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ABSTRACT. Cocoa farming provides employment for over 800,000 households in rural Ghana, with the country currently touted as the second largest producer of cocoa worldwide. Agriculture is one of the riskiest occupations for the eyes due to the numerous ocular hazards on farms. The authors conducted an ocular health assessment among cocoa farmers at Mfuom, a rural community in the Central Region of Ghana, to examine the ocular health status and the ocular safety measures used by cocoa farmers. A structured questionnaire was used to evaluate demographic characteristics, ocular injuries, and utilization of eye care services and ocular protection, and a clinical examination was used to evaluate their ocular status. Cocoa farmers were at high risk for ocular injuries and farm-related vision disorders and utilized eye care services and ocular protection poorly. Ocular condition identified were mainly refractive error (28.6%), cataract (20.0%), glaucoma (11.7%), conjunctivitis (13%), pterygium (2.7%), and cornea opacity (2.2%). There is a need for the introduction of an interventional eye care program to help address the ocular health challenges identified among the farmers. This can be done through collaborative efforts by educational institutions, government, and other role players in the agricultural industry to improve the quality of life of the vulnerable cocoa farmers in rural Ghana.

KEYWORDS. Cocoa farmers, eye conditions, health-seeking behavior, ocular health, protective eye wear

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INTRODUCTION

Ocular diseases and injuries among agricultural workers have been prominently highlighted in the literature due to workers' exposure to a variety of ocular hazards such as chemicals, dust, unintentional injuries, radiations, and other agents.[1] Several conditions on the farms such as harsh working conditions and environmental exposures, coupled with the lack of use of ocular protection, predispose farm workers to eye disorders.[2–5] Airborne soil and particulates that result from farming practices create environmental conditions that pose a risk to eye health. Exposure to allergens such as pollen has the ability to cause allergic reactions or abrasions to the eyes.[6] Equally, symptoms of irritated eyes also result from exposure to pesticide and pesticide residues on crops, as well as from pesticide mixing.[3,7,8] In addition, living in housing located next to fields sprayed with pesticides provides a mechanism for continuous exposure.[9,10]

Sunlight is also considered to be a continuous risk exposure that is detrimental to eye health.[11] Farm workers spend a significant amount of time outdoors, exposing them to extreme amounts of ultraviolet light. Short-term ocular conditions as a result of exposure to intense ultraviolet light include eye irritation and photosensitivity, whereas long-term conditions include development of pterygium, cataract formation, and in some cases retinal damage.[4,12,13] In addition, farm workers may also suffer from corneal abrasions from foreign bodies as well as injuries from thorns, stalks, vines, and bushes.[3] The existence of these hazards underlines the reports that agricultural work is one of the riskiest occupations for the eyes.[1]

Despite the high risk of eye diseases and injuries that farm workers are exposed to, there is a paucity of knowledge on their ocular health status.[12] In Ghana, policies and interventions to boost cocoa production have always been in the areas of diseases and pest control, farm rehabilitation, producer price management, produce payment processes, soil fertility management, planting materials, research, and extension services.[4] Due to the invaluable role that sight plays in all activities on a farm, the visual care needs of cocoa farmers is obviously a major concern that must be attended to in Ghana. It is for these reasons that this study examined the oculovisual health status and safety precautions adopted by cocoa farmers in a rural community in Ghana. This study aimed to evaluate demographic characteristics, utilization and barriers to eye care services, as well as the ocular conditions among cocoa farmers in a rural farming community.

METHODS

The study was conducted at Mfuom, a farming community in the Twifo-Hemang Lower Denkyira District in the Central Region of Ghana. The district is one of the three main cocoa producing districts in the region.[14] In the Twifo-Hemang, Lower Denkyira District, agriculture employs more than two thirds of the work force.[14] The settlement is located about 40 km north of Cape Coast, the regional capital. The population of the town was estimated to be 2500 in 2009.[14] The town has no hospital or health clinic facility but two primary and two junior high schools. The inhabitants of the town are mainly farmers.

