Disability, Social Functioning and School Inclusion Among Older Children and Adolescents Living with HIV In Zimbabwe

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Abstract

Objective Increasing numbers of children with HIV are surviving to adolescence and encountering multiple clinical and social consequences of longstanding HIV infection. We aimed to investigate the association between HIV and disability, social functioning and school inclusion among 6 to 16-year olds in Zimbabwe.

Methods HIV-infected children receiving antiretroviral therapy from a public-sector HIV clinic, and HIV-uninfected children attending primary care clinics in the same catchment area were recruited. Standardised questionnaires were used to collect sociodemographic, social functioning and disability data. Multivariable logistic regression was used to assess the relationship between HIV status and disability and social functioning.

Results We recruited 202 HIV-infected and 285 HIV-uninfected children. There was no difference in age and gender between the two groups, but a higher proportion of HIV-infected children were orphaned. The prevalence of any disability was higher in HIV-infected than uninfected children (37.6% *vs*. 18.5%, p<0.001). HIV-infected children were more likely to report anxiety (adjusted odds ratio (aOR) 4.4; 95% CI 2.4, 8.1), low mood (aOR 4.2; 2.1, 8.4) and difficulty forming friendships (aOR 14.8; 1.9, 116.6) than uninfected children. Children with HIV also reported more missed school days, repeating a school year and social exclusion in class. These associations remained apparent when comparing children with HIV and disability to those with HIV but no disabilities.

Conclusions Children with HIV commonly experience disabilities, and these are associated with social and educational exclusion. Rehabilitation and support services are needed to facilitate educational attainment and social participation in this population.

Introduction

In 2016, worldwide approximately 160,000 children were newly infected with HIV (1). Of the estimated 2.1 million children aged under 15 years living with HIV, nearly 90% live in Sub-Saharan Africa (SSA) (1). The global scale-up of antiretroviral therapy (ART) programmes has meant that increasing numbers of children with HIV who would previously have died in infancy without treatment are now surviving to older childhood and adolescence. However, there is increasing evidence that childhood HIV infection is associated with chronic multi-system complications, resulting in hearing, cognitive, mobility and visual impairments (2, 3).

HIV may lead to impairments through a variety of mechanisms. For example, HIV-mediated immunosuppression may lead to opportunistic infections such as CMV that can cause visual impairment (4). The risk of impairments is increased if initiation of ART is delayed, as is common in many resource-limited settings (5). ART itself may also contribute to impairment; for instance, nucleoside analogue reverse-transcriptase inhibitors (NRTI) commonly used at the time of ART roll out for children in SSA (*e.g.* stavudine and lamuvidine) is linked to hearing loss (6, 7). Zidovudine has been independently linked to myopathy (8), which may lead to physical impairments. Once established, impairments may not be completely reversed by ART (9) and negatively impact on social functioning and schooling (3, 10). In other words, HIV or its treatment may lead to disability, which is defined as the restriction of participation in society of an individual due to an underlying impairment in combination with attitudinal and environmental and other barriers (11). Socio-economic deprivation, often associated with HIV infection (12), potentially exacerbates disability by further restricting participation in society. To optimise the quality of life and long-term care amongst those living with HIV and their families, HIV programmes need to broaden their focus and address longer-term consequences of HIV infection, including the impact on schooling and social inclusion. Even in the absence of HIV, education and schooling are a major global concern for children and adolescents with

disabilities, who are substantially less likely to be enrolled in school and, even when enrolled, lag behind their peers in educational attainment (13). HIV is likely to magnify these issues among children due to poverty resulting from parental ill health, food insecurity and unemployment (14).

We therefore conducted a cross-sectional study to investigate the association between HIV and disability, social functioning and school inclusion among HIV-infected children compared to uninfected peers in Zimbabwe.

