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Dynamics of Myopia Progression in Ghana—Evidence From Clinical Practice: A Retrospective Cohort Study

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ABSTRACT

Background and Aim: To investigate the pattern of progression of myopia among a Ghanaian clinical cohort.

Methods: A retrospective cohort analysis of a clinical data set of all healthy myopic participants attending a tertiary eye care center was performed. Participants' biennial refraction examinations were tracked for refractive changes 4 years after the date of the first visit. This covered the period from January 2015 to December 2019. Myopia progression was defined as a difference in spherical equivalent between consecutive biennial visits equal to, or greater than −0.50 D of myopia.

Results: The medical records of 169 myopic participants were reviewed, with the majority (53.8%) being female. Most of the participants (51.4%) were younger than 36 years, and at the end of the study period, 96 participants (56.8%), who made up the majority, showed progression of myopia Univariate regression revealed that the 36–59-year-old age range is associated with a 60% [cOR = 0.40, 95% CI: −0.17, 0.97; $p = 0.04$] reduced likelihood compared to those belonging to the 0–17-year-old age group, and the Mole-Dagbon ethnicity is associated with an almost fourfold [cOR = 3.80; 95% CI: −1.40, 10.316; $p = 0.01$] increased likelihood of experiencing myopia progression compared to those of Ga-Adangbe ethnicity. Multivariate regression revealed that the Mole-Dagbon ethnicity is associated with an increased likelihood of experiencing myopia progression 4 years after their initial visit [aOR = 3.49; 95% CI: −1.27, 9.63; $p = 0.02$] compared to those of Ga-Adangbe ethnicity.

Conclusion: Our study provides important insights into myopia progression in Ghana, with findings that are consistent with global trends. The association of myopia progression with age, place of residence, degree of myopia, and ethnicity highlights the need for tailored interventions to manage this growing public health concern in African populations.

1 | Introduction

The rising myopia prevalence, a major non-communicable disease, is a global concern [1]. The global prevalence of myopia was estimated to be more than 28% in 2020, and projections indicate that by 2050, around five billion people will have some degree of myopia [2]. This trend has been well-documented in Europe and Asia, but recent evidence shows a similar increase in Africa [3, 4].

In Africa, myopia prevalence varies by region (North, Southern, East, Central, and West Africa). Recent data shows a rising trend in all five regions, with West Africa having the lowest reported prevalence of 3.5% [4]. Despite this, the overall lower prevalence of myopia in African children remains relatively low at 4.7% [4, 5]. Nevertheless, the projected prevalence of childhood myopia is expected to reach 10.3% by the next decade and 16.4% by the next three decades [4]. This trend

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emphasizes the need for focused research on myopia in the African context.

In Ghana, myopia is increasingly surpassing other refractive errors, with prevalence rates ranging from 0.8% to 44.4% among various populations and settings [6–12]. This highlights the urgent need for focused research to understand this shift and to guide effective myopia management practices in the region. This growing trend highlights the need for localized research to understand the dynamics of myopia progression in the country. Research conducted in Ghana can provide valuable insights that may be applicable to other regions of Africa, given the similar patterns observed across the continent.

Myopia progresses over time and is linked to severe ocular complications, including cataracts, glaucoma, retinal detachment, and myopic maculopathy, which can lead to vision loss [13–16]. The study by Nti et al. [10] indicates that eye care practitioners in Africa are aware of the growing prevalence of myopia but lack comprehensive data on its progression and associated factors.

There is the need for studies to investigate the progression of myopia, its extent, and related demographic characteristics across different age groups in Ghana. This research provides baseline data for future studies and help develop effective management guidelines for myopia, ultimately contributing to better control of this condition and its complications in Ghana.

