1 **Household socio-economic status and likelihood of HIV infection among under five-year**

2 **children in Muheza district, north-eastern Tanzania**

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Abstract

Background: There are evidences of the association between socio-economic factors and HIV prevalence in Sub-Saharan Africa. However, there is dearth of information on such relationship in Tanzania. Here, we present data on the relationship between household's socio-economic factors and HIV prevalence among under five-year children in Muheza district, Tanzania.

Methods: We conducted a facility-based study from June 2015 to June 2016 in which we enrolled under five-year children born to HIV positive mothers. Information on HIV status of the child and socio-demographic characteristic of the head of the household was collected using a structured questionnaire. Data analysis was done using STATA version 13.0.

Results: A total of 576 mothers/guardians were interviewed each with respective HIV exposed under five-year child. Children who belonged to a head of household with at least a high education level (AOR= 0.4, 95% CI 0.2-0.8) and living in a relatively wealthy household (AOR = 0.5, 95% CI 0.2-0.9) was associated with reduced odds of HIV infection among children. Univariate analysis revealed that the odds of HIV infection was three-fold (COR = 2.9, 95% CI 1.2-7.0) higher among children living in rural than in urban areas. The heads of household living in rural areas (AOR=0.3 95% CI 0.1-0.9) had low education level compared to those living in urban areas.

Conclusion: Children who belong to the head of households with high educational level, high household wealth were associated with reduced likelihood of HIV infection in Tanzania. Children living in rural areas had increased likelihood of acquiring HIV infection. These findings stress the need to focus on improving education status of the population and economically disadvantaged populations as a strategy for HIV prevention and control measures.

45   **Keywords: socio-economic, education, household, children, HIV, Tanzania**

46   Introduction

47   By the end of 2016, Sub-Saharan Africa had the highest burden of paediatric HIV with over 90%

48   of the estimated 2.1 million children living with HIV worldwide [2]. Tanzania is one of the

49   countries in Sub-Saharan Africa most devastated by this global pandemic. In 2016, estimated 1.4

50   million people in Tanzania were living with HIV and 18% of these infections were due to mother

51   to child transmission (MTCT) [3]. Maternal immunological status with a Cluster of

52   Differentiation 4 (CD4) cell count less than 200 cell per mm^3 near delivery, high maternal viral

53   load, advanced stage of maternal HIV infection have been observed to increase the risk of MTCT

54   [4, 5]. These risk factors operates through socio-economic statuses such as occupation, marital

55   status, education and income to bring a health outcome among children [6, 7].

56

57   Studies have indicated that higher education attainment is a proxy for higher socio-economic

58   status which is an indication of increased wealth [8]. It has been argued that in early HIV

59   epidemic, higher education achievement was associated with higher wealth, and increased

60   mobility that potentially increases exposure to HIV infection [9]. However, as the epidemic

61   matures the pattern shifts towards reduced risk among the wealthy and higher educated

62   individuals [10-12]. Whilst HIV has been classified as the disease of the poor, the causality of

63   which one cause the other between poverty and HIV is complex and challenging [13, 14]. Over

64   the recent years, the burden of HIV has been reported to be greater among the poorer and least

65   educated populations [11, 15, 16]. This is likely to be due to their engagement in risky sexual

66   behaviours and transactional sexual relationships and limited access to health facilities [17].

67

68 According to the World Bank report, it has been observed that improved education leads to

69 poverty reduction, boosts economic growth and increases income [18]. Countries with high

70 HIV/AIDS burden are continuously stressing the need to put the goal for universal education for

71 all as an important Sustainable Development Goal as well as a strategy for combating the

72 HIV/AIDS epidemic [19-22]. In countries with mature HIV epidemics, whereby HIV/AIDS

73 education programmes have been introduced, high education attainment appears to become

74 protective against HIV [11, 16]. Higher education levels attainment has been associated with

75 decreased risk of HIV infection especially among younger people in Ethiopia, Zambia, Uganda

76 and Tanzania [10, 23-25]. This association has been attributed, in part to increased awareness,

77 adoption of safe behavioral practices and prompt access to preventive and curative health

78 services by the more educated individuals [13]. Several existing evidence in support of the

79 positive impact of education on better health outcomes are available [11, 14, 16, 26, 27], most of

80 them suggest that education attainment imparts similar influences on HIV burden, reduced child

81 mortality and increased survival.

