**Productivity of Primary Pediatric Eye Care: Are we there yet?**

**ABSTRACT**

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| --- |
| **Aim:** To investigate the productivity of primary pediatric eye care and associated barriers.  **Study design**: a cross-sectional study  **Place and duration of study**: primary health care facilities in Hai and Mwanga districts between August 2023 and July 2024  **Methodology:** This study involved health care workers in primary health facilities at Hai and Mwanga Districts. These Districts were purposively selected because of ongoing activities for pediatric eye health for years. Simple random sampling was implemented to get the 32 health facilities among 93 public health facilities in Hai and Mwanga districts. Health care workers on the selected facilities at RCH and OPD clinics were interviewed using a structured questionnaire. The register (for 2023) was used to record the number of eye cases in children under 5 years at each health facility to obtain productivity and health care workers on the selected facilities were interviewed using a structured questionnaire to investigate barriers for productivity.  **Results:** A total of 30 health facilities were included, which made a total of 111 HCW’s enrolled. Productivity of specific health facilities was calculated as:  The number of children under five years eye visits annually per Catchment population for children under five years(per 100 population). The mean productivity was found to be 4.95(1.21) per 100 population with 95% confidence interval (2.48-7.43). Majority of health facilities (83.3%) had productivity of less than 10 per 100 population. The most common barriers mentioned are inadequate knowledge and skills, lack of screening tools, poor supervision, lack of medication and staff shortage.  **Conclusion:** The findings of this study underscore persistent productivity challenges in primary pediatric eye care despite ongoing interventions. Productivity remains significantly low across health facilities, with less than 10 cases per 100 population of under-fives. Systemic barriers, including inadequate knowledge, lack of screening tools, poor supervision, medication shortages, and staffing constraints—continue to hinder effective service delivery. Addressing these limitations through targeted training, improved resource allocation, and enhanced oversight is essential for strengthening pediatric eye care services in Northern Tanzania |

***Keywords:*** *Primary eye care, pediatric eye health, productivity, health care workers.*

**INTRODUCTION**

Primary Eye Care is defined as a foreground activity providing care and disease identification before they cause serious medical issues and can be delivered in different ways (Malik *et al.*, 2020) The aim of primary pediatric eye care is to prevent and reduce blindness in children.(Kishiki *et al.*, 2012) Primary health facilities are designed to be the first point of interaction with patients and the major goal of this is to easily make health services available even in remote areas.

Effectiveness of primary eye care services has become a global concern and 40 years since the Alma Ata declaration low-middle income countries are still facing problems in providing better yet sustained services at the primary level. With the integration of primary eye care to the primary health care a lot of problems in adapting the change is expected. With limited resources available, productivity of primary eye care is still low with a reported significant number of children who present late to the tertiary health facilities.

The World’s Health Organization (WHO) considers Primary health care (PHC) to be the most inclusive, equitable and cost-effective strategy to enhance people’s health and to facilitate global progress towards universal health coverage (UHC) and health- related sustainable development goals(World Health Organization WHO, 2018). The World Report on Vision 2019 (WRV) argues that the integration of primary Eye Care (PEC) into PHC is essential, not only for increasing equitable access to eye care, but also for strengthening service delivery at all levels. At the Seventy-third World Health Assembly in November 2020, WHO Member States adopted resolution WHA73 “Integrated people-centered eye care, including preventable vision impairment and blindness” and initiated the package for eye care intervention (PECI) which among many others highlighted the important resources needed for implementation of eye care across different levels of care to increase productivity with enough emphasis on primary eye care.(Mueller, Keel and Cieza, 2021)

Approximately, 1.5 million children have lost vision worldwide(Israeli *et al.*, 2022) Africa being among major contributors. Nearly 44% of Tanzania population are children between 0-15 years and more than 50% of population is below 18 years and an estimated prevalence of childhood blindness in Tanzania is 13640 blind children.

Inclusion of eye condition and red reflex testing in the training curriculum of Primary health care workers (PHCW’s) who manage children as an integral part of integrated management of newborn and childhood illness (IMNCI), newborn eye screening as part of postnatal care as recommended by WHO in 2022, on job training of PHCW’s on screening and management of eye conditions at primary health levels and outreach programs to reach patients at the most inaccessible areas are among several efforts which have been done to early detect childhood eye diseases in Tanzania.