2 | Methods and Materials

2.1 | Study Design

The study was a retrospective cohort analysis of a clinical data set of all healthy myopic individuals who visited the Dr. Agarwal's Eye Hospital, a tertiary eye care facility in Accra, the most populated region of Ghana. Participants' biennial reviews for refraction were tracked for refractive changes 4 years after the date of first attendance. This spanned the period of January 2015 to December 2019 delimiting the study period to the pre-COVID-19 era in Ghana (COVID-19 with its attendant lockdown was officially declared in March 2020).

2.2 | Study Setting and Participants

The eye care facility attends to walk-in patients and referral cases nationwide, with an annual average patient inflow of over 4000. Their services include medical and surgical eye services, refractive services including refraction and optical correction with contact lenses, and spectacle lenses. The facility is located in Accra, in the Greater Accra Region of Ghana, which is the region with the highest population [17]. Despite Accra being the home city of the Ga-Adangbe ethnic group, it is also a highly cosmopolitan city, with a considerable number of individuals from all the other ethnic groups in Ghana residing there. Thus, its population diversity approximates various ethnicities in Ghana. These five main ethnic groups include the Akans, Ewes, Ga-Adangbes, Mole-Dagbanis, and Guans, with Akan being the largest ethnic group in Ghana.

2.3 | Data Collection and Selection Procedure

Electronic records of participants' ages, sex, ethnicity, residence, and occupation were extracted. Unique patient identifiers (codes) were used to track the patient's records. Myopic participants were identified as those who had −0.50 D or more negative spherical equivalent (SE) of myopia in their right eyes at baseline and had two subsequent biennial review visits for refraction within 4 years (January 2015 to December 2019). These encompassed participants with spherical myopic errors and those with simple or compound myopic astigmatism. Additionally, the value of the sphere (considering the negative cylinder notation) was to have been zero or less [18]. Participants with values of spheres in their right eyes that were greater or equal to zero, with absolute cylinder powers greater or equal to 1.00D, and with their absolute values of cylinders greater than their absolute values of the sphere were excluded [18]. By this, participants with high mixed astigmatism that had negative SEs (e.g., +0.25/−6.00 × 90) were excluded. Each refraction visit was treated as a data point and served as the baseline for the subsequent visit. Participants were not excluded based on high myopia and anisometropia but on the existence of all other ocular (uveitis, glaucoma, cataract, and retinopathies of any form) and systemic (hypertension, diabetes mellitus, and sickle cell) comorbidities. Participants with a history of refractive surgery were excluded from the study.

2.4 | Definitions

SEs of the refractive errors from non-cycloplegic subjective refraction were used to define myopia (SE ≤ −0.50; sphere ≤ 0) [18]. The magnitude of myopia was classified as either myopia (−0.50 to > −6.00 D) or high myopia (≤ −6.00 D) [19]. Refraction was carried out by an experienced optometrist using an auto-refractometer (Topcon RM-8800, Tokyo, Japan). Progression (ΔSE) was defined as a difference in SE between consecutive biennial visits which was equal to or more than −0.50 D of myopia. The rate of progression was specified as fast (ΔSE ≤ −1.00) or slow (−0.50 ≥ ΔSE > −1.00) [20]. “Peri-urban area was defined in relation to a nearby metropolitan area on its inner boundary, a rural area on its outer boundary” [21].

2.5 | Data Analysis

Statistical analysis was carried out with IBM SPSS version 29 (SPSS Inc., Chicago, IL, USA). The χ^2 test and univariate, and multivariate logistic regressions were used to determine the association between myopia progression and independent variables. Crude odds ratios were reported to show the strength of the association between the outcome and each independent variable. A multivariable logistic regression model, which was adjusted for age and ethnicity, was formulated to evaluate the sociodemographic risk factors of myopia. Adjusted odds ratio, 95% CI, and two-sided p value were calculated. To provide a stable baseline and to increase the predictive power of the univariate and multivariate logistic regressions, the categories with the highest baseline frequencies for each variable were assigned as reference categories [22]. A p value less than 0.05 was considered statistically significant.