82

83 Little is known about the effect of head of households' socio-economic (SES) on HIV prevalence

84 of their children in Tanzania. It is important that this relationship is investigated in order to

85 understand factors influencing paediatric HIV. This study was therefore carried out to determine

86 the relationship between household SES and HIV prevalence among under five-year children in

87 Muheza district, Tanzania.

88

Methods

Study area and population

This facility-based study was carried out from June 2015 to June 2016 in Muheza district, in north-eastern Tanzania (4^0, 45'S; 39^000'E). The study population involved mothers/guardians with their respective HIV exposed under five-year children. Using a multistage sampling approach, we enrolled a random sample of mother/guardian child pairs. More details of this study have been described elsewhere [28]. More than 79% of households in the district are involved in agriculture as the main source of livelihood and income. The remaining proportion include petty traders, fisherman and livestock keepers. The district has 116 primary schools and 31 secondary schools [29]. The district has a total of 46 health facilities which include one hospital, four health centers and 41 dispensaries.

Data collection

Socio-demographic factors of the mother/guardian-child pairs (education, age, sex, marital status, distance from a health facility, occupation, residence; head of household (age, sex, education, size of household, proxy variables for household wealth) were collected using a structured questionnaire. The household's wealth was also assessed based on four key questions; namely primary house construction materials, main source of fuel used for cooking, ownership of land and presence/absence of electricity.

Information on the HIV status of the children was extracted from data-base available at the district hospital. Data on education level was based on the Tanzanian system whereby,

111   individuals attend 7 years of primary education, 4 years of secondary education (ordinary level),

112   and 2 years of advanced secondary education. After ordinary secondary education or advanced

113   secondary education, individuals meet criteria for college education or qualify for University

114   education after advanced level of secondary education.

115

116   **Data management and analysis**

117   Data analysis was performed using Stata software version 13. For the child HIV status was

118   categorized into a binary outcome variable as "HIV positive" and "HIV negative". Education

119   level attainment was categorized into a binary outcome ('low education' or 'high education'),

120   measured as the number of formal school years attended by the respondent. Low education level

121   was recorded as 0-6 years schooling and high education as 7+ years schooling. The household

122   wealth was categorized into a binary variable 'high' or 'low'. Size of the household was

123   categorized into two: less or equal to seven people and more than seven people living in the same

124   household. Multiple logistic regression was done by including variables from univariate analysis

125   with P-value of ≤0.2. Multiple logistic regression analyses were used to examine the associations

126   between various socio-economic factors of the head of household and the child's HIV infection

127   status. Backward Logistic Regression method was employed by removing variables with highest

128   P-value until the remaining variables in the final model had a P-values ≤ 0.05 and adjusted odd

129   ratios (AOR) at 95% confidence interval. Crude odd ratios (COR) with corresponding P-values

130   were also presented.

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134 Ethical considerations

135 Ethical approval was obtained from Medical Research Coordinating Committee of the National

136 Institute for Medical Research in Tanzania with reference number NIMR/HQ/R.8a/Vol. IX/1978.

137 Permission to conduct this study was granted by Muheza District Council Authority. Written

138 informed consent was obtained from each mother/guardian before recruitment.

139 Results

140 Socio-demographic characteristics of the respondents

141 A total of 576 mothers/guardians each with HIV exposed under five-year child were interviewed.

142 Out of 576 under five-year children, 281 (48.8%) were males and 295 (51.2%) were females. A

143 total of 379 (65.8%) under five-year children were aged ≤ 24 months and 197 (34.2%) aged 25-

144 59 months. More than half (n=309) of under five-year children were livingfar (more than 30

145 minutes walk by foot) from a health facility. A total of 61 under five-year children were

146 confirmed to be HIV positive whereby 75.4% (46) of them, belonged to the head of households

147 who had completed primary (7 years) level of education (Figure 1). The education level of the

148 heads of household were: 58 (10.1%) had less than 7 years of education, 518 (89.9%) had 7+

149 years of education. Majority (82.1%, n=473) of the heads of household had completed primary

150 (7 years) level education. Forty-two (7.3%), 3 (0.5%), had 8-11 years and 12+ years of schooling

151 respectively. A total of 445 (73%) household heads were living in rural areas. Households with

152 low wealth were 441 (77%) and those with high wealth were 135 (23%).