Through the years Tanzania has managed to strengthen the primary health services ensuring well established and widespread services at dispensaries, heath centers and district hospitals although there are some inherent weaknesses in the health system(Byamukama and Courtright, 2010)

Despite success in delivering services in eye care, the pediatric population seem to be left behind and some of the competing factors like diarrhea, HIV & AIDS, and Upper respiratory tract infections among many others seem to mask the needs in eye care. Majority of other children’s programs like Malaria and HIV&AIDS do better in making sure that as many children have been screened and closely monitored to reduce mortality rates especially for the under-fives population(U5’s). While this is not the same in eye care, which is only categorized under non communicable diseases, many children lack the opportunity to be early screened and the burden of having children with ocular defects seems not to have improved much even with a lot of movements and interventions which have been made by the government and other stakeholders some.

While it is a different story in developed countries, LMIC’s still have low productivity of primary eye care, and this is due to number of factors. Bronsard and Fabian stated that eye health care services in infants and children at primary level are deficient in most low resource settings whereby children with treatable eye conditions present very late leading to poor outcomes hence the goal to minimize the magnitude of children with blindness and severe visual impairment becomes so difficult to attain(Bronsard *et al.*, 2008). Yasmin and Schmidt found that system barriers that need attention were governance, health financing, procurement and HMIS,(Yasmin and Schmidt, 2022) while Mndeme and others found that staff shortage, increased workload, multiple tasks and large number of children attending the clinic were the factors that affected productivity of PEC(Mndeme *et al.*, 2021).

The aim of this study was to assess productivity of primary pediatric eye care and associated barriers.

1. **METHODOLOGY**

A cross-sectional study was carried out in Hai (population 240,999) and Mwanga districts (population 148,763) of Kilimanjaro Region, Tanzania from February 2024 to April 2024. The catchment population for primary health facilities ranges between 1,000-32,000 depending on the type of facility. The staff consists of medical attendants, nurses, clinical officers, assistant medical officers and medical doctors. Different training concerning primary eye health has been conducted in these districts for the past 5 years aiming on early intervention of eye conditions including children. Mwanga and Hai districts have a total of 100 health facilities of which 93 are government owned. All the health facilities in these two districts are similar in terms of eye care services thus, 32 public health facilities (dispensaries, health centers and district hospitals) were randomly selected due to the available time and resources for the study. In every health facility 2 to 3 HCW’s were conveniently selected to be interviewed. Annual data from a book registry at a specific facility and face to face interview were used to collect data.

Two types of data were obtained:

1. The register (for 2023) was used to record the number of eye cases in children under 5 years at each health facility.
2. The interview was conducted in Swahili by the principal investigator with the 30-health facility in-charges and other 81 HCW’s who staffed the health facilities using a pre-tested questionnaire installed in a SURVEY CTO SOFTWARE which aimed to speculate on productivity barriers in primary pediatric eye health and also to get information on the catchment population of a particular health facility which was then used on calculation of the facility productivity.

Productivity of specific health facilities was calculated as:

Number of children under five years eye visits annually/Catchment population for children under five years.

The collected data were transferred from SURVEY CTO SOFTWARE to an excel spreadsheet. Data was analyzed using STATA version 16. Data was checked for consistency prior to analysis and mean productivity score, and standard deviation was calculated. Chi square was used to assess the differences.

1. **RESULTS AND DISCUSSION**

**3.1 RESULTS**

All 32 primary health facilities were visited with a follow-up visit to those who were absent on the first visit. At two dispensaries facilities in charges were absent, so the presented findings are for 30 health facilities where the health facilities in charges and their respective 81 HCW’s were interviewed.

**3.1.1 Response rate**

The response rate was 30 (115%) for health facilities and 111(154%) for HCW.

**3.1.2 Background characteristics of the participants**

Majority of study participants were females (71.2%) and median age was 35 with almost equal distribution HCW’s from dispensaries and Health centers whereby there was preponderance of nurses group (46.9%) and those who received previous eye training were half of all participants and more than two third of HCW’s didn’t have refresher training in eye health as summarized in table 1.

