), and a post-test II during PBL III conducted six months later. The findings revealed a significant increase in farmers' knowledge, with the median score improving from 90 (pre-test) to 100 (post-test I), maintaining the same level in post-test II. The proportion of participants categorized as having adequate knowledge rose from 27.3% to 63.6% and further to 80% over the evaluation period. However, challenges in PPE usage persisted due to discomfort and equipment quality. The study highlights that while community-based educational programs can effectively enhance awareness, their long-term success depends on continued support, including the provision of comfortable PPE, local leadership involvement, and culturally sensitive strategies. This intervention model has implications for public health efforts in similar rural settings.

ABSTRAK

Meskipun ada kekhawatiran yang meningkat terhadap kesehatan kerja, penggunaan alat pelindung diri (APD) yang tidak tepat di kalangan petani yang terpapar pestisida masih menjadi tantangan yang sangat penting, terutama di daerah pedesaan. Intervensi yang telah dilakukan sebelumnya sering kali tidak memiliki dampak yang berkelanjutan dan keterlibatan yang kontekstual. Penelitian ini bertujuan untuk mengevaluasi efektivitas program edukasi yang dirancang untuk meningkatkan kesadaran dan penggunaan APD di kalangan petani di Dusun Kampung Beru, Indonesia. Dengan menggunakan pendekatan kuantitatif dengan metode Asset-Based Community Development (ABCD), sebelas petani lokal berpartisipasi dalam intervensi terstruktur yang melibatkan pre-test, post-test I selama sesi pembelajaran berbasis masyarakat kedua (PBL II), dan post-test II selama PBL III yang dilakukan enam bulan kemudian. Temuan ini menunjukkan adanya peningkatan yang signifikan dalam pengetahuan petani, dengan nilai rata-rata meningkat dari 90 (pre-test) menjadi 100 (post-test I), dan mempertahankan tingkat yang sama pada post-test II. Proporsi peserta yang dikategorikan memiliki pengetahuan yang memadai meningkat dari 27,3% menjadi 63,6% dan selanjutnya menjadi 80% selama periode evaluasi. Namun, tantangan dalam penggunaan APD tetap ada karena ketidaknyamanan dan kualitas peralatan. Studi ini menyoroti bahwa meskipun program edukasi berbasis masyarakat dapat secara efektif meningkatkan kesadaran, keberhasilan jangka panjangnya bergantung pada dukungan yang berkelanjutan, termasuk penyediaan APD yang nyaman, keterlibatan kepemimpinan lokal, dan strategi yang peka terhadap budaya.

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INTRODUCTION

Pesticide exposure remains a critical occupational health issue in the agricultural sector, particularly in developing regions where protective practices are often neglected. A major contributing factor is the low utilization of personal protective equipment (PPE) among farmers during pesticide application. Fitriana et al. (2020) reported that most farmers did not wear complete PPE while spraying pesticides. Similarly, Tallo et al. (2022) found that in Rote Ndao Regency, no farmer used comprehensive protection. This situation is largely attributed to a lack of awareness and understanding about the types and benefits of PPE, which exacerbates the risk of direct exposure through skin contact, inhalation, or eye contact (Syafriani & Saputri, 2023).

Such exposure has proven detrimental to farmers' health. Indrianti (2021) demonstrated a correlation between unsafe pesticide practices and decreased blood cholinesterase levels, indicating organophosphate exposure. Kumala and Agung (2022) identified impaired liver function in pesticide-exposed farmers, marked by elevated SGPT enzyme levels. On a broader scale, Vatthanasak et al. (2024) reported that long-term pesticide exposure is associated with increased cancer risks among agricultural workers. Educational outreach is considered an effective strategy to raise farmers' occupational safety literacy. Hayat et al. (2023) highlighted a significant link between farmers' knowledge levels and compliance in PPE usage, although increased knowledge does not always lead to behavioral change, thus emphasizing the need for evaluation beyond cognitive outcomes.

The persistent gap between knowledge and safe work practices among farmers underlines a critical problem in agricultural occupational safety: while many farmers may understand the importance of PPE, consistent and proper use remains low. This inconsistency calls for not only educational interventions but also evaluative frameworks that measure both cognitive and behavioral impacts. A structured community-based approach integrating knowledge dissemination and long-term behavioral monitoring is thus needed to promote sustainable changes in PPE practices (Ramadhaningtyas et al., 2021; Yuharson et al., 2022).