In a community-based cross-sectional study within the Mfuom community, a census was conducted for all cocoa farmers. A cocoa farmer, for the purpose of this study, is an individual whose major occupation is cocoa farming and/or works on a cocoa farm for a living throughout the year or for major periods of the year. Using this definition, 230 cocoa farmers were identified for the study within the community, of which 185 met the inclusion criteria (80.4% response rate). Each one of these farmers was 18 years and older and has worked on a cocoa farm for a period of not less than 3 years (the average gestation period of a cocoa tree).

Following recruitment of eligible participants and obtaining informed consent from each participant, data collection was undertaken using a structured questionnaire administered to the farmers in their local language

through interviews. Interviewers underwent a 1-day training to be familiarized with the study. The questionnaire included demographic characteristics, reports on ocular injuries and causes, use and barriers to use of ocular protection, as well as utilization of eye care services. This was followed by a comprehensive eye examination conducted by the researchers (optometrists) that included taking case history, visual acuity measurement (distance and near) with a Snellen E chart, external eye examination with penlight, internal eye examination with an ophthalmoscope, and measurement of intraocular pressure (IOP) with a hand held applanation tonometer.

The Statistical Package and Service Solutions (SPSS) version 16 (SPSS, Chicago, IL, USA) was used to analyze the data. Descriptive statistics were calculated for sample demographic characteristics, ocular injuries, use and barriers to use of ocular protection, chief complaints, visual acuity, and eye conditions. Visual acuity was classified using the International Statistical Classification of Diseases 10 (Revised 2010).[15] According to the classification, normal vision is defined as visual acuity (VA) of 6/18 (US Snellen 20/63) or better in the worse eye, visual impairment is also defined as visual acuity of <6/18 to 6/60 (US Snellen 20/63-20/200), whereas blindness is defined as visual acuity of <3/60 (US Snellen 20/400) in the better eye.[16] Refractive error was defined as the spherical equivalent value in the better eye of −1.00 D or worse or spherical equivalent value in the better eye of ≥+1.00 D or −0.50 D cylinder or worse in the better eye.[17] Presbyopia was based on functional disability from near work and confirmation upon near-vision assessment. Glaucoma was diagnosed based on intraocular pressure assessment with a hand held applanation tonometer (IOP >21 mm Hg) and a cup-to-disc ratio of greater than or equal to 0.7. Injury in this study was defined as any damage to any of the ocular tissues. All non–farm-related injuries were excluded from this study. The intensity of injury was recorded as very severe, severe**,** moderate, and not severe (using the pain scale, 1–10) as reported by the participants.

RESULTS

Demographic Characteristics of Respondents

The total number of respondents for this study was 185 cocoa farmers, out of which 125 (67.6%) were males and 60 (32.4%) were females. As shown in Table 1, the ages of respondents ranged between 19 and 70 years, with a mean age of 52.7 years ($SD = 11.7$). Only 3.8% of respondents were under 30 years (2.4% males and 6.7% females). Almost half of the population (48.6%) had only attained middle school or junior secondary/high school education and two out of every three of the respondents were married, with a mean household size of 6.7 (Table 1).

Self-reported Ocular Injury and Causes

Most of the ocular injuries reported were sustained during weeding (40.5%), whereas spraying with pesticides recorded the second highest source of injury (10.8%) (Figure 1). At least 50% of the people reporting injury on the farm graded their injury as either severe or very severe. A quarter of the eye injuries reported (25.8%) were as a result of projectiles (mainly flying stones and sand), with injuries from stick, cocoa husk, and pod accounting for the least (6.5%) number of injuries (Figure 2).

Utilization of Ocular Protection and Barriers to Its Use

As shown in Figure 3, spraying of chemicals on farms recorded the highest percentage of goggle use (25.4%), followed by fertilizing and pruning, which recorded (2.2%) and (1.6%), respectively. No farmer reported the use of safety glasses.