**Table 1: Socio-demographic characteristics of health providers (N=111)**

|  |  |  |
| --- | --- | --- |
| **Variable** | **n** | **%** |
| **Age (Years)** |  |  |
| 24-34 | 50 | 45.1 |
| 35-44 | 26 | 23.4 |
| 45+ | 35 | 31.5 |
| Median (IQR) | 35(31,46) |  |
| **Sex** |  |  |
| Male | 32 | 28.8 |
| Female | 79 | 71.2 |
| **Health station** |  |  |
| Hospital | 15 | 13.5 |
| Health Centre | 47 | 42.3 |
| Dispensary | 49 | 44.1 |
| **Cadre** |  |  |
| Medical attendant | 28 | 25.2 |
| Nurses | 52 | 46.9 |
| Doctors | 31 | 27.9 |
| **Duration** |  |  |
| <10 | 52 | 46.9 |
| 10 to 20 | 34 | 30.6 |
| >20 | 25 | 22.5 |
| Median (IQR) | 10(6,18) |  |
| **Activities** |  |  |
| Single | 48 | 43.2 |
| Multiple | 63 | 56.8 |
| **Training** |  |  |
| Yes | 56 | 50.5 |
| No | 55 | 49.5 |
| **Refr-training** |  |  |
| Yes | 29 | 26.1 |
| No | 82 | 73.9 |

**3.1.3 Characteristics of health facilities**

Figure 1 shows the distribution of health facilities by district where 57% of health facilities were from Mwanga district. While Figure 2 shows the distribution of health facilities by level of care. By contrast, dispensaries made 67% of all primary health facilities visited.

**Figure 1: Distribution of health facilities by districts**

**Figure 2: Distribution of health facilities by level of care.**

Table 2 shows characteristics of health facilities in these districts of which screening tools were not present in nearly one third of facilities while focal eye person was present in only 60% of facilities and existing budget for eye health was present in only 20% of health facilities

**Table 2: Characteristic of health facility (N=30)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **n** | **%** | |
| **Screening tools** |  |  |
| Present | 20 | 66.7 |
| Absent | 10 | 33.3 |
| **Focal eye person** |  |  |
| Yes | 18 | 60 |
| No | 12 | 40 |
| **Existing eye budget** |  |  |
| Yes | 6 | 20 |
| No | 24 | 80 |
| **Priority for eye care** |  |  |
| Priority | 19 | 63.3 |
| No priority | 11 | 36.7 |
| **Health facility committee** |  |  |
| Present | 30 | 100 |

**3.1.4 Productivity of health facilities on pediatric eye health**

Figure 3 shows the mean productivity was found to be 4.95(1.21) per 100 population with 95% confidence interval (2.48-7.43). As note, there is diversity of calculated productivity in individual facility, four facilities (13.3%) had zero productivity.

**Figure 3: Distribution of health facilities individual productivity (N=30)**

Distribution of health facility characteristics with productivity whereby all the five (16.7%) health facilities with productivity of more than 10 per 100 population are from Hai district with a p value of 0.005 as summarized in Table 3

**Table 3: Distribution of health facility characteristics with productivity(N=30)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** |  | **Productivity** | |  |
|  | **Total n (%)** | **<10 per 100 population n (%)** | **>=10 per 100 population n (%)** | **P-value** |
|  |  | **25(83.3)** | **5(16.7)** |  |
| **District** |  |  |  |  |
| Mwanga | 17(56.7) | 17(100.0) | 0(0.0) | 0.005 |
| Hai | 13(43.3) | 8(61.5) | 5(38.5) |  |
| **Screening tools** |  |  |  |  |
| Present | 22(73.3) | 17(77.3) | 5(22.7) | 0.140 |
| Absent | 8(26.7) | 8(100.0) | 0(0.0) |  |
| **Focal eye person** |  |  |  |  |
| Yes | 18(60.0) | 15(83.3) | 3(16.7) | 1.000 |
| No | 12(40.0) | 10(83.3) | 2(16.7) |  |
| **Existing budget** |  |  |  |  |
| Yes | 6(20.0) | 5(83.3) | 1(16.7) | 1.000 |
| No | 24(80.0) | 20(83.3) | 4(16.7) |  |
| **Priority for eye care** |  |  |  |  |
| Priority | 19(63.3) | 15(79.0) | 4(21.0) | 0.397 |
| No priority | 11(36.7) | 10(90.9) | 1(9.1) |  |

**3.1.6: Productivity barriers in Primary pediatric eye health**

There was a range of barriers highlighted in this study as summarized in figure 4 some of the most frequently mentioned barriers include inadequate knowledge and skills, lack of screening tools, poor supervision, lack of medication and staff shortage as elaborated in figure 4.