Methods

Study setting and participants

HIV-infected children aged 6 to 16 years and receiving either first or second line ART for at least six months were consecutively recruited from Harare Central Hospital (HCH); this is the largest public-sector hospital in Harare, providing HIV care for more than 3,000 children. This age range was selected because it represents children of school going age. Recruitment was restricted to the first five eligible participants a day for logistical ease. Exclusion criteria were being acutely ill i.e. having a respiratory tract or other acute infection or tuberculosis, not residing in Harare and no guardian consent and/or participant assent.

A comparison group of HIV-uninfected children aged 6-16 years was recruited from primary health care clinics (PHC) in seven high-density communities from the same catchment area served by the clinic from which the HIV-infected participants were enrolled. Provider initiated HIV testing and counselling was offered by the PHCs to all children attending for acute care regardless of the reason for presentation, and those who tested HIV-negative were invited to participate and attend pre-booked appointments for assessments. The same exclusion criteria were applied to HIV-uninfected children.

Data collection

Socio-demographic data including age, sex and orphan status were recorded. Trained research nurses administered standardised questionnaires to collect data on disability, education and social functioning. The Washington Group/UNICEF Child Functioning and Disability 21 Question Set was administered jointly to all children and caregivers by a research nurse to assess disability (15). This question set is validated for children aged 2-17 years. Self-reported functional difficulties were defined as binary variables in the following domains: vision, hearing, walking, speech, learning, memory, self-care, anxiety, low mood, difficulty controlling behaviour, dealing with change, forming friendships and concentration. Disability was defined as reported difficulties in any of the functional domains. Additional information on school and social functioning was collected, including the following: school enrolment, school attendance, repeated school year, problems getting help from teachers and friends, interaction with other children (leadership, play, bullying) and inclusion in lessons and school activities. Caregivers of HIV-infected children were asked additional questions relating to HIV diagnosis, testing, ART history, and children's awareness of diagnosis. At the time of enrolment, CD4 count was determined using an Alere PIMA $CD4^+$ (Waltham, Massachusetts, USA) and HIV viral load was measured using COBAS Ampliprep/Taqman 48 Version 2.0 (Roche, Rotkreuz, Switzerland).

Ethics

Ethical approval was obtained from the Medical Research Council of Zimbabwe (MRCZ/A/1856), the Biomedical Research and Training Institute (AP125) Institutional Review Board, Harare Hospital Ethics Committee and the London School of Hygiene and Tropical Medicine (LSHTM) Ethics Committee (8263). All guardians gave written consent, and participants gave assent to participate in the study.

Data management and analysis

Data were collected using paper forms and entered into a Microsoft Access database using optical mark recognition software (Cardiff TELEFORM Intelligent Character, Version 10.7), which has inbuilt quality control checks. Paper forms were manually checked for missing data and inconsistencies before being captured. Further internal and external consistency checks were carried out using database queries.

Data completeness was assessed by summary and descriptive statistics. There was a low proportion of missing data (<6%) in HIV-infected and uninfected children for demographic, clinical, disability and school functioning and social inclusion data. The prevalence of functional difficulties and disability was summarised as frequencies and percentages for each variable by HIV status. Continuous variables were summarised as mean and standard deviation (SD) when normally distributed and median and interquartile range (IQR) when not. Univariable logistic regression analysis was used to compare functional, school and social outcomes between HIV-infected and uninfected children. Multivariable logistic regression was used to adjust each functional outcome of interest for a priori defined variables of age and sex. Orphan status and previous infection/co-morbidity did not significantly affect the fit of the model ($p<0.05$) on likelihood ratio testing and therefore were excluded. Hence, the final model was adjusted for age and sex alone. All statistical analyses were carried out using Stata v13.0 (College Station, Texas: StataCorp LP).

Results

Baseline characteristics of participants

We recruited 202 HIV-infected children (median age 11 years [IQR 8-13]; 48.0% female) and 285 uninfected children (median age 10 years [IQR 8-13]; 48.8% female). There were no significant differences in age or sex between the two groups, but HIV-infected children were

more likely to be orphaned (p<0.001) (Table 1). Among HIV-infected children, the median age at HIV diagnosis was 5 years [IQR 3-7] and the median CD4 count was 726 cells/ μl [IQR 476-941]. The median duration of ART was 2 years [IQR 1-5] and the median age of ART initiation was 8 years [IQR 5-10].