Several reasons were reported by the farmers for not using protective goggles. Unavailability (34.5%), lack of adequate education (23.2%), and lack of money (19.6%) were some of the reasons mentioned. Other reasons were feeling uncomfortable when using goggles and foggy vision when in use (Figure 4).

TABLE 1. Demographic Characteristics of Respondents

Characteristic	*n* (%)		
	Male (n =125)	Female (n = 60)	Total (N = 185)
Age			
<30	3 (2.4)	4 (6.7)	7 (3.8)
30–39	8 (6.4)	9 (15.0)	17 (9.2)
40–49	32 (25.6)	13 (21.7)	45 (24.3)
50–59	37 (29.6)	21 (35.0)	58 (31.4)
60–69	29 (23.2)	13 (21.7)	42 (22.7)
70–79	16 (12.8)	0 (0.0)	16 (8.6)
Level of education			
Never attended any school	13 (10.4)	13 (21.7)	26 (14.1)
Primary	16 (12.8)	12 (20.0)	28 (15.1)
Middle/JSS/JHS	62 (49.6)	28 (46.7)	90 (48.6)
Secondary/SSS/SHS/Tec/Voc	22 (17.6)	6 (10.0)	28 (15.1)
Tertiary	12 (9.6)	1 (1.7)	13 (7.0)
Marital status			
Never married	3 (2.4)	0 (0.0)	3 (1.6)
Married	79 (63.2)	34 (56.7)	113 (61.1)
Living together	24 (19.2)	5 (8.3)	29 (15.7)
Divorced	11 (8.8)	6 (10.0)	17 (9.2)
Separated	1 (0.8)	3 (5.0)	4 (2.2)
Widowed	7 (5.6)	12 (20.0)	19 (10.3)
Household size			
1–3	12 (9.6)	6 (10.0)	18 (9.7)
4–6	46 (36.8)	31 (51.7)	77 (41.6)
7–9	60 (48.0)	18 (30.0)	78 (42.2)
10+	7 (5.6)	5 (8.3)	12 (6.5)

FIGURE 1. Self-reported eye injury and associated farm activity.

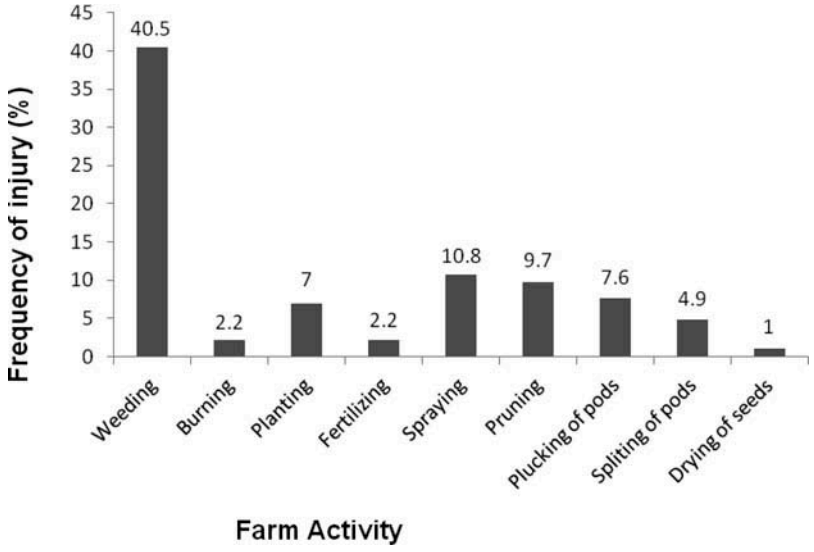


FIGURE 2. Causes of ocular injuries on the farm.