**Figure 4: Productivity barriers for primary pediatric eye health**

**3.2 DISCUSSION**

This study highlighted what is happening in Primary Pediatric eye care in terms of productivity and barriers that health care workers are facing that hinders its efficiency in preventing late presentation of childhood ocular diseases hence increasing the burden of children with low vision and blindness. The findings from this study call attention to policy makers and other stakeholders to re-evaluate a sustainable and effective way to eliminate avoidable childhood blindness and severe visual impairment

In this study, there was female dominance (79.7%) of workers participating in this study and this is explained by a fact that most of participants were nurses involving a cultural myth that most nurses are females and could have masked other cadres. These findings seem to be like many of studies conducted including a study done in Dar es salaam (70%)(M., 2010), Rwanda (69%)(Müller *et al.*, 2010) and Pakistan (60.8%)(Tariq *et al.*, 2022). Majority of participants were youth median age 35, (45.1%). This could be attributed to the fact that most of the current generation started school at a young age compared to the previous generation and the distribution of health workers by the government has prioritized all levels and all geographical areas unlike some years ago where many workers preferred to work in urban areas. These findings are similar to study done in Malawi(Kalua *et al.*, 2014) where mean age was 35.3, and South Africa (44.6%)(Xulu-Kasaba, Mashige and Naidoo, 2021) but differ from other study in Kenya where the mean age was 29.64 (62.2%)(So, Kahaki K and Njambi L, 2016) this can be due to the fact that their sample size was small hence could affect the distribution of age of participants.

This study found that there is an increase in the number of primary health facilities in these two districts making a total of 100 health facilities which has in turn reduced the catchment population of the facilities especially the dispensaries. This could be because recently the government of Tanzania has engaged in building more health facilities and encouraged health services investment from other stakeholders to ease availability and accessibility of health services. These findings are different from a study done seventeen years ago at the same setting where the total number of health facilities in two districts were only 61(Byamukama and Courtright, 2010).

Furthermore, eye screening tools were absent in 27% of facilities and this could reflect on the overall productivity of primary eye care as most of these facilities could not attend eye cases and refer them to the higher-level facility and deviate from the main goal of the primary eye care. Although these findings were like a study done in England where lack of age- appropriate practice equipment hindered the ability to conduct eye test in young children it was different from a study done in Nigeria where less than 5% had visual acuity chart and less than a third had a functioning torch(Aghaji *et al.*, 2021). Also different from a study done in Morogoro Tanzania where all participated facilities (100%) had at least a Visual acuity chart(Müller *et al.*, 2010; Mafwiri *et al.*, 2016). This difference is attributable to the different efforts and prioritization of Primary eye care in respective study areas.

Findings from this survey found that the mean productivity of primary pediatric eye health is lower compared to the productivity for other non-ocular diseases in the same age group of U5’s. while there is limited published data on productivity of primary pediatric eye care in actual fact there is small increase of the productivity of primary eye care compared to the study done in Tanzania some years ago. There are number of explanations, first, ongoing activities and efforts which have been made so far to improve primary eye health by the government and different stakeholders. There is a hope that with increased commitment and sustainable strategies primary eye care, especially in children, can be better than now. Second, there is a diversity in productivity among health facilities, some being higher than the others which masks the total mean productivity, Third, a slight increase in productivity does not match the efforts which have been made in primary pediatric eye care which poses questions on whether the approach to this is correct. Fourth, lack of a standard guideline on a well-defined goal for productivity in primary pediatric eye care services makes no one accountable and committed to reaching the goal. Fifth, there is a possibility that community awareness on general childhood eye health is still low hence many children lack the opportunity to be attended at these health facilities. A study which was done in Rwanda and Tanzania reported lower mean productivity of less than 0.5 per 100 population(Müller *et al.*, 2010) and (Kishiki *et al.*, 2012) Different findings have been published from a study which involved three countries, Kenya, Malawi and Tanzania which found the mean productivity to be 101 per 100 population, 204 per 100 population and 52 per 100 population respectively(Kalua *et al.*, 2014). This could be due to different methodological approaches where the sample size was almost triple of this study but also cumulative effect of number of patients visits in all centers and individualization of productivity per facility gives an approximate of <1 per 1000 population.

