Academic Performance Among Children with Perinatal HIV Exposure in Botswana

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Kathleen M. Powis MD, MPH[1,2,3], Lesedi Lebanna MEd[4], Sara Schenkel MPH[1], Gosego Masasa RN[3], Samuel W. Kgole RN[3], Martha Ngwaca RN[3], Paige L. Williams PhD[5], Amy L. Slogrove MBChB, PhD[6], Roger L. Shapiro MD, MPH[2,3], Shahin Lockman MD, MSc[2,3,7], Mompati Mmalane MD, FRCS-Ed, MSc[3], Joseph M. Makhema MBBS[3], Jennifer Jao MD, MPH[3,8], Adam R. Cassidy PhD[3,9]

[1] Department of Internal Medicine and Pediatrics, Massachusetts General Hospital, Boston, MA, USA [2] Department of Immunology and Infectious Diseases, Harvard T.H. Chan School of Public Health, Boston, MA USA. [3] Botswana Harvard AIDS Institute Partnership, Gaborone, Botswana [4]Department of Curriculum Development and Evaluation, Botswana Ministry of Basic Education, Gaborone, Botswana [5]Departments of Biostatistics and Epidemiology, Harvard T.H. Chan School of Public Health, Boston, MA, USA [6]Stellenboscch University –Department of Paediatrics & Child Health and Ukwanda Centre for Rural Health, Department of Global Health, Faculty of Medicine and Health Sciences, Stellenbosch University, Worcester, South Africa [7]Division of Infectious Diseases, Brigham and Women's Hospital, Boston, MA, USA [8]Department of Pediatrics, Northwestern Feinberg School of Medicine, Chicago, IL, USA [9]Departments of Psychiatry & Psychology and Pediatric & Adolescent Medicine, Mayo Clinic, Rochester, MN, USA

BACKGROUND

- Some studies have reported a higher risk of suboptimal neurodevelopment among children with fetal HIV-exposed who remain HIV uninfected compared to children born without fetal HIV exposure.
- Actual academic performance among school-aged children by fetal HIV exposure status has not been well studied.

Table 1. Maternal and Child Characteristics

Characteristics	Mothers Living with HIV N=114	Mothers HIV Seronegative N=46	p-value
Maternal Age (years)			0.0004
18-24	20 (17.5%)	22 (47.8%)	
25-29	27 (23.7%)	12 (26.1%)	
30-34	32 (28.1%	9 (19.6%)	
35-39	26 (22.8%)	2 (4.3%)	
40+	9 (7.9%)	1 (2.2%)	
Highest Level of Maternal Education			0.002
None	2 (1.8%)	0 (NA)	
Primary	16 (14.0%)	0 (NA)	
Secondary School	83 (72.8%)	30 (66.7%)	
University	13 (11.4%)	15 (33.3%)	
Marital Status			0.13
Single	62 (54.4%)	33 (73.3%)	
Married/Cohabitating	48 (42.1%)	12 (26.7%)	
Divorced	1 (1%)	0 (NA)	
Widowed	3 (2.6%)	0 (NA)	
Current Household Income			0.07
None	33 (29.2%)	11 (24.5%)	
P1 to P200 per month	6 (5.3%)	2 (4.4%)	
P201 to P500 per month	11 (9.7%)	6 (13.3%)	
P501 – P1000 per month	17 (15.1%)	6 (13.3%)	
P1001 – P5000 per month	42 (37.2%)	12 (26.7%)	
>P5000 per month	4 (3.5%)	8 (17.8%)	
Current Household Electricity Availability	97 (85.1%)	41 (89.1%)	0.51
Current Household Cooking Source			0.40
Gas or electric stove	80 (70.2%)	32 (69.6%)	
Wood burning stove or open fire	17 (14.9%)	10 (21.7%)	
No regular means of heating	17 (14.9%)	4 (8.7%)	
Current number of household members			0.74
Two	3 (2.6%)	1 (2.2%)	
Three	15 (13.2%)	5 (10.9%)	
Four	22 (19.3%)	7 (15.2%)	
Five	26 (22.8%)	8 (17.4%)	
Six or more	48 (42.1%)	25 (54.3%)	
Male Child	56 (49.2%)	28 (60.9%)	0.22
Birthweight (grams)			
Males	3130	3100	0.53
Females	2885	3000	0.10
Birth prior to 37 weeks gestational age	16 (14.2%)	4 (8.7%)	0.44
Ever Breastfed	22 (19.3%)	46 (100%)	<0.0001
Attending Public School	113 (99.1%)	45 (97.8%)	0.49