Functioning and disability

The prevalence of any self-reported difficulties in functioning (*i.e.* disability) was higher in HIV-infected children compared to uninfected children (37.6% compared to 18.8% p<0.001) (Table 2). Amongst those with HIV, the most common types of disability were learning (reported by 23.2%) and memory difficulties (reported by 17.8%). Difficulties with seeing (7.7%), hearing (4.8%) and walking (2.5%) were also reported more commonly amongst HIV infected children.

After adjustment for age and sex, the odds of any disability were 2.8 times higher in HIV-infected than HIV-uninfected children (95% CI 1.8, 4.2 p<0.001). HIV-infected children were significantly more likely to report visual (aOR 3.0; 1.3, 6.9), hearing (aOR 3.4; 1.0, 10.5), speech (aOR 3.8; 1.1, 13.9), learning (aOR 3.9; 1.4, 3.4) and memory problems (aOR 3.5; 2.0, 6.6) (Table 2). In addition, HIV-infected children were more likely to report anxiety (aOR 4.4; 2.4, 8.1), low mood (aOR 4.2; 2.1, 8.4) and difficulty forming friendships (aOR 14.8; 1.9, 116.6) compared to their uninfected peers. There was no significant association between age at HIV diagnosis, age of ART initiation, CD4 count, viral load, ART duration or previous comorbidity and disability among HIV-infected children (Table 3).

Schooling and social inclusion

School enrolment rates were high among all children (96.0% in both HIV-infected and uninfected groups). However, children living with HIV were more likely to have repeated a school year (aOR 3.2; 1.6, 3.8) and on average, missed more days of school in the preceding month (mean 0.9 days (range 0-15 days) vs. 0.3 days (range 0-7 days). HIV-infected children more frequently reported not receiving help from teachers (aOR 2.1; 1.2, 3.8) or friends (aOR 3.0; 2.0, 4.5) at school. They were more likely to feel excluded in lessons and activities (aOR 4.7; 2.7, 8.3) and more likely to be physically and verbally bullied by other children (aOR 3.7; 2.2, 6.0). Among children with HIV, those with disabilities were less likely to be enrolled in the same school grade as their age peers (aOR 3.3; 1.7, 6.1) and more likely to repeat a school year (aOR 1.9; 1.0, 3.6) compared to HIV-infected peers without disability. They were also more likely to report that their peers did not look up to them as leaders (aOR 2.1; 1.4, 3.4) and that they experienced violence from their peers (aOR 2.5; 1.3, 4.8) (Table 4). Amongst children with disability, those with HIV were less likely to be enrolled in school, more likely to have needed to repeat a school year and much more likely to have been physically or verbally bullied than disabled children without HIV (Supplementary Table 5).

Discussion

This study demonstrates a high prevalence of physical and cognitive functional difficulties among HIV-infected children compared to their uninfected peers. Children with HIV were more likely to report low mood, anxiety, difficulty forming friendships, repeating a school year and to experience poor social support at school, particularly when HIV and disability co-existed.

Other studies have reported increased physical, sensory and cognitive difficulties in HIV-infected children compared to those uninfected (3,16-22). Developmental delay is strongly

associated with HIV in SSA (2), affecting up to 78% of children (22). Fortunately, in the post-ART era, severe forms of cognitive impairment in children appear to be decreasing; however, the prevalence of mild impairment remains largely unchanged and may even be increasing (23). A number of studies have assessed the prevalence of cognitive (18, 22, 24, 26-29) and motor (18, 19, 21, 23-29) impairments among HIV-infected and uninfected children; however, to date these have largely focused on infants and younger children before school age. Our study highlights both the increased prevalence of learning difficulties among HIV-infected school-age children, but also shows that learning difficulties are common in uninfected children in Zimbabwe.