Findings from this study have revealed that, as much as availability of screening tools, focal eye person, existing eye budget and prioritization for eye services is important, higher productivity of at least more than 10 per 100 population was of significance in one of the districts of which one among many explanations could be good supervision of these facilities. This shows that regardless of so many efforts applied, sustainable supervision might be an opening step to reach the desired goal in PEC

The number of barriers to higher productivity found in this study includes: -

Inadequate knowledge and skills

Inadequate knowledge and skill have been mentioned as the most common barrier to practice and productivity by participants making it difficult to recognize conditions that need urgent referrals and in turn lead to late presentation of children at higher level facilities with severely impaired vision. Shifting staff from one area to the other has contributed to this as some of the trained people at the facility shift to other places or are on academic leave. This makes the rest of the practitioners not aware of what to do when these cases are present. Majority of workers recommended regular refresher training to all health workers to cover for the absence of few who won’t be available when needed. Another study done in Tanzania had same findings(M., 2010)

Lack of medicines

It has been found in this study that most practitioners use eye ointments like chloramphenicol and tetracycline to treat ocular conditions in children. It has also come to my understanding that not all the newborns are given antibiotic eye ointment soon after being delivered due to lack of medicine. So, many newborns are given this medication not to prevent ophthalmia neonatorum but to treat it when a child develops it. In addition to this, medication such as sodium cromoglycate and Dex chloramphenicol are not allowed by the MoH to be prescribed at the primary health facilities, this makes it difficult for practitioners who are aware of ocular allergies in children to manage these children in time.

Staff shortage

Staff shortage have been underscored in this study as it has been found in Many other studies from Nigeria(Aghaji *et al.*, 2021), Tanzania(Mndeme *et al.*, 2021).this can be explained by the fact that competing conditions in children under five like malaria, HIV, malnutrition, diarrhea, upper respiratory infections as highlighted in the IMNCI pause another challenge on prioritizing eye conditions since eye conditions are categorized under non-communicable diseases in the health sector strategic plan of which its monitoring and evaluation is not as regular as those mentioned earlier. World health organization report on Vison 2020 highlighted the professional workforce as a remaining challenge to achieving avoidable blindness(Abdulhussein and Abdul Hussein, 2023)

Lack of screening tools

Absence of diagnostic tools in nearly a third of facilities contribute to poor practice of health workers on eye conditions which impacts overall productivity of the facility as most of the practitioners could not attend any eye related condition not to mention in pediatric group. However, unlike previous studies in this area, more than half of facilities were having diagnostic tools provided by the donors. This is to be appreciated as a significant milestone in Primary eye care.

Poor supervision

Poor supervision in pediatric eye health was found to be a barrier to productivity as it gives unmatched energy compared to other diseases like malaria, HIV, URTI’s and Malnutrition. This can be explained partly by prioritization of eye care services yet considering its position in Tanzania Health Sector Strategic Plan where it falls under non-communicable diseases. But also, the current supervision is not determined to improve eye health services but rather fulfilling the responsibilities. Same findings were reported in a study done in Nigeria and Tanzania (M., 2010; Jolley et al., 2017; Aghaji et al., 2021). Different findings were discussed by (Yasmin and Schmidt, 2022) in a program evaluated study where supervision was constantly implemented.

Explanation of these results on productivity may be limited by poor documentation on the registry book by the individual health facilities.

**CONCLUSION**

This study underscores the low productivity of primary pediatric eye care services, with most facilities recording fewer than 10 cases per 100 population. Key factors influencing productivity include workforce distribution, training background, and healthcare facility type. However, persistent barriers—such as insufficient knowledge, lack of screening tools, poor supervision, medication shortages, and understaffing—remain major obstacles.

The strength of this study is that it is among a few studies that assessed the productivity of primary eye care with limited published studies found recently on primary pediatric eye care. But also, it has shown clearly the easiest way to assess productivity at primary health level.

This study recommends that A mixed study should be conducted to have a comparative component between qualitative and quantitative data. And critically addressing these challenges through strategic improvements in training, resource allocation, and healthcare system support by the policy makers and other stakeholders to enhance productivity in pediatric eye care services.

**ETHICAL APPROVAL**

The ethical clearance was sought from Kilimanjaro Christian Medical University-Clinical Research Ethical Reviewing Committee with **registration** **No.PG 85/2023.** Permission to conduct research was sought from the District Medical Officers of respective Districts

**Consent**

As per international standards or university standards, Participants’ written consent has been collected and preserved by the author(s).

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

I hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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