Educational interventions are frequently employed to improve farmers' safety behavior. Ramadhaningtyas et al. (2021) showed that farmers with higher knowledge levels were more likely to use complete PPE compared to those with limited knowledge. However, practical gaps remain. Uly et al. (2022) observed that while many farmers in Sababangunan Village wore hats or gloves, crucial protective gear like masks and goggles were often disregarded. This partial application indicates that knowledge alone is insufficient to drive comprehensive PPE use.

Yuharson et al. (2022) reinforced these findings, noting that although many farmers possessed good knowledge about PPE, few demonstrated positive attitudes or consistent implementation. These observations suggest that behavior change requires more than information transfer; it needs culturally contextualized interventions and ongoing reinforcement mechanisms. Integrating community leaders, religious narratives, and peer influence into educational programs may provide the additional motivation required for behavior adoption and continuity.

While previous studies have established the importance of knowledge in shaping safety behaviors, few have examined the long-term retention and sustainability of these interventions, especially in remote rural contexts. The literature emphasizes immediate outcomes following training, with limited evidence on knowledge persistence over time or translation into sustained practice. There is also a paucity of research utilizing participatory, community-driven models such as Asset-Based Community Development (ABCD) to leverage local strengths in improving occupational safety.

In response, this study evaluates the educational program on PPE use implemented in Dusun Kampung Beru, conducted as part of the Community-Based Learning Experience (PBL) by public health students. By using pre- and post-test evaluations over a six-month period, the study aims to assess the program's impact on farmers' knowledge and attitudes toward PPE. The findings are expected to inform the development of more contextual and sustainable occupational health interventions in similar rural agricultural comm

METHODS

This study employed a quantitative research design using the Asset-Based Community Development (ABCD) approach to evaluate the impact of an educational intervention on farmers' knowledge of personal protective equipment (PPE) usage during pesticide application. The intervention was implemented in Dusun Kampung Beru, located in Bontomanai Village, Rumbia Subdistrict, a rural agricultural area characterized by limited access to occupational health services.

The study was conducted over two phases of the Community-Based Learning Experience (PBL), involving a six-month interval between initial and follow-up evaluations. The target population consisted of local farmers engaged in pesticide-based agriculture. A purposive sampling technique was applied, selecting 11 farmers who met the inclusion criteria: active involvement in pesticide application, willingness to participate in the educational program, and availability for follow-up assessment. Exclusion criteria included non-agricultural workers and individuals unable to participate in all stages of the program.

The intervention utilized local assets to enhance engagement and relevance. Community resources such as the village head, religious leaders, and farmer groups were actively involved in planning and implementing the educational sessions. The content was delivered through interactive lectures, PPE usage demonstrations, group discussions, and supporting media including leaflets and strategically placed visual boards.

Data collection occurred in three stages: a pre-test and post-test I during PBL II to assess immediate knowledge change, and a post-test II during PBL III to evaluate medium-term knowledge retention (See Figure 1). All measurements used a closed-ended questionnaire with consistent indicators across the three time points. To analyze differences in knowledge scores over time, the Friedman Test was employed using IBM SPSS Statistics version 23.

All participants were informed about the study objectives and procedures and provided written informed consent. Ethical considerations were upheld throughout the study, including confidentiality, voluntary participation, and the right to withdraw without consequence.

Figure 1
Process of evaluating the complete PPE education program

RESULTS AND DISCUSSION

The extension program on the use of complete Personal Protective Equipment (PPE) implemented in Kampung Beru Hamlet showed positive results in increasing farmers' knowledge and awareness of the use of PPE. Table 1 illustrates that before the counseling, the majority of farmers (72.7%) had a low level of knowledge, with only 27.3% having sufficient knowledge. After counseling, there was a significant increase. The pre-test median score was 90 with a score range of 60 to 100. After counseling (post-test I), the median value increased to 100 with a score range of 90 to 100, and the value remained at post-test II with the median remaining 100. Friedman test results showed a p value = 0.003, indicating a significant difference between pre-test, post-test I, and post-test II.

This increase indicates that the extension method used is effective in increasing farmers' knowledge about the use of PPE. This is consistent with research by Eliyana et al. (2024), which showed that interactive extension methods can increase the knowledge of participants. This extension includes lectures, demonstrations, and interactive discussions that provide practical understanding to farmers.

