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Factors associated with protective eyewear use among cocoa farmers in Ghana

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ABSTRACT

To determine the factors that are associated with the use of protective eyewear (PEW) among cocoa farmers in Ghana, a multistage random sample of 556 cocoa farmers were recruited from four districts in the country. A questionnaire was used to elicit information on the use of PEW and barriers to its use among these farmers. Only 34 (6.1%) participants reported using PEW. Being female, old age and perception of good distance vision was associated with lower odds of PEW use. However, higher educational attainment, application of fertiliser and pesticides were associated with higher odds of PEW use. Participants cited non-availability, unaffordability and ignorance/lack of training as the main barriers to the use of PEW. The low use of PEW could be addressed through ocular health education and occupational health and safety policy initiatives.

INTRODUCTION

The importance of regular use of protective eyewear (PEW) to prevent eye injuries among agricultural workers has been highlighted by several authors.[1 2] In spite of this, eye injuries still occur among this group because they do not wear eye protection or they wear the wrong kind of eye protection.[3] For example, a study of ocular injuries reported to the hospital in the Upper East Region of Ghana revealed that 19.6% were agriculture-related.[4] These injuries are mainly penetrating or open wound caused by branches or foreign bodies and blunt injuries from objects hitting the eye.

Farming activities such as spraying of chemicals, cutting, weeding and harvesting have the potential to cause ocular injuries. PEW such as goggles and safety glasses are therefore recommended when performing such activities.[5 6] These simple interventions needed to prevent ocular injuries can be very cost effective and significantly change the person's quality of life and economic opportunities. They can easily prevent ocular injuries and therefore minimise the risk of visual impairment and blindness. However, many farmers, especially in developing countries, including Ghana, report infrequent use of PEW,[3 7] and common reasons cited for this include PEW interfering with work, discomfort, poor cosmesis, economic, misconception, ignorance of PEW, poor compliance to safety policies, and low education and training.[3 5 7]

Cocoa is Ghana's most important cash crop, employing >800 000 small households and contributing greatly to the national economy.[8] In producing this crop, farmers are exposed to numerous ocular hazards from their work activities, as well as those from farm tools, ultraviolet radiations, airborne soil and particulates, dust, pollen, plant components, all of which may lead to eye injuries.[9]

Despite the fact that ocular injuries are common among cocoa farmers in Ghana,[9] attributes associated with the use of PEW among this group are not well documented. Compounding this is the lack of occupational and safety policy that seeks to enforce the use of PEW among these workers that limits interventional planning.[10] Understanding use of PEW and addressing the barriers to their use is important for preventing ocular injuries in this population. This study therefore set out to investigate the factors associated with the use of PEW and the barriers to their use among cocoa farmers in Ghana.

METHODS

Ghana had a population of approximately 24.6 million in 2010,[11] and cocoa production is focused nearly exclusively on the forest agro-ecological zones of six regions.[12] A cross-sectional survey was conducted among cocoa farmers selected from four cocoa-growing districts in Ghana, namely Juaboso (Western), Kwahu West (Eastern), Atwima Mponua (Ashanti) and Assin North (Central) selected from these regions.[13] A simple random sampling through a multistage approach to reduce the likelihood of selection bias was used in this study. Following the selection of the districts, cocoa marketing companies that purchase cocoa beans directly from the farmers within these districts were contacted. These companies have organised cocoa farmers into societies for easy purchases and access when distributing farm implements and information dissemination. A list of cocoa farmers' societies in the districts was obtained, these being complied on the locations of villages. Similarly, using simple random sampling (ballots), five villages were selected from each participating district. With the assistance of societal heads and chief cocoa farmers in the selected villages, a compilation of all cocoa farmers in the villages was made to constitute a sampling frame out of which participants of the study were randomly selected.[13 14] A proportion of the sample size was assigned to each village based on the population size of the settlement to give equal weighting.[13 14] As a result, an average of 25 participants was selected from each of the five villages in each district to constitute the study sample.

The sample size for the study was determined by using the formula, $n=Z^2(1-\alpha/_2)\ pq/d^2$, where $Z=1.96$ at 95% confidence, $\alpha=0.05$, p=prevalence of ocular injury, $q=1-p$, d=absolute allowable error, assumed to be 10% (ie, $p=0.1$ and $q=0.9$, a precision (d) of ±3% and design effect of 1.5.