2.6 | Ethical Consideration

The study protocol was approved by the Institutional Review Board, University of Cape Coast, Cape Coast, Ghana (UCCIRB/CHAS/2023/90). Permission was sought from the management of Dr. Agarwal's Eye Hospital and patient anonymity and confidentiality were ensured. Informed consent was waived since medical records were used. Investigators had access to patient-identifiable information, but these were not reported anywhere in the study. The study abided by the tenets of the Declaration of Helsinki.

3 | Results

3.1 | Sociodemographic Characteristics of Participants

A total of 17,611 medical records were reviewed, of which 7600 were identified as refractive cases within the study period. Out of the medical records related to myopia (2530), 169 met the inclusion criteria. The majority of the participants were female, constituting 91 (53.85%) cases. Table 1 details the distribution of baseline SEs, overall progression, rate of progression, and the sociodemographic characteristics of the participants. More than half of the participant group (51.4%) were younger than 36 years, and the youngest participant was 4 years old. At the end of the study period, 96 participants (56.8%), who made up the majority, showed progression of myopia. Of those that showed no myopia progression, 36 (21.3%) had no change in myopia (stable myopia) and 37 (21.9%) had hyperopic shifts (regression in myopia) (Table 2).

Participants who were 36 years and older (45.72%) throughout the study period showed a faster rate of progression compared to younger participants. Nevertheless, the higher magnitude of progression during the study period was observed in those who were younger than 18 years of age (27.91%). Individuals living in rural settlements had the highest level of myopia on average at the time of their first visit but had the slowest rate of progression over the study period.

Individuals with high myopia exhibited a significantly higher magnitude of myopia progression at the end of the study period than those with myopia (Table 1). Nevertheless, a proportion of them (13.51%) were observed to have a higher magnitude of regression of myopia compared to those with myopia. Table 2 details the distribution of regressive and stable myopia and the sociodemographic factors of participants who showed no progression in myopia.

3.2 | Association Between Sociodemographic Characteristics of Participants and Myopia Progression Within the Study Period

To establish the significance or otherwise of the relationships between the participants' sociodemographic characteristics and myopia progression, univariate (Table 3), and multivariate (Table 4) logistic regression analyses were carried out.

Univariate analyses showed that participants aged between 36 and 59 years were found to be approximately 60% less likely [cOR = 0.40, 95% CI: −0.17, 0.97; $p = 0.04$] to experience myopia progression at the end of the second biennial review compared to those belonging to the 0–17-year-old age group.

Univariate analyses also showed that participants belonging to the Mole-Dagbon ethnicity were approximately four times [cOR = 3.80; 95% CI: −1.40, 10.316; $p = 0.01$] more likely to experience myopia progression compared to those of Ga-Adangbe ethnicity, and this was ascertained 4 years after their initial visit.

Multivariate analysis showed that participants of Mole-Dagbon ethnicity had about a threefold chance of experiencing myopia progression 4 years after their initial visit, in comparison to those of Ga-Adangbe ethnicity [aOR = 3.49; 95% CI: −1.27, 9.63; $p = 0.02$].

4 | Discussion

Our study found that 56.8% of participants experienced myopia progression, a finding that aligns with previous studies in African populations, where increasing trends in myopia prevalence and progression have been reported [4, 5, 10, 11].

The faster rate of myopia progression in females than in males, as observed in this study, is consistent with the findings of several other studies that have investigated the variation in myopia progression with sex differences [22, 23]. One mechanism postulated to explain this variation is that thinner choroids and altered blood supply could lead to faster eye elongation and consequently faster myopia progression in females [24]. Therefore, it is crucial to implement sex-specific management strategies for myopia progression, particularly in the context of developing tailored treatment plans. Early intervention in females may be crucial in preventing high myopia and its associated complications.