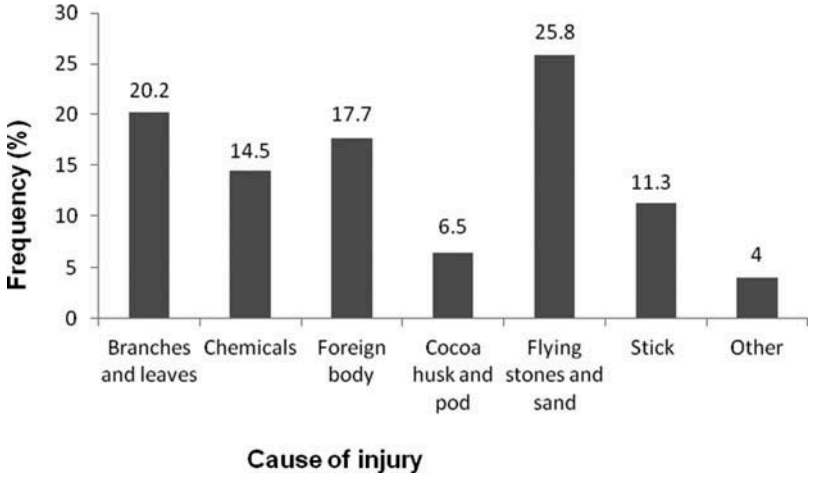


FIGURE 3. Goggle use among farmers.

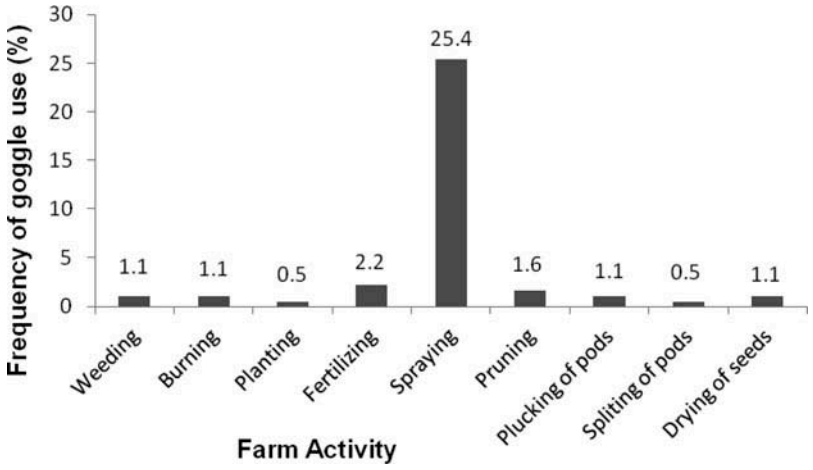
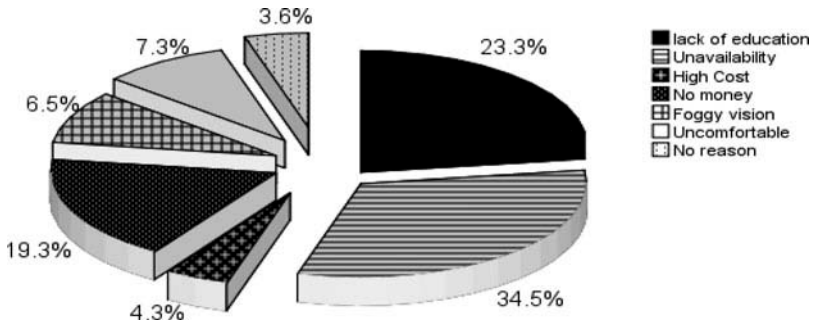


FIGURE 4. Reasons for not using goggles.



Ocular Health Status of Participants

The chief complaints of farmers were poor distance vision (37.8%) and poor near vision (22.2%). Others included itching (17.8%) and ocular pain (5.4%) (Figure 5).