Based on these, a sample size of 576 cocoa farmers were required.[15] Farmers, 18 years and older, engaged in production activities on the farm for a minimum period of 3 years (average gestation period for a cocoa tree) and who worked only on a cocoa farm were included in the study. Face-to-face interviews were conducted with participants using a structured questionnaire. Three interviewers who were university graduates with relevant experiences in data collection and who underwent a training session for 2 days were involved in the data collection while certified optometrists were involved in taking visual parameters such as visual acuity. A questionnaire (see online supplementary appendix 1) on the demography of the farmers, use of PEW and barriers to its use was used for data collection. Other variables collected included both the distance and near visual acuity using the distance and near logarithm of the minimum angle of resolution (logMAR) charts. Participants who reported use of PEW provided them for confirmation. The design of the questionnaire was based on the review of relevant literature.[5 7 16]

The questionnaire was pilot tested and retested after 4 weeks among 30 farmers who were not part of the study population before the data collection process. A correlation of 0.76 was obtained between the pilot and the retest. The main objective of the pilot study was to determine whether there were any items in the questionnaire that the participants had difficulty understanding or answering, and also to check the reliability, validity and the objectivity of the questionnaire. All queries from the questionnaire during the pilot study were addressed and the questionnaire adjusted accordingly before the final study was conducted. The questionnaire comprised of close ended statements.

Analysis

Data were analysed using STATA V.12 and descriptive statistics were computed for sample demographics, farm characteristics, frequencies of use and barriers to use of PEW. For categorical data, χ^2 and Fisher's exact tests were used to analyse proportions while t tests were used for continuous variables. Differences in test were considered significant if $p<0.05$. Bivariate (unadjusted) and multivariate (adjusted) logistic regression was also used to predict the odds of factors that may have influenced the use of PEW based on some defined exposure, demographics, as well as farm characteristics supported by the literature.[5 7 17]

RESULTS

In total, 556, out of the 576, who were recruited for the study, fully completed the study giving a response rate of 96.5%. The participants consisted of 359 (64.6%) males and 197 (35.4%) females, with a mean age of 54.9 (±11.2) years. Also, 142 participants (25.5%) had no formal education. Males were more likely to be educated than females ($p<0.001$). Similarly, more males were in the higher-income earning group than females ($p<0.001$). Participants were asked about mobile phone use to assess the feasibility of doing a technology-based educational campaign and 363 (65.3%) reported the use of mobile phones (table 1). Most of the participants reported being involved for a greater part of their active years in cocoa farming (23.1 ±12.5 years), with males having 24.3 (±0.7) mean years of farming and females 20.9 (±11.7) mean years ($p<0.001$). Participants reported spending an average of 33.3 (±13.4) h per week on the farm, with males spending significantly more time than females ($p<0.001$).

Table 1 Demographic characteristics of cocoa farmers

Demographic characteristics	Sex		Total	p Value
	Male n=359	Female n=197		
Age, n (%)				
<40	29 (8.1)	15 (7.6)	44 (7.9)	0.970
40–49	85 (23.7)	48 (24.4)	133 (23.9)	
50–59	115 (32.0)	66 (33.5)	181 (32.6)	
≥60	130 (36.2)	68 (34.5)	198 (35.6)	
Age/years (Mean SD)	55.2 (11.2)	54.6 (11.0)	54.9 (11.2)	0.548
Education, n (%)				
No education	69 (19.2)	73 (37.1)	142 (25.5)	<0.001
Primary	51 (14.2)	25 (12.7)	76 (13.7)	
Middle/Junior high school	210 (58.5)	91 (46.2)	301 (54.1)	
Secondary/post secondary	29 (8.1)	8 (4.1)	37 (6.7)	
Income/Gh¢, n (%)				
<5000	233 (62.1)	164 (83.3)	387 (69.6)	<0.001*
5000–9999	89 (24.8)	30 (15.2)	119 (21.4)	
10 000–14 999	28 (7.8)	2 (1.0)	30 (5.4)	
≥15 000	19 (5.29)	1 (0.5)	20 (3.6)	
Marital status, n (%)				
Never married	2 (0.6)	3 (1.5)	5 (0.9)	<0.001*
Married	265 (73.8)	93 (47.2)	358 (64.4)	
Living together	65 (18.1)	20 (10.2)	85 (15.3)	
Divorced	13 (3.6)	41 (20.8)	54 (9.7)	
Widowed	14 (3.9)	40 (20.3)	54 (9.7)	
Family size, n (%)				
>4	7 (1.95)	11 (5.6)	18 (3.2)	<0.001
4–6	113 (31.5)	79 (40.0)	192 (34.5)	
7–9	131 (36.5)	84 (42.6)	215 (38.7)	
≥10	108 (30.1)	23 (11.7)	131 (23.6)	
Family size (mean, SD)	8.3 (3.4)	6.9 (2.2)	7.8 (3.1)	<0.001
Mobile phone use n (%)				
Yes	258 (71.9)	105 (53.3)	363 (65.3)	<0.001
No	101 (28.1)	92 (46.7)	193 (34.7)	

*Fischer's exact.