This progression rate is consistent with global patterns, particularly in younger age groups, where the highest magnitude of progression was observed among participants under 18 years old [23, 24]. This observation is comparable to studies from Asia and Europe [23, 24], which also report rapid myopia progression during childhood and adolescence. It was anticipated that the study participants aged between 18 and 35 years would demonstrate refractive stabilization. However, this was not the case, as the participants within the 18–35 age group continued to experience myopia progression, albeit at a magnitude that was lower than that observed among the 0–17 age group. This may be indicative of a continuum of aggressive and potentially genetically influenced pathologic myopia, which has an onset in early childhood and results in the development of time-dependent complications such as posterior staphyloma [25].

Among participants aged 36 and above, there was a resurgent increase in myopia progression. This finding is consistent with that of a similar study which assessed the longitudinal progression of high myopia among a Chinese cohort which reported a similar resurgence in myopic shift among individuals aged 40–70 years old [25]. This resurgence in myopia in individuals aged 36 years and above could be attributed to the onset of early (subclinical) nuclear cataracts [26, 27].

TABLE 1 | Sociodemographic factors associated with myopia progression.

	Baseline SE			Overall progression			Fast progression			Slow progression		
	N	Mean ± SD[a]	95% CI	*N* (%)	Mean ± SD[b]	95% CI	*N* (%)	Mean ± SD[b]	95% CI	*N* (%)	Mean ± SD[b]	95% CI
Sex												
Male	78	−2.49 ± 2.37	−3.03 to −1.95	44 (56.41)	−1.39 ± 0.96	−1.68 to −1.10	30 (38.46)	−1.75 ± 0.97	−2.11 to −1.39	14 (31.82)	−0.63 ± 0.16	−0.71 to −0.54
Female	91	−3.13 ± 3.09	−3.79 to −2.48	52 (57.14)	−2.03 ± 1.36	−2.41 to −1.65	40 (43.96)	−2.43 ± 1.31	−2.85 to −2.01	12 (23.08)	−0.7 ± 0.16	−0.80 to −0.60
Age (years)												
0–17	44	−3.32 ± 2.34	−4.05 to −2.61	27 (61.36)	−1.87 ± 1.33	−2.39 to −1.34	22 (50.00)	−2.16 ± 1.3	−2.74 to −1.59	5 (11.36)	−0.56 ± 0.11	−0.69 to −0.43
18–35	43	−2.98 ± 4.33	−4.31 to −1.64	26 (60.47)	−1.33 ± 0.82	−1.66 to −1.00	16 (37.21)	−1.70 ± 0.86	−2.15 to −1.24	10 (23.26)	−0.74 ± 0.14	−0.84 to −0.64
36–59	41	−2.38 ± 1.73	−2.85 to −1.78	16 (39.02)	−1.73 ± 1.54	−2.56 to −0.91	10 (24.39)	−2.37 ± 1.65	−3.56 to −1.19	6 (14.63)	−0.67 ± 0.19	−0.86 to −0.47
60+	41	−2.68 ± 2.04	−3.34 to −2.04	27 (65.85)	−2.00 ± 1.21	−2.48 to −1.52	22 (53.66)	−2.32 ± 1.12	−2.81 to −1.82	5 (12.19)	−0.60 ± 0.16	−0.80 to −0.40
Residence												
Rural	3	−7.08 ± 8.46*	−28.11 to 13.94	3 (100.00)	−1.04 ± 0.29	−1.76 to −0.32	1 (33.33)	−1.37 ± 0.00	—	2 (66.67)	−0.87 ± 0.00	−0.88 to −0.88
Peri-urban[c]	13	−2.48 ± 2.36	−3.91 to −1.05	7 (53.85)	−2.25 ± 1.59	−3.72 to −0.78	5 (38.46)	−2.87 ± 1.44	−4.66 to −1.09	2 (15.39)	−0.69 ± 0.09	−1.48 to 0.11
Urban	153	−2.81 ± 2.63	−3.21 to −2.36	86 (56.21)	−1.72 ± 1.21	−1.98 to −1.46	64 (41.83)	−2.09 ± 1.19	−2.39 to −1.79	22 (14.38)	−0.64 ± 0.16	−0.71 to −0.57
Ethnicity												
Ewe	12	−4.10 ± 5.67	−7.70 to −0.50	9 (75.00)	−1.36 ± 0.49	−1.74 to −0.98	7 (58.33)	−1.52 ± 0.44	−1.92 to −1.12	2 (16.67)	−0.81 ± 0.09	−1.61 to −0.02
Mole-Dagbon	30	−2.74 ± 1.71	−3.38 to −2.10	24 (80.00)	−1.66 ± 1.34	−2.23 to −1.10	15 (50.00)	−2.23 ± 1.42	−3.02 to −1.45	9 (30.00)	−0.71 ± 0.14	−0.83 to −0.6
Akan	49	−2.55 ± 1.98	−3.12 to −1.98	23 (46.94)	−1.66 ± 1.03	−2.11 to −1.22	17 (34.69)	−2.05 ± 0.91	−2.52 to −1.58	6 (12.25)	−0.56 ± 0.10	−0.67 to −0.45
Ga-Adangbe	50	−2.76 ± 2.80	−3.54 to −2.19	40 (80.00)	−1.91 ± 1.38	−2.35 to −1.46	31 (62.00)	−2.47 ± 1.44	−2.77 to −1.77	9 (18.00)	−0.64 ± 0.18	−0.78 to −0.5
Occupation												