Actual school academic performance appears to be lower among children HIV-exposed uninfected compared to children unexposed within a Botswana-based cohort

METHODS

- The Botswana-based FLOURISH study is an ongoing prospective observational study re-enrolling mother-child pairs who previously participated in Botswana Harvard AIDS Institute Partnership (BHP) studies where data was prospectively collected from pregnancy through 18-36 months of a child's life, including maternal HIV status, maternal antiretroviral treatment (ART), obstetric history, child HIV status, child antiretroviral (ARV) prophylaxis and child outcomes.
  - FLOURISH parents report their child's school grades at enrollment, including subject grades and an overall grade.
- A Cochran-Mantel-Haenszel test was used to compare academic performance between children whose last grade completed was standard 3 or 4 (4th and 5th grade United States equivalence) by HIV exposure status.
- Lower academic performance was defined as an overall grade for all coursework of "C" or lower (≤65%).
- Unadjusted and adjusted logistic regression models were fit to identify factors associated with lower academic performance.

RESULTS

- Of 160 children, 114 were HIV-exposed uninfected (HEU).
- 16 (14%) children HEU were born preterm (<37 weeks gestation) compared to 4 (9%) children HIV-exposed uninfected (HUU). (Table 1)
- Among children HEU, 76% had fetal exposure to triple maternal ART, 23% to zidovudine only, and 1% had no fetal ARV exposure.
- Women with HIV were more often older at enrollment, had no or primary education only (16% versus 0%), and breastfed less often (19% versus 100%).

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RESULTS

- A higher proportion of children HEU had lower academic performance compared to children who were HUU (71% vs 48%; p=0.013).
- In unadjusted analyses, children HEU were significantly more likely to have lower academic performance (Odds Ratio (OR): 2.68 [95% CI: 1.32, 5.42]; p<0.01) (Table 2).
- After adjustment for maternal education, breastfeeding, and sex, this association was attenuated (aOR:1.64 (0.55, 4.94), p=0.38).

Table 2. Unadjusted and Adjusted Logistic Regression Model of Factors Associated with Lower Academic Performance in Children Completing Standard 3 or 4

	Unadjusted Model		Adjusted Model	
Covariates of Interest	Odds Ratio (95% CI)	p-value	Odds Ratio (95% CI)	p-value
HEU versus HUU	2.68 (1.32, 5.42)	**<0.01**	1.64 (0.55, 4.94)	0.38
Low Maternal Education[1]	3.01 (0.83, 10.89)	0.09	2.44 (0.64, 9.29)	0.19
Maternal Depression/Anxiety at Enrollment[2]	1.94 (0.51, 7.34)	0.33		
Low Maternal Income at Enrollment[3] None to < P500 per month	1.12 (0.58, 2.18)	0.73		
Household Food Insecurity in the Last Year[4]	0.79 (0.38, 1.65)	0.53		
Male Child	1.72 (0.89, 3.30)	0.10	1.97 (0.99, 3.96)	0.06
Preterm Birth[5]	0.96 (0.36, 2.56)	0.93		
Never Breastfed	2.32 (1.23, 4.62)	**0.01**	1.75 (0.63, 4.82)	0.28

[1]Low maternal education defined as no or primary education only.
[2]Maternal Depression was evaluated using the PHQ9 screening tool and anxiety via the GAD7 screening tool.
[3]Low maternal income defined as no monthly income or < P500 where $1 USD ~ P10 compared to monthly income of ≥P500.
[4]Household food insecurity was defined as being present if a caregiver reported that in the last 12 months the household ever had to cut the size of meals or skip meals because there was not enough food in the household.
[5]Preterm birth was defined as a gestational age < 37.0 week completed gestational age.
Abbreviations: HEU: HIV-exposed uninfected; HUU: HIV-unexposed uninfected; P=Pula
NB: Covariates in unadjusted analyses with a p-value ≤ 0.20 were included in the adjusted model.

CONCLUSIONS

- In this Botswana-based cohort, primary school academic performance appeared to be lower among children HEU compared to children HUU.
- Sociodemographic factors also contributed to this difference.
- Further research is needed to identify modifiable contributors, develop screening tools to identify risk of poor academic performance, and design interventions to mitigate the risk.

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