This study further demonstrates the additional burden of low mood and anxiety amongst HIV-infected children. There is evidence of a strong bidirectional association between mental health and educational attainment with mood and anxiety disorders having a direct effect on early school leaving, substance misuse and disruptive behavioural disorders (30). Mental health issues impact negatively on treatment compliance and retention in social care and school through the fear of disclosing HIV status and social ostracism (31). Socialising and making friends at school are key protective factors for psychosocial wellbeing in children with HIV, whereas negative peer interactions such as lack of friends, bullying and being beaten by friends have been identified as risks (32). Therefore, school peer support interventions should be adopted as they have been shown to reduce psychological distress, depression, anxiety and anger in children with HIV (33, 34).

Similar to our findings, a recent Malawian cross-sectional study found that a high proportion of HIV-infected school children had hearing impairment identified by extensive audiological testing (10). These children were less likely to attend school and had poorer emotional and school functioning than HIV-infected children without hearing loss. Furthermore, only 40% of

caregivers accurately perceived their child's hearing loss, and few had sought treatment, implying that routine screening may be necessary as disability may be underreported (10).

Our study found no significant association between HIV disease severity or treatment factors and disability. However, previous studies have shown a relationship between CD4 count, viral load at enrolment, ART duration and disability (2,10). The Malawian study mentioned above (10) found hearing loss to be significantly associated with HIV WHO Stage 3 or 4 disease, but not duration of ART or CD4 count. A recent systematic review of disability and HIV in SSA found a significant dose-response relationship between indicators of disease progression (CD4 or WHO stage) and disability in 48% of studies (2). The evidence suggests that earlier ART initiation in children may reduce the risk of impairments and consequent disability, but once established, ART alone may not be sufficient to enable children with HIV to lead healthy lives (2).

Given the high prevalence of physical and sensory impairments amongst children living with HIV, our study underlines the need for increased availability of rehabilitation services to support school age children and adolescents with HIV. Currently, the few existing services are mainly located in urban areas or private health facilities which limits access for many (35). Greater support for children with learning difficulties is required in schools to facilitate social inclusion and educational attainment (36) as learning, remembering, and concentration appear to be common in HIV-infected and uninfected children.

Although incorporating disability inclusive approaches into HIV treatment and care is likely to increase the social participation and school functioning of children with HIV (37), so far only 5 of 18 countries (27%) in Eastern and Southern Africa have recognised the need for specific support services and interventions for people with disabilities in their national strategic responses to HIV and AIDS (38). Although Zimbabwe is one of these countries, the findings

of this study suggest that further work is required to extend services to support school age children with HIV.

To our knowledge, this is the first study to estimate the prevalence of disability and its association with school and social functioning in HIV-infected and uninfected older children in a Sub-Saharan African population. Study limitations include the potential selection bias from non-probability based sampling: selecting the first five children attending the HIV clinic may have led to under-reported disability if children with physical or behavioral disabilities were more likely to attend at clinic later. Alternatively, children with disabilities may have been less likely to go to school and thus be the first to attend. Furthermore, misclassification and/or recall bias from the use of self-reported functional difficulties and disability without contemporaneous clinical measures of the impairments or their cause, coupled with the fact that carers may not accurately perceive their children's functional difficulties, may have also led to under-reported disability.

Unfortunately, socioeconomic data such as household income and size, asset ownership, caregiver education and food security were not available which meant that analyses could not be adjusted for socio-economic status. This is important as poverty and disability are likely to reinforce each other, leading to vulnerability and exclusion. Children who are poor are more likely to become disabled through poor healthcare, malnutrition, or dangerous living conditions. Once disabled, they are more likely to be denied basic resources that would mitigate deepening poverty (39). There is evidence that poverty is a major contributor to poor treatment adherence among in HIV-infected children. (40). Furthermore, evidence from a large cross-sectional study of South African adolescents from deprived urban areas showed that orphanhood by AIDS was significantly related to childhood depression, peer problems, post-traumatic stress and behavioural problems; however, adjusting for poverty indictors in this

study attenuated the association between AIDS-orphanhood and these psychological problems (41).