(Continues)

TABLE 1 | (Continued)

	Baseline SE			Overall progression			Fast progression			Slow progression		
	N	**Mean ± SD[a]**	**95% CI**	***N* (%)**	**Mean ± SD[b]**	**95% CI**	***N* (%)**	**Mean ± SD[b]**	**95% CI**	***N* (%)**	**Mean ± SD[b]**	**95% CI**
Armed forces	2	−2.38 ± 2.30	−23.02 to 18.27	2 (100.00)	−2.25 ± 2.47	−24.49 to 19.99	1 (50.00)	−4.00 ± 0.00	—	1 (50.00)	−0.50 ± 0.00	—
Retired	38	−2.85 ± 2.24	−3.61 to −2.12	24 (63.16)	−1.90 ± 1.17	−2.4 to −1.41	19 (50.00)	−2.17 ± 1.19	−2.76 to −1.73	5 (13.16)	−0.60 ± 0.16	−0.80 to −0.40
Professionals	57	−2.37 ± 2.33	−2.94 to −1.70	28 (49.12)	−1.5 ± 1.25	−1.98 to −1.02	19 (33.33)	−2.24 ± 1.07	−2.53 to −1.22	9 (15.79)	−0.71 ± 0.15	−0.83 to −0.59
Students	72	−3.24 ± 3.31	−4.04 to −2.45	42 (58.33)	−1.78 ± 1.22	−2.15 to −1.40	31 (43.05)	−1.87 ± 1.37	−2.6 to −1.73	11 (15.28)	−0.66 ± 0.16	−0.77 to −0.55
Classification												
High myopia	16	−9.21 ± 4.33**	−11.71 to −6.98	11 (68.75)	−2.50 ± 1.46	−3.48 to −1.52	10 (62.50)	−2.66 ± 1.43	−2.35 to −1.75	1 (6.25)	−0.87 ± 0.00	—
Myopia	153	−2.18 ± 1.39	−2.38 to −1.93	85 (55.56)	−1.64 ± 1.17	−1.89 to −1.39	60 (39.22)	−2.05 ± 1.16	−3.69 to −1.64	25 (16.34)	−0.65 ± 0.16	−0.72 to −0.59

Note: Fast progression ($\Delta SE \leq -1.00$); slow progression ($-0.50 \geq \Delta SE > -1.00$).
Abbreviation: SE, spherical equivalent.
[a]Mean ± SD: Mean baseline SE.
[b]Mean ± SD: Mean rate of progression.
[c]A peri-urban area is an area in the immediate vicinity of an urban area.
*$p < 0.05$: significant (two-sided).; **$p < 0.001$: significant (two-sided).