PEW was defined broadly as eyewear that offered some form of ocular protection against hazards. These included safety glasses, goggles and sunglasses. Participants who reported the use of hats to reduce radiations from the sun were also captured as using PEW. The use of PEW was reported by 34 (6.1%) participants, with the main types being goggles (n=24, 70.6%) and protective glasses (n=4, 11.8%) while others reported the use of sunglasses (n=4, 11.8%) and hats (n=2, 5.9%). Protective eye wear was mainly used during chemical application (spraying) (n=31, 91.2%). However, among those who reported using PEW, 28 (82.4%) did not routinely use the devices while 6 (17.7%) used the devices every time they were engaged in spraying activities.

Bivariate logistic regression analyses indicated that sex (OR 0.10, 95% CI 0.02 to 0.44, p=0.002), age (OR 0.11, 95% CI 0.30 to 0.39, p=0.001), education (OR 6.0, 95% CI 2.03 to 11.51, p=0.008), perception of good distance vision (OR 0.69, 95% CI 0.51 to 0.94, p=0.017), fertilising (OR 4.69, 95% CI 1.41 to 15.57) and spraying of chemicals (OR 9.98, 3.47 to 28.73, p<0.001) were associated with the use of ocular protection. However, after adjusting for all other factors, only age (OR 0.22, 95% CI 0.05 to 0.94, p=0.043), education (OR 3.35, 95% CI 1.34 to 14.87, p=0.026) and spraying of chemicals (OR 5.5, 1.34 to 15.24, p=0.018) remained significantly

Table 2 Factors influencing the use of ocular protection

Factor	Bivariate regression (unadjusted) OR (95% CI)	p Value	Multivariate regression (unadjusted) OR (95% CI)	p Value
Sex				
Male†	1.00 (1.00 to 1.00)	1.00	–	–
Female	0.10 (0.02 to 0.44)	0.002*		
Age				
<40†	1.00 (1.00 to 1.00)	1.00	1.00	
40–49	0.38 (0.13 to 1.10)	0.075	0.34 (0.10 to 1.12)	0.084
50–59	0.44 (0.17 to 1.17)	0.102	0.48 (0.15 to 1.50)	0.209
≥60	0.11 (0.30 to 0.39)	0.001*	0.22 (0.05 to 0.94)	0.043*
Education				
No education†	1.00 (1.00 to 1.00)	1.00	1.00 (1.00 to 1.00)	1.00
Primary	7.83 (0.86 to 10.40)	0.068	5.39 (0.56 to 51.87)	0.145
Middle/JSS	6.0 (2.03 to 11.51)	0.008*	3.35 (1.34 to 14.87)	0.026*
Secondary/post secondary	–			
Income (Gh¢)				
<5000†	1.00 (1.00 to 1.00)	1.00		
5000–9999	1.29 (0.58 to 2.88)	0.526	–	–
10 000–14 999	1.13 (0.25 to 5.04)	0.872		
≥15 000	–	–		
Years of farming				
<20†	1.00 (1.00 to 1.00)	1.00		
20–39	1.29 (0.62 to 2.67)	0.494	–	–
≥40	0.44 (0.10 to 1.98)	0.283		
Farm size				
<5†	1.00 (1.00 to 1.00)	1.00		
5–9	2.02 (0.80 to 5.03)	0.132		
10–14	1.34 (0.41 to 4.36)	0.623	–	–
≥40	1.34 (0.43 to 4.10)	0.607		
Work hours/week				
<20†	1.00 (1.00 to 1.00)	1.00		
20–39	1.82 (0.53 to 6.30)	0.343	–	–
≥40	1.47 (0.40 to 5.42)	0.562		
Presenting DVA				
≥0.5 logMAR†	1.00 (1.00 to 1.00)	1.00	–	–
<0.5 logMAR	0.03 (0.85 to 1.33)	0.120		
Presenting NVA				
≥0.3 logMAR†	1.00 (1.00 to 1.00)	1.00	–	–
<0.3 logMAR	0.38 (0.09 to 1.61)	0.190		
Perception of DVA				
Good	0.69 (0.51 to 0.94)	0.017*	0.88 (0.60 to 1.29)	0.313
Poor†	1.00 (1.00 to 1.00)	1.00	1.00	1.00
Perception of NVA				
Good	0.76 (0.54 to 1.06)	0.107	0.88 (0.60 to 1.29)	0.507
Poor†	1.00 (1.00 to 1.00)	1.00	1.00 (1.00 to 1.00)	1.00
Weeding				
Yes	0.84 (0.11 to 6.64)	0.871	–	–
No†	1.00	1.00		
Fertilising				
Yes	4.69 (1.41 to 15.57)	0.012*	1.48 (0.39 to 5.54)	0.564
No†	1.00	1.00	1.00	1.00
Spraying				
Yes	9.98 (3.47 to 28.73)	<0.001*	5.50 (1.34 to 15.24)	0.018*
No†	1.00	1.00	1.00	1.00
Harvesting				
Yes	1.55 (0.46 to 5.20)	0.480	–	–
No†	1.00	1.00		