Although it is evident that disability is common in HIV-infected children and has a major impact on their lives, further research to understand the aetiology of different impairments is needed to inform the design of effective interventions and appropriate rehabilitation services. Examples of the type of interventions for HIV-infected children that could be introduced include: 1) routine screening for impairments 2) linking HIV care to rehabilitation and additional clinical services (*e.g.* ENT in the case of hearing impairment) 3) interventions to promote school inclusion and social acceptance among children with HIV (e.g. through training of parents, teachers and peers).

In conclusion, this study suggests physical and cognitive functional difficulties are common among children with HIV. These difficulties are associated with school exclusion, including impaired educational progress, difficulty forming friendships and reduced ability to participate in lessons and activities. Further work is required to develop tools to better detect and understand the need for rehabilitation and support services within paediatric HIV programmes.

Competing interests

The authors have no competing interests to declare.

Authors' contributions

RAF and HK designed the study. RR performed the statistical analysis and drafted the report. All authors provided feedback on the draft manuscript and approved the final manuscript.

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Tables and Figures

Table 1. Baseline Characteristics of HIV-infected and HIV-uninfected Children in Zimbabwe

Characteristic	HIV+ n=202 n (%)[a]	HIV- n=285 n (%)	p value
Age			
6 -11 years	132 (65.4)	165 (57.9)	0.06[b]
12 -16 years	70 (34.6)	32 (42.1)	
Median (IQR) years	*11 (8, 13)*	*10 (8, 13)*	0.61[c]
Sex			
Female	97 (48.0)	139 (48.8)	0.11[b]
Orphan status			
Single orphan	69 (34.2)	25 (8.8)	<0.001[b]
Double orphan	28 (13.9)	7 (2.5)	
Not orphaned	98 (48.5)	245 (85.9)	
Age at HIV diagnosis			
Median (IQR) years	*5 (3, 7)*		
Age at ART initiation			
Median (IQR) years	*8 (5, 10)*		
ART duration			
<1 years	75 (37.1)		
1-5 years	97 (48.0)		
>5 years	30 (14.9)		
CD4			
<200 cells/µl	9 (4.5)		
200-500 cells/µl	47 (23.2)		
>500 cells/µl	144 (71.3)		
Median (IQR) cells/µl	*726 (476, 941)*		
Viral load			
<400 copies/ml	152 (75.2)		
400-5000 copies/ml	14 (7.0)		
>5000 copies/ml	32 (15.8)		
Median (IQR) copies/ml	*19 (19, 250)*		

Abbreviations: **HIV+** HIV-infected, **HIV-** HIV-uninfected, **SD** standard deviation, **IQR** inter quartile range

a) n (%) shown, except for median and IQR shown in italics

b) p value from χ^2 test

c) p value from Mann-Whitney U test

Table 2. Domains of Disability and Functioning in HIV-infected and HIV-uninfected Children in Zimbabwe