A few (4.8%) of the participants reported using glasses and their visual acuity was taken with their spectacles on. Using the International Statistical Classification of Diseases (ICD), the visual acuity (Table 2) indicates that 9.7% were blind in the right eye and 10.4% blind in the left eye. Twenty-six percent were visually impaired in both eyes, with all others having normal vision. A paired *t*-test analysis (Table 2) indicated that there was no significant difference

FIGURE 5. Chief complaints of cocoa farmers.

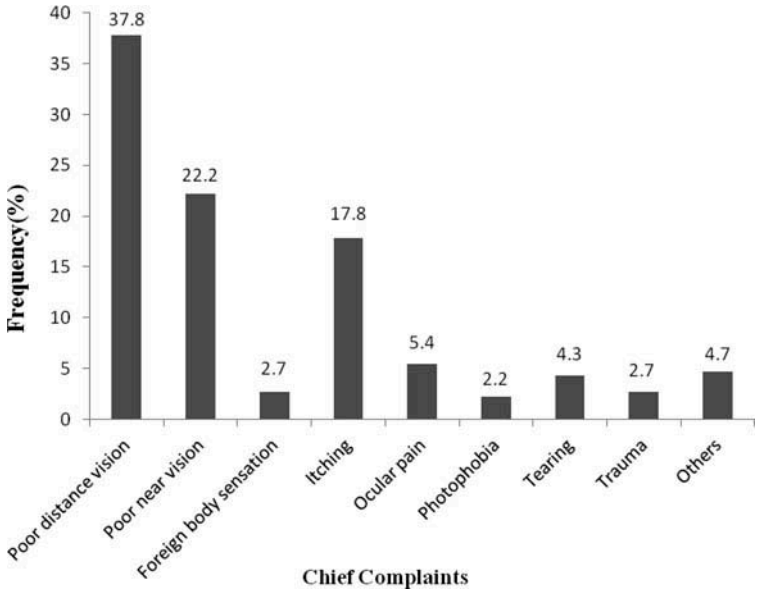


TABLE 2. Distance Visual Acuity (VA) of Cocoa Farmers

Visual status	Visual acuity	OD		OS		BCDVA	
		Frequency	(%)	Frequency	(%)	Frequency	(%)
NV	6/4 (20/13)	7	3.8	7	3.8	7	3.8
	6/5 (20/16)	47	25.4	39	21.1	52	28.1
	6/6 (20/20)	35	18.9	36	19.5	42	22.7
	6/9 (20/32)	19	10.3	32	17.3	47	25.4
	6/12 (20/40)	18	9.7	18	9.7	6	3.2
VI	$6/18^{-}$ ($20/63^{-}$)	15	8.1	11	5.9	10	5.4
	6/24 (20/80)	10	5.4	10	5.4	7	3.8
	6/36 (20/125)	7	3.8	6	3.2	3	1.6
	6/60 (20/200)	9	4.9	10	5.4	5	2.7
Blind	3/60 (20/400)	3	1.6	1	0.5	—	—
	CF at 3 m	10	5.4	10	5.4	6	3.2
	HM	2	1.1	—	—	—	—
	LP	1	0.5	4	4.0	—	—
	NLP	2	1.1	1	0.5	—	—

Note. OS = left eye; OD = right eye; BCDVA = best-corrected distance visual acuity; CF = counting figures; HM = hand movement; LP = light perception; NLP = no light perception; NV = normal vision; VI = vision impairment.

between the visual acuity (VA) of the right eyes (OD) (4.72 ± 3.04) and those of the left eyes (OS) (4.71 ± 2.96). As a result, the right eye (OD) was conventionally used for categorization of the visual acuity of the cocoa farmers. Using the ICD classification with best-corrected distance visual acuity (BCDVA), 83.2% had normal vision whereas 16.7 % had visual impairments, with 3.2% being legally blind in one eye.