153

154 Figure 1:

155 **Socio-economic factors associated with HIV infection among under-five year children**

156 In multiple logistic regression, higher odds of HIV infection was observed among children aged

157 more than two years (AOR=3.0, 95% CI 1.5-5.9) than in younger children. Likewise, higher

158 likelihood of HIV infection was 2.4 (AOR= 2.4 (1.2-5.0) times higher among those who lived far

159 from a health facility as compared to their counterparts. The odds of HIV infection in children

160 was lower (AOR= 0.4, 95% CI 0.2-0.8) among those with a head of household who had attained

161 high education level and in those living in households with high wealth (AOR = 0.5, 95% CI 0.2-

162 0.9) (Table 1). At univariate analysis, the odds of HIV infection was 3 times higher among

163 children living in rural areas than urban areas. Guardian's marital status, occupation and

164 education did not show any association with HIV infection among under five-year children.

165

166 **Table 1: Household's socio-economic factors associated with HIV infection among under**

167 **five-year children**

Variables	Proportion (%)	COR (95% CI)	§P value	AOR (95%CI)	*P value
Child age (months)					
≤24	65.8	1		1	
25-59	34.2	5.1 (2.9-9.1)	< 0.001	3.0 (1.5-5.9)	0.002
Residence					
Urban	22.7	1		1	
Rural	77.3	2.9 (1.2-7.0)	0.02	1.5 (0.6-4.0)	0.4
Distance to health facility					

Near (≤30 minutes)	46.4	1		1	
Far (>30 minutes)	53.6	3.2 (1.7-6.0)	<0.001	2.4 (1.2-5.0)	0.02
Head of household education					
Low (0-6 years schooling)	10.1	1		1	
High (7+ years schooling)	89.9	0.5 (0.3-1.1)	0.08	0.4 (0.2-0.8)	0.02
Household wealth					
Low	77	1		1	
High	23	0.8 (0.4-1.6)	0.2	0.5 (0.2-0.9)	0.03

168   **Notes:** (a) Total sample size, N = 576 (b) *P values of AOR; §P values of COR (c) COR = Crude

169   odd ratio; AOR = Adjusted odd ratio; CI = Confidence interval

170

171   **Head of household's education**

172   Results of the multiple logistic regression model showed significant association between level of

173   education, and gender, size of the household, wealth. Males who were heads of household (AOR

174   =2.0, 95% CI 1.1-3.5) had high education level attainment compared to their counterpart

175   females. The households with high wealth were significantly associated with high education

176   level of the heads of household (AOR =1.5, 95% CI 1.3-2.0). Heads of household living in rural

177   areas (AOR=0.3 95% CI 0.1-0.9) had low education level compared to those living in urban

178   areas. In the household with more than seven people living in the same house (AOR=0.5, 95%

179   CI 0.2-0.9), was significantly associated with low education level of the head of household

180   (Table 2).

181

182

183 **Table 2: Factors associated with high education level attainment of the heads of household**

Variables	Proportion (%)	COR (95%CI)	§P value	AOR (95%CI)	*P value
Head of household sex					
Female	29.9	1		1	
Male	70.1	2.2 (1.3-3.9)	0.004	2.0 (1.1-3.5)	0.02
Residence					
Urban	22.7	1		1	
Rural	77.3	0.2 (0.1-0.6)	0.01	0.3 (0.1-0.9)	0.03
Size of household					
≤ 7 people	90.1	1		1	
> 7 people	9.9	0.4 (0.2-0.7)	0.01	0.5 (0.2-0.9)	0.04
Household wealth					
Low	77	1		1	
High	23	1.4 (1.3-1.8)	0.01	1.5 (1.3-2.0)	0.02

184 **Notes:** (a) Total sample size, N = 576 (b) *P values of AOR; §P values of COR (c) COR = Crude

185 odd ratio; AOR = Adjusted odd ratio; CI = Confidence interval

186

Discussion

188 Our findings indicate that high education level of the heads of household and high household

189 wealth have higher probability of reduced odds of HIV infection among under five-year children.