Outcome	HIV+ n=202 n (%)	HIV- n=285 n (%)	Crude OR (95% CI)	p value[a]	aOR (95% CI)	p value[a]
Any disability	76 (37.6)	53 (18.8)	2.3 (1.6, 5.3)	<0.001	2.8 (1.8, 4.2)	<0.001
Seeing	16 (7.7)	9 (3.1)	2.7 (1.2, 6.0)	0.009	3.0 (1.3, 6.9)	0.009
Hearing	10 (4.8)	4 (1.4)	3.4 (1.1, 10.6)	0.031	3.4 (1.0, 10.5)	0.036
Walking	5 (2.5)	1 (0.4)	7.4 (0.9, 63.5)	0.065	7.4 (0.9, 63.5)	0.055
Speaking	9 (4.3)	3 (1.1)	4.0 (1.1, 14.5)	0.042	3.8 (1.1, 13.9)	0.042
Learning	48 (23.2)	33 (11.6)	2.1 (1.3, 3.2)	0.002	3.9 (1.4, 3.4)	0.001
Memory	37 (17.8)	16 (5.6)	3.6 (2.0, 6.6)	<0.001	3.5 (2.0, 6.6)	<0.001
Self-caring	3 (1.5)	1 (0.4)	1.7 (0.4, 8.0)	0.072	1.6 (0.4, 7.8)	0.524
Anxiety	42 (20.3)	14 (5.6)	4.6 (2.4, 8.2)	0.000	4.4 (2.4, 8.1)	<0.001
Depression	32 (15.5)	12 (4.2)	4.2 (2.1, 8.5)	0.010	4.2 (2.1, 8.4)	0.010
Controlling behaviour	3 (1.5)	1 (0.4)	4.0 (0.4, 39.4)	<0.001	4.0 (0.4, 39.3)	0.003
Concentration	2 (1.0)	6 (2.1)	0.4 (0.1, 2.2)	0.478	0.4 (0.1, 2.2)	0.311
Accepting change	39 (10.9)	36 (12.6)	1.6 (0.9, 2.6)	0.085	1.5 (1.0, 2.5)	0.075
Making friends	10 (4.8)	1 (0.4)	14.6 (1.9, 115.2)	0.001	14.8 (1.9, 116.6)	0.011

Abbreviations: HIV+ HIV-infected, **HIV-** HIV-uninfected, **OR** odds ratio, **aOR** age, sex adjusted odds ratio.
a) p value from χ^2 test

435 **Table 3. Difference in HIV Characteristics Amongst HIV-infected Children With and Without**
436 **Disability in Zimbabwe**
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Characteristic		HIV+ with disability: n[a]=76	HIV+ without disability: n=126	p value	
Age	*Median (IQR) years*	*10.9 (2.6)*	*10.3 (2.6)*		
	6-9 years	24 (31.6)	48 (38.1)	0.77	-
	10-12 years	31 (40.8)	50 (39.7)		
	13-14 years	15 (19.7)	20 (15.9)		
	15-16 years	6 (7.9)	8 (6.4)		
Age at diagnosis					
	Median (IQR) years	*5.0 (3.0)*	*5.1 (2.9)*		-
Age of ART initiation					
	Median (IQR) years	8 (6, 11)	7 (5, 10)	0.78	
Sex					
	Female	35 (46.0)	62 (49.2)	0.66	
					aOR (95% CI)
CD4 count					
	Median (IQR) cells/uL	*736 (513, 914)*	*720 (459, 910)*		
	<200 cells/uL	3 (4.0)	6 (4.7)	0.78	1.0
	200-500 cells/uL	15 (19.7)	32 (25.4)		1.4 (0.8, 2.5)
	>500 cells/uL	57 (75.0)	87 (69.1)		
Viral load					
	Median (IQR) copies/ml	*19 (19, 190)*	*19 (19, 343)*		
	<400 copies/ml	57 (75.0)	95 (75.4)	0.16	1.0
	400-5000 copies/ml	2 (2.6)	12 (9.5)		1.1 (0.7, 1.6)
	>5000 copies/ml	14 (18.4)	18 (14.3)		
ART duration					
	Median (IQR) years	*2 (1,5)*	*1 (0, 4)*		
	<1 years	24 (31.6)	51 (40.5)	0.21	1.0
	1-5 years	39 (51.3)	58 (46.0)		1.2 (0.8, 1.9)
	>5 years	13 (17.1)	17 (13.5)		
No of hospital admissions in 12 months					
	>1	5 (6.6)	5 (4.0)		1.9 (0.6, 6.1)
Past history of TB		29 (38.2)	50 (39.7)	0.94	0.9 (0.5, 1.6)