TABLE 2 | Distribution of regressive and stable myopia with the sociodemographic factors among participants with non-progressive myopia.

	Regressive[a]			Stable[b]		
	N (%)	Mean ± SD	95% CI	*N* (%)	Mean ± SD	95% CI
Sex						
Male	16 (43.24)	0.98 ± 0.81	0.81 to 0.55	18 (50.00)	−0.17 ± 0.15	−0.25 to −0.09
Female	21 (56.76)	1.55 ± 2.04	2.04 to 0.63	18 (50.00)	−0.20 ± 0.14	−0.27 to −0.13
Age (years)						
0−17	8 (21.62)	1.42 ± 1.78	1.78 to −0.07	9 (25.00)	−0.24 ± 0.13	−0.34 to −0.13
18−35	10 (27.03)	0.67 ± 0.65	0.65 to 0.21	7 (19.44)	−0.20 ± 0.12	−0.31 to −0.08
36−59	11 (29.73)	0.92 ± 0.85	0.85 to 0.34	14 (38.89)	−0.17 ± 0.16	−0.26 to −0.08
60+	8 (21.62)	2.52 ± 2.53	2.53 to 0.4	6 (16.67)	−0.13 ± 0.16	−0.29 to 0.04
Residence						
Rural	0 (0.00)	0.00 ± 0.00	—	0 (0.00)	0.00 ± 0.00	—
Peri-urban	3 (8.11)	0.67 ± 0.14	0.14 to 0.31	3 (8.33)	−0.17 ± 0.14	−0.53 to 0.19
Urban	34 (91.89)	1.36 ± 1.69	1.69 to 0.77	33 (91.67)	−0.19 ± 0.14	−0.24 to −0.14
Ethnicity						
Ewe	1 (2.70)	5.50 + 0.00	—	2 (5.56)	−0.31 + 0.09	−1.11 to 0.48
Mole-Dagbon	6 (16.22)	1.09 + 0.60	0.6 to 0.47	0 (0.00)	0.00 + 0.00	—
Akan	12 (32.43)	1.53 + 1.54	1.54 to 0.55	14 (38.89)	−0.13 + 0.12	−0.21 to −0.06
Ga-Adangbe	18 (48.65)	0.99 + 1.67	1.67 to 0.16	20 (55.56)	−0.21 + 0.15	−0.28 to −0.14
Occupation						
Armed forces	0 (0.00)	0.00 ± 0.00	—	0 (0.00)	0.00 ± 0.00	—
Retired	8 (21.62)	2.59 ± 2.46	2.46 to 0.53	6 (16.67)	−0.19 ± 0.17	−0.37 to −0.01
Professionals	14 (37.84)	0.84 ± 0.87	0.87 to 0.34	15 (41.67)	−0.16 ± 0.16	−0.25 to −0.08
Students	15 (40.54)	1.05 ± 1.37	1.37 to 0.29	15 (41.67)	−0.21 ± 0.12	−0.28 to −0.14
Classification						
High myopia	5 (13.51)	4.33 ± 2.61	2.61 to 1.08	0 (0.00)	0.00 ± 0.00	—
Myopia	32 (86.49)	0.83 ± 0.71	0.71 to 0.58	36 (100)	−0.19 ± 0.14	−0.23 to −0.14

[a]Regressive myopia: > 0 D of change in myopia.
[b]Stable, non-progressive myopia: Between −0.50 and ≤ 0 D of change in myopia.