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190   The likelihood of acquiring HIV infection is higher among under five-year children located in

191   rural than in urban areas. Households with higher wealth were significantly associated with high

192   education attainment of the heads of household. Moreover, the heads of household located in

193   rural areas had low education level attainment compared to those in urban areas.

194

195   Education is one of the most important component of social and economic development [30].

196   Education has positive spill-over effects whereby all people in the society will benefit even if

197   only few of them have received education [13]. The observed reduction on the likelihood of HIV

198   infection among under five-year children in the households with heads with higher education

199   level in this study could be due to adoption of preventive strategies on HIV/AIDS among higher

200   educated individuals [13]. A study in Zambia has reported that the number of years one spent in

201   school have an impact on the knowledge and ability to follow prevention strategies against

202   HIV/AIDS transmission, that influence better health outcomes and child survival in the

203   community [11, 16, 31]. The assumption that effects of educational attainment of the head of

204   household on the likelihood of acquiring of HIV infection in children is likely to be exerted

205   through mediator factors such as the power of decision to send the child to clinic to access

206   interventions [32, 33]. It has been argued that, a set of proximate determinants can be influenced

207   by changes in socio-economic determinants or by interventions which have a direct effect on

208   biological mechanisms to influence the risk of morbidity and mortality among children (34). This

209   implies that educational attainment in itself cannot, however, be isolated from other socio-

210   economic factors as the grounds of HIV risk reduction.

211

212 Moreover, levels of knowledge, literacy and education tend to be lower among the poor and

213 individuals living in rural areas which greatly influence household decisions with regard to the

214 proximate determinants of health [18, 35]. However, educational opportunities might be quite

215 limited in rural areas with poor road infrastructures that make the formal school system difficult

216 to enter. A previous study in Tanzania, demonstrated increased HIV prevalence in rural

217 population with less educated individuals at an increased risks [10]. Studies conducted in Sub

218 Saharan Africa have reported that children living in rural areas are more prone to home

219 deliveries that predispose them to HIV infection [36-38]. This could be attributed to

220 inaccessibility to health promotion messages regarding HIV/AIDS prevention in rural compared

221 to urban settings or women's participation in household decision making to access health related

222 information and services in those male-headed household.

223

224 Higher educational achievement associated with higher household wealth observed in this study

225 has also been reported elsewhere [14, 35, 39]. More-educated individuals are most likely to have

226 more income and thus more control over their living [9]. They are likely to place higher value on

227 future endeavors and thus be more motivated to adopt preventative measures particularly against

228 infectious disease risks [40]. In addition, the interaction effects between education and wealth

229 could be very positive; when individuals have resources and the ability to use those resources,

230 they can act on safeguarding their health seeking behavioral patterns [41]. This suggest that a

231 convincing interaction do exist between wealth and education, as well as between education and

232 the risk of acquiring diseases among family members living in the same household. Moreover,

233 higher income at household level is interrelated with higher educational attainment and better

234 health outcomes which is attributed, in part to more frequent and more intensive use of health

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235   services at both private and public health sectors [42]. A recent study in South Africa reported

236   decreased risk of HIV infection among individuals living in less poor household and having

237   tertiary education [43]. This indicates that strategies that enhance economic empowerment and

238   provision of quality education to every individuals is highly recommended in order to bring

239   positive health outcomes in the society.

240

241   The study has limitations including the possibility that our results could have been affected by

242   unmeasured confounders, which cannot be eliminated. Since some variables may not fully be

243   adjusted during analysis, especially when dealing with proxy variables for household wealth

244   which might be subjected to misclassification. Selection bias, as only those who have attended at

245   the health facility got higher chance to be selected. These individuals may differ from those who

246   were left to be unidentified in the community.

247

248   # Conclusion

249   High educational level attainment of the heads of household and high household wealth was

250   associated with reduced likelihood of acquiring HIV infection among under five-year children

251   living in the same household. Under five-year children located in rural areas had increased

252   likelihood of acquiring HIV infection than their counterparts in urban areas. Thus, there is a need

253   to focus on improving education and general knowledge to the whole population and

254   economically disadvantaged populations as complementary strategies in HIV/AIDS control and

255   prevention programmes.