Abbreviations HIV+ HIV-infected, **HIV-** HIV Uninfected, **aOR** odds ratio adjusted for age and sex, **ART** antiretroviral therapy, **TB** tuberculosis, **IQR** inter quartile range.
a) n shown, except for median and IQR shown in italics

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Table 4. School and Social Inclusion at School in HIV-infected and HIV-uninfected Children and in HIV-infected Children with and Without Disability

Characteristic	HIV+ n=202 n (%)	HIV- n=285 n (%)	aOR (95% CI)	HIV+ with disability n=76 n (%)	HIV+ without disability n=126 n (%)	aOR (95% CI)
School inclusion as reported by children and their carers						
Currently enrolled in school	194 (96.0)	273 (96.0)	0.98 (0.4, 2.5)	71 (93.4)	123 (97.6)	0.3 (0.1, 1.5)
Enrolled in the same grade as peers	102 (50.5)	197 (69.1)	2.4 (1.6, 3.6)	24 (31.6)	78 (61.9)	3.3 (1.7, 6.1)
Ever repeated a year at school	68 (33.7)	53 (18.6)	2.5 (1.6, 3.8)	32 (42.1)	36 (28.6)	1.9 (1.0, 3.6)
Social inclusion at school as reported by children and their carers						
No help from teachers, if problem at school	4 (2.0)	2 (0.7)	2.1 (1.2, 3.8)	2 (2.6)	2 (1.6)	1.7 (0.9, 3.2)
No help from friends, if problem at school	15 (7.4)	3 (1.1)	3.0 (2.0, 4.5)	11(14.5)	4 (3.2)	1.5 (0.9, 2.4)
Child has no friends to play with	2 (1.0)	1 (0.4)	1.8 (0.7, 5.0)	2 (2.6)	1 (0.8)	1.7 (0.8, 5.7)
Friends look up to child as a leader	108 (53.5)	147 (51.6)	1.1 (0.8, 1.6)	44 (57.9)	41 (32.5)	2.1 (1.4, 3.4)
Other children hit, hurt /say nasty things to child	58 (28.7)	28 (9.8)	3.7 (2.2, 6.0)	30 (39.5)	28 (22.2)	2.5 (1.3, 4.8)
Child does not feel included in lessons and activities	6 (3.0)	2 (0.7)	4.7 (2.7, 8.3)	3 (4.0)	3 (2.4)	0.6 (0.1, 3.0)

Abbreviations HIV+ HIV-infected, **HIV-** HIV Uninfected, **aOR** odds ratio adjusted for age and sex.

Supplementary Table 5. School and Social Inclusion at School in Disabled Children With and Without HIV-infection

Characteristic	HIV+ with disability n=76 n (%)	HIV- with disability n=53 n (%)	aOR (95% CI)
School inclusion as reported by children and their carers			
Currently enrolled in school	71 (93.4)	52 (98.1)	1.1 (0.3, 4.5)
Enrolled in the same grade as peers	24 (31.6)	32 (57.1)	0.3 (0.1, 0.6)
Ever repeated a year at school	32 (42.1)	12 (21.4)	3.3 (1.4, 8.0)
Social inclusion as reported by children and their carers			
No help from teachers, if problem at school	2 (2.6)	1 (1.8)	0.1 (0.1, 8.1)
No help from friends, if problem at school	11 (14.5)	1 (1.8)	0.5 (0.0, 0.9)
Child has no friends to play with	2 (2.6)	0 (0.0)	-
Friends look up to child as a leader	26 (34.2)	27 (48.2)	0.5 (0.3, 1.1)
Other children physically or verbally bully	30 (39.5)	3 (5.4)	11.3 (3.9, 39.8)
Child excluded in lessons and activities	3 (4.0)	1 (1.8)	0.4 (0.0, 4.4)

Abbreviations HIV+ HIV-infected, **HIV-** HIV Uninfected, **aOR** odds ratio adjusted for age and sex.