A considerable magnitude of regression in myopia among children was observed. This phenomenon could be explained by the lens acting as a balance weight to compensate for myopic shifts associated with axial elongation and changes in corneal curvature during emmetropization [28, 29]. This "push-back" mechanism has been postulated to be generated when refractive errors drop out of the preferred hyperopic range in children aged 4 years or less [28, 29].

The age group comprising participants aged 60 years and older exhibited the highest magnitude of regression in myopia (hyperopic shift) compared to the other age groups. Of particular interest was the case of a single initially highly myopic Ewe participant who exhibited a hyperopic shift of 5.50 D. Although a rare occurrence, this magnitude of hyperopic shift may be attributed to a decrease in the lens equivalent refractive index with age [30]. While the magnitude of longitudinal hyperopic shift associated with aging remains poorly defined [31], data from the Beaver Dam [32], Blue Mountains [33], Reykjavik [27], and Tehran [31] Eye Studies have demonstrated that a notable proportion of individuals over 40 years of age exhibit longitudinal refractive shifts exceeding +0.50 D over 5–10-year periods.

Interestingly, participants aged 36 years and older showed a faster rate of progression, yet the magnitude of progression was higher in those under 18. This suggests a possible age-related difference in how myopia progresses, with younger individuals potentially experiencing more substantial changes in refractive error over time. Our findings are in line with studies that indicate slower progression in adults, with the possibility of stabilization in later years [23]. This age-related pattern is crucial for developing age-specific management strategies, such as orthokeratology or pharmacological treatments [34].

Our study also revealed that individuals in rural areas had higher baseline levels of myopia but experienced slower progression compared to their urban counterparts. This finding supports the urbanization hypothesis, which suggests that urban living conditions, which is characterized by increased near work and reduced outdoor activities can contribute to higher myopia prevalence and faster progression [35–40].

TABLE 3 | Univariate analysis of sociodemographic factors associated with myopia progression within the study period.

Univariate						
	First biennial progression		Second biennial progression		Overall progression	
	p	cOR (95% CI)	*p*	cOR (95% CI)	*p*	cOR (95% CI)
Sex						
Male	0.98	0.993 (0.54, 1.823)	0.41	0.774 (0.422, 1.418)	0.924	0.971 (0.527, 1.787)
Female						Reference
Age (years)						
0–17						Reference
18–35	0.925	1.042 (0.446, 2.431)	0.071	0.453 (0.192, 1.069)	0.932	0.963 (0.407, 2.279)
36–59	0.535	0.759 (0.318, 1.815)	0.167	0.544 (0.229, 1.289)	0.041	0.403 (0.168, 0.965)
60+	0.235	1.681 (0.713, 3.965)	0.473	0.729 (0.308, 1.728)	0.668	1.214 (0.501, 2.945)
Residence						
Rural	0.657	0.577 (0.051, 6.503)	0.582	1.974 (0.175, 22.228)	—	4.76E+08 (4.76E+08, 4.76E+08)
Peri-urban	0.284	0.513 (0.152, 1.738)	0.808	1.152 (0.37, 3.585)	0.87	0.909 (0.292, 2.831)
Urban						Reference
Ethnicity						
Ewe	0.804	1.167 (0.346, 3.936)	0.934	0.95 (0.282,3.204)	0.137	2.85 (0.717, 11.329)
Mole-Dagbon	0.962	1.021 (0.439, 2.375)	0.262	1.641 (0.691,3.898)	0.009	3.8 (1.4, 10.316)
Akan	0.556	0.805 (0.39, 1.658)	0.356	0.713 (0.347,1.463)	0.634	0.84 (0.411, 1.719)
Ga-Adangbe						Reference
Occupation						
Armed forces	0.784	1.483 (0.089, 24.666)		1.85E+08 (1.85E+08, 1.85E+08)	—	1.61E+08 (1.61E+08, 1.61E+08)
Retired	0.135	1.832 (0.828, 4.053)	0.677	0.846 (0.385, 1.859)	0.624	1.224 (0.545, 2.749)
Professionals	0.682	1.158 (0.573, 2.342)	0.335	0.71 (0.353, 1.426)	0.298	0.69 (0.343, 1.388)
Students						Reference
Classification						
High myopia	0.671	0.8 (0.285, 2.242)	0.05	0.312 (0.096, 1.011)	0.32	0.568 (0.188, 1.714)
Myopia						Reference

Note: $p < 0.05$: significant (two-sided).