Upon examination, there was no evidence of ocular abnormality in 41.6% of the workers. Ocular diseases diagnosed were cataract (20.0%), glaucoma (11.7%), conjunctivitis (13%), pterygium (2.7%), corneal opacity (2.2%), and pinguecula (1.1%). Other disorders were hypertensive retinopathy (2.7%), chorioretinopathy, e.g., retinitis pigmentosa (2.7%), and optic atrophy (0.5%), with about 1.1% being blind in at least one eye (Table 3).

Refractive errors were identified in 28.6% of the population studied, whereas the prevalence of presbyopia was 21.1% based on farmers who complained of inability to do near work (functional disability from near work) and was confirmed upon assessment. Using the BCDVA (Table 2), 16.7% and 3.2 % of respondents had visual impairment and blindness in one eye, respectively. Among the visually impaired participants, the main causes of visual impairment (Table 4) were cataracts (51.6%), uncorrected refractive error (22.6%), glaucoma (12.9%), and cornea opacity (6.5%).

TABLE 3. Major Eye Diseases Identified Among the Farmers

Disease condition	Frequency	Percentage
No abnormality	77	41.6
Conjunctivitis	24	13.0
Pterygium	5	2.7
Pinguecula	2	1.1
Cornea opacity/scar	4	2.2
Cataract	37	20.0
Glaucoma	22	11.9
Diabetic retinopathy	1	0.5
Hypertensive retinopathy	5	2.7
Chorioretinopathy	5	2.7
Optic atrophy	1	0.5
Blind eye	2	1.1
Total	185	100.0

Note: This excludes refractive errors and presbyopia.

TABLE 4. Causes of Visual Impairment and Blindness

Causes of visual impairment	Male ($n = 20$) *n*	Female ($n = 11$) *n*	Total ($N = 31$) *n* (%)
Cataract	12	4	16 (51.6)
Refractive error	2	5	7 (22.6)
Glaucoma	3	1	4 (12.9)
Cornea opacity	2	0	2 (6.5)
Amblyopia	0	1	1 (3.2)
Optic atrophy	1	0	1 (3.2)

TABLE 5. Ocular Health–Seeking Behavior of Farmer 1 Year Preceding the Study

Behavior	Male ($n = 31$) %	Female ($n = 18$) %	Total ($N = 49$) %
Ever had eye examination			
Yes	24.8	30.0	26.5
Place of examination			
Hospital	64.5	22.2	49.0
Clinic	22.6	44.4	30.6
Chemical shops	6.5	33.3	16.3
Herbalist (Traditional medicine)	6.5	0.0	4.1

Ocular Health-Seeking Behavior of Farmers

Of the total number of participants, 26.5% reported seeking eye care services within the last 2 years preceding the study (Table 5). Of the numbers seeking eye care, 79.6% visited hospitals and clinics, 16.3% visited chemical shops, and 4.1% visited herbalists or used traditional medicine.

DISCUSSION

The age distribution of the participants reflects a relatively older generation of farmers, with approximately 87% being between 40 and 70 years old (mean age of 52.7 years). The age distribution of farmers in this study

is consistent with reports that the cocoa farming industry is dominated by older people.[4,18,19] Approximately 67% of the participants were male, which is in consonance with literature[5,20] in that men are given priority in the purchase of farm land for cocoa farming and other cash crops, whereas women are more inclined to produce food crops. The results of this study also confirm that farmers tend to have large family sizes, as family members constitute a main source of labour on cocoa farms.[4]

The main ocular complaints of poor near and distance vision, itching, and pain are comparable to earlier studies conducted in North Carolina that showed that itching, blurred vision, eye pain, or burning sensation were most prevalent in farm workers after working in the fields.[3,21] Similarly, the California Agricultural Workers Health Survey reported irritated itchy eyes and blurred vision as major complaints.[22]

Cocoa farmers are involved in a number of activities that predispose them to a number of injuries. The activities range from weeding and planting of seeds to plucking and drying of seeds. These injuries were mainly caused by flying stones, sand, branches, leaves, other foreign bodies, and chemicals. The frequency of injuries in this study is comparable to that reported in other studies.[3,5,23] However, injury resulting from chemical use was 10 times higher than that reported by Quandt et al.[3] This may be due to the fact that whereas cocoa farmers who are largely heavy chemical users were involved in this study, the former study included both crop and animal farmers who may not have used the same proportions of chemicals on their farms.