Authors' contributions

VMB conceived the study. VMB, CCM, LEGM, SGM, ES contributed to the design of the approach. VMB analysed and interpreted the data. VMB wrote the manuscript and all authors read, contributed to, and approved the final version of the manuscript.

Acknowledgments

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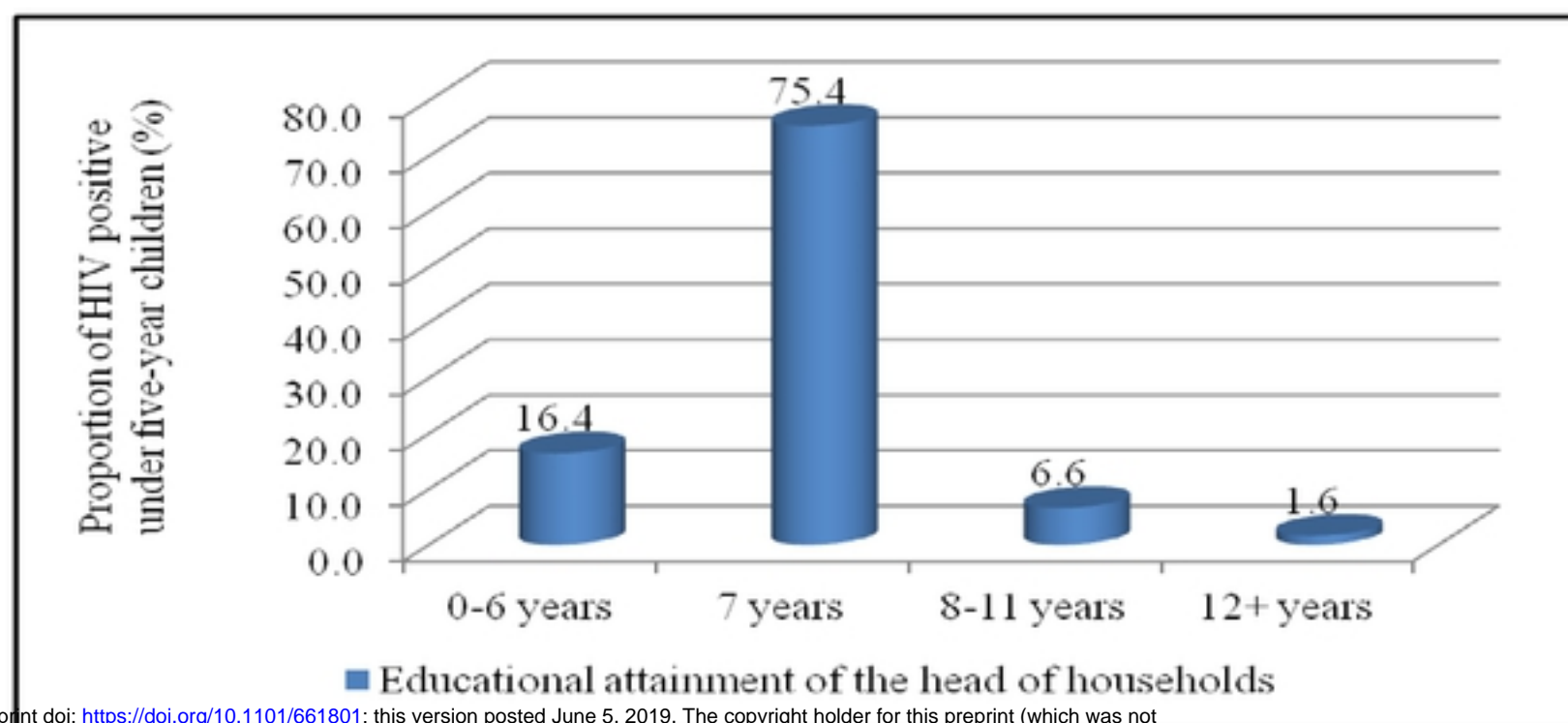
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Figure 1: Proportion of HIV positive under five-year children by educational attainment of their head of households

Figure