*Significant p-value. DVA, distance visual acuity; logMAR, logarithm of the minimum angle of resolution; NVA, near visual acuity. +, Reference point.

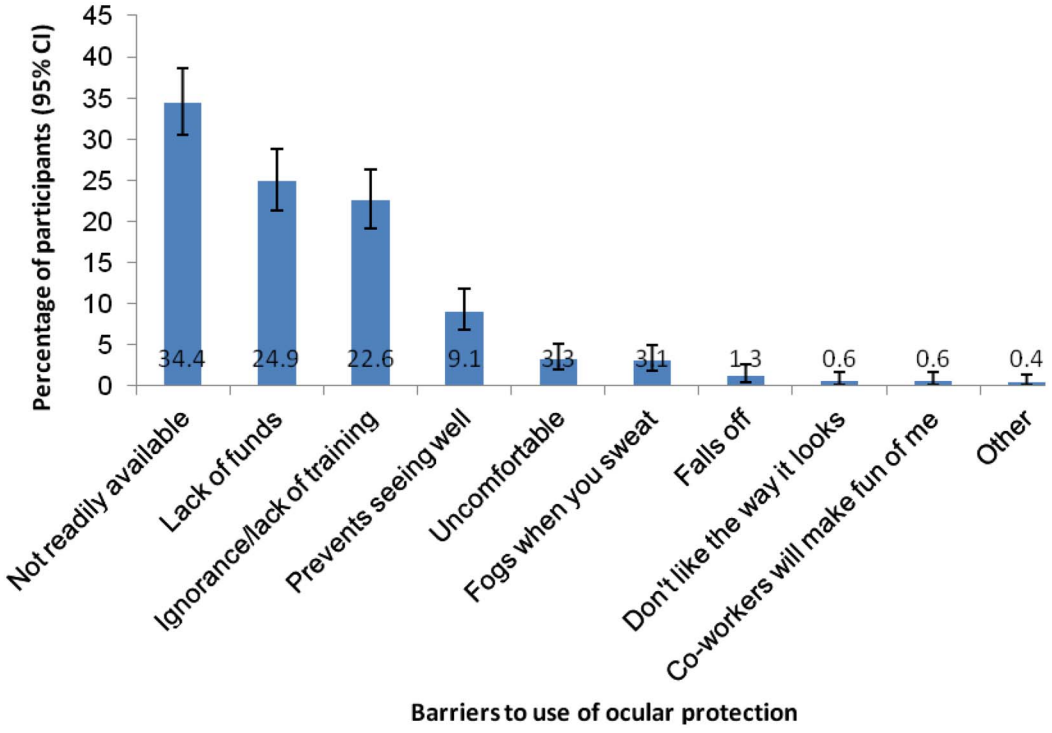

Figure 1 Barriers to use of ocular protection.

associated with the use of PEW (table 2). Thus, participants involved in chemical spraying were 5.5 times more likely to use PEW compared with those not engaged in spraying activities on cocoa farms.

Barriers to the use of PEW

Cocoa farmers reported reasons such as unavailability of the device 189 (34.4%), lack of funds 137 (24.9%) and ignorance/lack of training 124 (22.6%) for the poor use of ocular protection. Other reasons are shown in figure 1. It must be noted that each farmer reported the main reason they considered as a barrier to the use of PEW. Many participants 538 (96.8%) indicated that they would use ocular protection if it was given to them at no cost by the government and 529 (95.1%) agreed to use ocular protection if it was made mandatory by law.