Similar trends have been observed in studies from other regions, highlighting the role of environmental factors in myopia progression [35–40].

We found significant ethnic differences in myopia progression, with participants from the Mole-Dagbon ethnicity being more likely to experience myopia progression compared to those from the Ga-Adangbe ethnicity. Also, participants of Ga-Adangbe ethnicity experienced the fastest rate of myopia progression as compared to participants from the other ethnic groups. These disparities may possibly be influenced by genetic diversity, the result of a complex interplay of demographic events, including migration and admixture, and selective pressures, such as diet [41]. Additionally, environmental factors such as cultural practices and lifestyle behaviors may influence these disparities [38]. These findings are consistent with those of other studies that have highlighted ethnic disparities in myopia progression, potentially due to genetic and environmental factors [38, 42, 43]. Our results emphasize the need for further research to understand the genetic and environmental mechanisms underlying these differences.

TABLE 4 | Multivariate analysis of sociodemographic factors associated with myopia progression within the study period.

	Multivariate	
	Overall progression	
	p	aOR (95% CI)
Age (years)		
0–17		Reference
18–35	0.697	0.836 (0.338, 2.063)
36–59	0.071	0.437 (0.178, 1.075)
60+	0.587	1.288 (0.517, 3.208)
Ethnicity		
Ewe	0.137	2.936 (0.71, 12.148)
Mole-Dagbon	0.016	3.493 (1.267, 9.633)
Akan	0.57	0.809 (0.389, 1.682)
Ga-Adangbe		Reference

Note: $p < 0.05$: significant (two-sided).

Individuals with high myopia in our study exhibited a significantly higher magnitude of progression, which underscores the importance of close monitoring and early intervention in this group to prevent complications such as retinal detachment [44].

The study's limitations, including the use of non-cycloplegic refraction, the lack of biometry data and a relatively small sample size, should be considered when interpreting these findings. Further studies are required to confirm these results and explore the underlying mechanisms in greater depth. These studies should incorporate biometry data with larger, more diverse cohorts and the use of cycloplegic refraction.

5 | Conclusion

Our study provides important insights into myopia progression in Ghana, with findings that are consistent with global trends. The association of myopia progression with age, place of residence, degree of myopia, and ethnicity highlights the need for tailored interventions to manage this growing public health concern in African populations.

Author Contributions

Samuel Kyei: conceptualization, funding acquisition, validation, visualization, writing–review and editing, supervision, project administration, resources, methodology. **Godwin Avornyo:** investigation, funding acquisition, writing–original draft, methodology, data curation, writing–review and editing. **Randy Asiamah:** funding acquisition, writing–review and editing, visualization, validation, formal analysis, software, resources. **Samuel B. Boadi-Kusi:** investigation, funding acquisition, writing–review and editing, project administration, supervision, resources, visualization. **Michael Agyemang Kwarteng:** investigation, writing–review and editing, visualization, resources, software, project administration.

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Ethics Statement

Ethical clearance for the study was granted by the University of Cape Coast, Ghana Institutional Review Board (UCCIRB/CHAS/2023/90).

Consent

Informed consent was waived since medical records were used.

Conflicts of Interest

The authors declare no conflicts of interest.

Transparency Statement

The lead author Samuel Kyei affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. The corresponding author, Samuel Kyei, had full access to all of the data in this study and took complete responsibility for the integrity of the data and the accuracy of the data analysis.

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