

Analysis of Pediatric Vision Screening Data: Incidence, Predictors, and Barriers to Eye Care in Pwani Region, Tanzania

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Objectives: The present study develops a database of vision screening records to examine (i) the incidence of pediatric (ages 3-19 years) vision conditions over three years, (ii) relationships between vision health and physical measurements, and (iii) differences between post-screening follow-up rates at hospital and mobile clinics.

BACKGROUND

- Vision screening is critical for early detection and prevention of vision loss in pediatric populations.
- In Tanzania, a shortage of eye health workers has prevented regular pediatric vision screenings.¹

VISION CARE

- South Korean international blindness relief organization.
- Vision Care has partnered with the Tanzanian ophthalmological community to train teachers to conduct vision screenings in five public primary schools in the Pwani region.



RESULTS

Incidence of Vision Conditions

Panel A. Sample decomposition by sex		
	Number	Share
Female	107	49.5%
Male	109	50.5%
Total	216	100.0%

Panel B. Characteristics		
	Mean	Std. dev.
Age (years)	10.87	2.69
Weight (kilograms)	32.85	10.84
Height (meters)	1.36	0.16
Height-for-age (percentile)	25.73	29.31
BMI (kg/m ²)	17.35	3.95
BMI-for-age (percentile)	41.93	32.27

Table 1: 2022 School Vision Screening Patient Demographics and Measurements

Notes: Height-for-age and BMI-for-age percentiles were calculated based on World Health Organization (WHO) standards.

Condition	Number	Share
Conjunctivitis	45	21%
Conjunctivitis and refractive error	7	3%
Corneal scar	5	2%
Eyelid abnormality	7	3%
Painful eyes	5	2%
Photophobia	12	6%
Refractive error	103	48%
Squint	4	2%
Other	21	10%
Unknown	7	3%
Total	216	100%

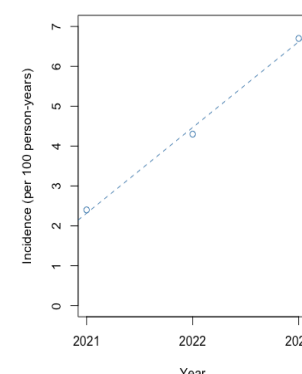
Table 2: 2022 Vision Condition Incidence

Notes: "Eyelid abnormality" includes chalazion, sty, trauma, swelling, ptosis, and growth. "Other" includes students with itching eyes, dislocated lens, nystagmus, eye strain, discharge, jaundiced eyes, ectropia, abnormal appearance of cornea, or unspecified poor vision. "Unknown" includes students who failed the vision screening with insufficient documentation of diagnostic information.

Year	Number of Schools	Number of Participants	Incidence (per 100 person-years)
2021	3	2,169	2.4
2022	5	4,971	4.3
2023	3	2,578	7.0

Table 3: Incidence of Vision Conditions in Pwani Region from 2021-2023

Notes: The screenings in 2022 were conducted at Kambarage, Kongowe, Mkoani, Mwambisi, and Tumbi Primary Schools. The screenings in 2021 and 2023 were conducted at Kambarage, Mkoani, and Tumbi Primary Schools.



METHODS

#1 Vision Screening



Physical
Measurements



Visual Acuity



Examination

#2 Follow-Up



Visual Acuity



Slit Lamp Examination



Autorefractor

#3 Analysis

- Patient records were compiled and digitized, and all statistical analyses were conducted in R.