The use of protective and safety equipment on farms have been widely recommended in the literature.[3,5,23,24] The use of goggles was generally low among the farmers, with the exception of pesticide and fertilizer application. The use of goggles for other activities that had equal chances of causing injury to the eye was very low. However, apart from goggle use during weeding, the reported use of goggle for other activities compares favorably with that reported in the literature. For example, Quandt et al.[3] reported that few people wore eye protection among migrant farm workers. Similarly, only 1.6% of Latino farm workers reported wearing protective goggles during the performance of their field's task.[5] The reasons mentioned by participants for the low use of protective eyewear were mainly unavailability, economic (high cost and no money), and low awareness as compared with quality of protective eye wear as reported by other authors.[5,6]

Eye diseases diagnosed were mostly preventable and those known to be exacerbated by longterm exposure to ultraviolet radiations, chemical, and other allergens as well as injuries on the farm.[3,25] For example in the Migrant Clinicians Network survey, conjunctivitis was the most frequent eye condition, presenting among 42% of farm workers.[25] Furthermore, telemedicine examinations in North Carolina also revealed that 23% of farm workers in a large, population-based sample presented with pterygium.[26] However, the prevalence of pterygium in the current study was low, and this could have been due to differences in level of exposure to ultraviolet radiation as well as nature of farm activities. The frequency of cataracts was 20%, which is higher than the 3.9% (cataract and glaucoma) reported by Lee et al.[27] in their study. The higher frequency of cataract in this study could be due to the differences in age ranges of participants, as cataracts are more frequent in older participants (60 years and above, which constituted about 31% of our study population) than younger ones. In addition, the level of exposure to ultraviolet (UV) radiation could be responsible for this finding. There is, however, the need to explore further the effect of exposure to ultraviolet radiation in this study population, since UV has widely been reported as contributing to the development of pterygium (lower prevalence in this study) and cataract.[26] The prevalence of refractive errors among cocoa farmers was high, similar to those reported by other authors.[3,5,22].The low self-reported cases of presbyopia (21.1%) may be due to the fact that we reported only functional disability from near work, although presbyopia was almost absolute in our study population with a mean age of 52.7 years.[28]

Visual impairment can present significant risks for cocoa farmers. The level of visual impairment could affect the output of cocoa farmers on their farms and subsequently lead to

low performance and productivity.[29] The prevalence of visual impairment from all causes was high, 16.7%, compared with the 3.8% reported by Verma[30] in farm worker population. This could be due to poor utilization of eye care services by farmers. This view is supported by the fact that only 26.5% sought eye care within the last 2 years preceding the study. Hypertensive and diabetic retinopathies, which are ocular complications of hypertension and diabetes mellitus, respectively, were also identified in this study population. Other studies[3,7,8] have also reported similar findings among Latino farmers. The prevalence of these systemic conditions with ocular implications suggests the need for general medical check-ups.

CONCLUSION

This study showed that eye diseases and injuries are prevalent among the cocoa farmers in the Mfuom community. There is poor utilization of protective eye wear (mainly due to unavailability) and eye care services among the cocoa farmers studied. These suggest the need for intervention eye care programs among educational institutions, government, and the agricultural industry to improve the quality of life of the vulnerable cocoa farmers in rural Ghana. Furthermore, there should be awareness programs aimed at promoting proper health seeking behavior to reduce the high rate of cataract and refractive errors among the farmers. Finally, reasons for the high rate of pesticides injury and low rate of pterygium among cocoa farmers need to be further explored.

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