DISCUSSION

This study showed that use of PEW was low among cocoa farmers in Ghana. Unavailability and unaffordability were important barriers and limit the use of PEW among cocoa farmers. There were more male cocoa farmers than females in this study. This is consistent with reports in the literature[8 13] and may be due to the fact that men are always given preference in acquiring land for cash crop farming in Ghana,[18] which is stressful and hence favours men's physical abilities.

Although the benefits of using ocular protection in agriculture are enormous and have been recommended,[5 19] few participants in this study reported its use. The low use of PEW among the study population appears to be the trend among agricultural workers in the literature, as similar findings have been reported elsewhere.[3 5 7 20 21] However, even lower prevalence figures of 2.0%, 1.6% and 0.6% were reported by Blanco-Muñoz and Lacasaña,[21] Quandt *et al*[22] and Forst *et al*,[5] respectively. The findings in this study support the conclusion that male farm workers and those with high educational attainment are more likely to use ocular protective devices as reported by other authors.[5 16] Farmers involved in applying chemicals (pesticides and fertilisers) were also more likely to use ocular protection, which may be due to their perceived hazardous and high-risk nature. However, there is the need to educate participants on other hazardous exposures that pose a risk to the eyes and require the use of PEW.

In developed economies, barriers to the use of PEW are associated with the quality of protective devices that are used by most farmers,[3 16] while in this study (developing economy), the barriers to use were related to supply, cost and poor education. This is because in most cases PEW is readily available in developed economies. However, few of the farmers cited reasons relating to quality of the product, such as fogging when one sweats and comfort, with anti-fog safety glasses being needed if this issue is to be overcome.[5]

Many farmers reported poor use of PEW. This finding reflects the need for a rigorous campaign to address the benefits of PEW in order to prevent or minimise ocular injuries. The main barriers reported by the participants are relatively easy to change. For example, unavailability of PEW can be changed by making them more easily available through key stakeholders such as optometrists, the Ghana Cocoa Board and the Ministry of Food and Agriculture.[23] Similarly, ignorance/lack of training can be changed by training farmers on the benefits and importance of PEW.[24 25] The study also highlights economic reasons as one of the leading barriers to the use of PEW. These economic reasons are related to the cost of PEW. If the cost of PEW is high, it may be unaffordable to many cocoa farmers. Provision of PEW at a low cost and affordable pricing system would address the issue of unaffordability. In addition to issues of affordability, the quality and comfort of the PEW are equally important.

The report by many farmers that they would use ocular protection if it was made mandatory underscores the need for an

occupational health policy that caters for the needs of farmers.[10] These suggestions are supported by the assertion by Calvert *et al*[26] that "combining educational interventions with financial benefits appear to increase their effectiveness in reducing injury and illness". Such a policy should include the recommendations of the International Labour Organization (ILO) Convention 184 on occupational health and safety for agricultural workers (ILO, 2001), and local policies that are expected to address their unique ocular health challenges. The overall objectives of these initiatives should focus on protecting the health of farmers, enhancing their quality of life, increasing productivity and decreasing workers' compensation claims.[27]

Limitation of the study

A possible limitation of this study is its quantitative nature and is therefore subjected to all the shortcomings of a quantitative study, such as limited in-depth understanding and investigation of the farmers' responses. Subsequent studies should consider the addition of qualitative data (ie, open-ended questions and focus group discussions) to fully understand the behaviour of farmers on the use of PEW.

CONCLUSION AND RECOMMENDATION

The results of this study show that there is poor use of PEW among cocoa farmers in Ghana. Addressing the reported barriers to the use of such devices could significantly minimise the risk of ocular injuries among cocoa farmers. This could be done through provision of the devices by the government/employers and the Ghana Cocoa Board, an ocular health education programme and policy initiatives.

What is already known on the subject

- Cocoa farmers are exposed to numerous ocular hazards.
- There is high rate of eye injury and irritation among cocoa farmers.

What this study adds

- The use of protective eyewear (PEW) is low among cocoa farmers in Ghana; however, chemical application positively influences the use of PEW among cocoa farmers.
- Barriers to the use of PEW among cocoa farmers include non-availability of devices, lack of funds and ignorance/lack of training.
- Highlights the importance of ocular health education among cocoa farmers in Ghana, and the need to enact an occupational health policy for agricultural workers.

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Contributors SBB-K developed the concept of the paper. All authors have contributed significantly to the design of the study, analysis, interpretation of the results and composing the manuscript.

Competing interests None declared.

Patient consent Obtained. The principles of privacy and confidentiality were strictly adhered to. Participants were given ocular health education and free eye examinations.

Ethics approval Ghana Health Service Ethics Committee on Research involving Human Subjects (GHS-ECRHS).

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