Vision Health & Physical Measurements

Condition	Height-for-age	Weight		BMI-for-age
		β	(standard error)	
Conjunctivitis	-0.004* (0.002)	0.005 (0.007)	0.001 (0.002)	
Corneal scar	0.001 (0.001)	0.001 (0.003)	0.000 (0.001)	
Eyelid abnormality	0.000 (0.000)	0.002 (0.002)	-0.001 (0.001)	
Painful eyes	0.000 (0.001)	-0.001 (0.002)	0.000 (0.000)	
Photophobia	0.000 (0.001)	-0.002 (0.003)	-0.000 (0.001)	
Refractive error	0.005* (0.002)	0.002 (0.008)	-0.002 (0.002)	
Squint	0.000 (0.001)	-0.004 (0.002)	0.001 (0.001)	
Other	-0.001 (0.001)	-0.003 (0.006)	0.001 (0.001)	
Unknown	0.000 (0.000)	-0.001 (.003)	0.000 (0.000)	

Table 4: Relationships Between Vision Conditions and Physical Measurements

Notes: Multivariate logistic regression models controlling for age and sex among the sample of children who failed the vision screening in 2022. *, p-value < .05; **, p-value < .01.

Hospital vs. Mobile Clinic Follow-Up Rates

Panel A. Hospital vs. Mobile Clinic Follow-Up Rates			
	Number of Schools	Referred	Follow-Up Rate
Hospital	3	136	96
Mobile Clinic	2	113	109
Total	5	249	205
P-value: rates are equal: 2.443e-07			

Panel B. Relationship Between School-Hospital Distance and In-Hospital Follow-Up Rate	
School	Follow-Up Rate
Tumbi	81%
Mkoani and Kambarage	62%
P-value: rates are equal: 0.026	

Table 5: Impact of Mobile Clinics and Hospital Distance on Post-Screening Follow-Up Rates in 2022

Notes: Of the five schools that conducted screenings in 2022, students from three schools (Tumbi, Mkoani, and Kambarage) were assigned in-hospital follow-up appointments, and students from the other two schools (Kongowe and Mwambisi) were assigned follow-up appointments at a mobile clinic on school grounds.

DISCUSSION

- Rising incidence of vision conditions among the pediatric population in the Pwani Region ($p=6.002e-12$).
- Negative relationship between conjunctivitis and height-for-age ($p=0.011$), and positive relationship between refractive error and height-for-age ($p=0.003$) among students who failed screenings.
- Higher post-screening follow-up rates observed at mobile clinics compared to the hospital clinic ($p=2.443e-07$).
- Higher hospital follow-up rates observed for students attending the school located closest to the hospital ($p=0.026$).

- The growing incidence of vision conditions in this region may be attributable to (a) increased willingness to participate in screening procedures, (b) rising access to technology, and (c) fluctuating rates of infection and seasonal conditions (e.g., allergic conjunctivitis).

- Prior studies demonstrate relationships between taller children and longer axial lengths.^{2,3} Several studies also suggest relationships between chronic malnutrition, susceptibility to infection,⁴ and conjunctival abnormalities.^{5,6}

IMPLICATIONS AND FUTURE DIRECTIONS

- This study strongly advocates for the importance of annual pediatric vision screenings and mobile eye health clinics.
- Future research should continue to explore links between vision health, height, and chronic malnutrition.
- Findings carry implications for policy recommendations concerning access to pediatric vision care in the Pwani region.

REFERENCES

- Mwakyusa, N., et al. "Eye health system assessment report, mainland Tanzania." *Dar es Salaam, Tanzania: MOHCDGEX*(2017).
- Saw, Seang-Mei, et al. "Height and its relationship to refraction and biometry parameters in Singapore Chinese children." *Investigative ophthalmology & visual science* 43.5 (2002): 1408-1413.
- Sharma, Abhishek, et al. "Height, stunting, and refractive error among rural Chinese schoolchildren: the See Well to Learn Well project." *American journal of ophthalmology* 149.2 (2010): 347-353.
- Schaible, Ulrich E., and Stefan H. E. Kaufmann. "Malnutrition and infection: complex mechanisms and global impacts." *PLoS medicine* 4.5 (2007): e115.
- Fuchs, George J., et al. "Relationship between vitamin A deficiency, malnutrition, and conjunctival impression cytology." *The American journal of clinical nutrition* 60.2 (1994): 293-298.
- Castejon, Haydee V., et al. "Prevalence of sub-clinical vitamin A deficiency and malnutrition in slum children in Maracaibo-Venezuela." *Archivos Latinoamericanos de Nutricion* 51.1 (2001): 25-32.