Table 1
Statistical Test Results of Pre-Test, Post-Test I, and Post-Test II Complete PPE Usage

Knowledge Score	Total	Min.	Max.	Median±Range	P-Value
Pretest	11	60	100	90.00+40	
Post test I	11	90	100	100.00+10	0.003
Post test II	11	90	100	100.00+10	

Table 2 shows that before counseling, most farmers were in the poor knowledge category. But after counseling, the majority reached the sufficient category, even increasing to 80% in post-test II. This is in line with the research of Fajriani et al. (2019), which stated that health education was able to improve participants' knowledge.

Despite the increase in knowledge, the program evaluation showed that some barriers to PPE implementation remained. The main barrier identified was the discomfort in using PPE. Some farmers complained of feeling hot when using PPE, especially in tropical weather conditions. This barrier is consistent with the findings of Gustina et al. (2019) who mentioned that comfort is one of the main factors in compliance with PPE use. In addition, the quality of available PPE is also an obstacle. Some farmers complained that PPE was quickly damaged or not durable. This is in line with the findings of Widianingsih et al. (2020) who noted that the durability and comfort of PPE are important factors in its successful use. To overcome this obstacle, it is necessary to provide PPE that is more comfortable and suitable for the tropical climate.

Social support from community leaders such as the dusun head and mosque imam is a contributing factor to the success of the extension program. This support not only increases farmers' participation in extension, but also motivates them to apply PPE. This is in line with the findings of Rasjid et al. (2019), which showed that social support from community leaders can increase farmers' compliance. Religious-based approaches have also proven effective. Religious values such as maintaining health as part of worship help strengthen farmers' motivation to use PPE. This is supported by Syafriani & Saputri's (2023) findings that a religious approach can improve participants' compliance with safety protocols. Extension materials delivered in simple language and linked to religious values are more easily understood and accepted by farmers.

In addition, the use of educational media such as leaflets and talking boards helped improve farmers' understanding. These media provided visual reinforcement of the material presented. Istriningsih et al. (2022) stated that visual media helps improve the memory and understanding of extension participants.

To ensure the sustainability of this PPE education program, several strategies need to be implemented. First, the provision of more comfortable and tropical-appropriate PPE, either through government subsidies or partnerships with farmer cooperatives. Secondly, regular supervision from agricultural extension officers and community leaders, who can help ensure farmers continue to use PPE consistently. Edigan (2019) noted that regular supervision and mentoring can improve compliance with PPE use. Third, the integration of religious values in education, such as conveying the importance of maintaining health as part of worship. This approach is effective in motivating farmers to use PPE as a form of responsibility to themselves and their families. Tallo et al. (2022) noted that community-based and religious approaches can increase participants' compliance. Finally, support from the government and related institutions can play an active role in providing quality PPE at affordable prices. Continuing education also needs to be conducted periodically to ensure that the knowledge provided can be implemented sustainably.

Table 2
Respondents' Level of Knowledge about the Use of Complete PPE

Knowledge	Pre-Test		Post-Test I		Post-Test II	
	N	%	N	%	N	%
Simply	3	27.3	7	63.6	8	80
Less	8	72.7	4	36.4	2	20

CONCLUSION

The educational program on the use of personal protective equipment (PPE) implemented in Dusun Kampung Beru demonstrated a significant impact in enhancing farmers' knowledge and awareness regarding occupational safety during pesticide application. The evaluation showed a substantial improvement in knowledge scores, with the median rising from 90 (pre-test) to 100 (post-test I), which was sustained in post-test II conducted six months later. The proportion of farmers with adequate knowledge increased markedly from 27.3% to 80% across the evaluation period. These findings affirm the effectiveness of interactive educational methods—such as lectures, demonstrations, and group discussions—in conveying essential safety information.

However, despite improved knowledge, persistent barriers to consistent PPE usage remain, particularly due to discomfort and substandard quality of available PPE. This underscores a critical insight: knowledge acquisition alone is insufficient to drive behavioral change. Therefore, long-term success requires an integrated strategy that addresses both informational and practical dimensions. Sustainable approaches should include the provision of more comfortable and affordable PPE, regular supervision by health educators, and the reinforcement of motivation through religious and community leader involvement.

To ensure program continuity, village-level governance structures must be actively involved in distributing quality PPE and facilitating regular occupational health education. Future initiatives should further explore socio-cultural mechanisms to promote behavioral adherence and evaluate the long-term health outcomes of improved PPE compliance. This study contributes to the growing body of evidence supporting community-based interventions for occupational safety in rural agricultural contexts.

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