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ISID Grant Report

The validation of a new developmental screening tool for neurodevelopmental delays among HIV–infected South African children

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Introduction

Studies on neurodevelopment of HIV-infected African children have reported high prevalence of developmental delays with most reporting prevalence over 50%.[1-5]Despite this high prevalence of developmental disabilities, infected children are not screened routinely for developmental delays. Early identification of children with developmental disabilities with accompanied early interventions have been associated with better long term developmental outcomes.[6,7]

In Africa, there is a dearth of locally validated standardized screening tools for developmental delays for HIV-infected children. Reliance on clinical judgement only for developmental delay surveillance, which is often the case in African setting, has been found to be insensitive in identifying children with significant developmental delays.[8] The use of a standardized developmental screening tool improves the percentage of children with developmental disabilities identified early remarkably.[9]

A simple screening tool was devised by the Division of Developmental Paediatrics of Red Cross War Memorial Children's Hospital (RCWMCH) for preliminary rapid screen and identification of HIV–infected children with moderate to severe developmental delays. The aim of this study is to validate the RCWMCH developmental screening tool by comparing it with a gold standard for infant developmental assessment; Bayley Scale of Infant and Toddler Development, third edition (BSID-III).

Materials and Methods

The study was a cross-sectional diagnostic accuracy study completed between June 2013 and April 2014 at the Infectious Diseases Clinic (IDC) of the RCWMCH, a tertiary level hospital affiliated to the University of Cape Town, Cape Town, South Africa. Vertically infected confirmed HIV-infected children aged 6 weeks – 36 months attending the IDC constituted the study population. Children were excluded from the study if they had been hospitalised and/or acutely ill within a one month period prior to the potential enrolment date. Ethical approval for the study was obtained from the Human Research Ethics Committee of the Faculty of Health Sciences of the University of Cape Town and the research committee of RCWMCH. Written informed consent was from the parents or legal guardians.

Doctors who routinely consult at the IDC administered the RCWMCH Screening tool. The doctors were given an orientation on how to properly administer the RCWMCH Developmental Screening Tool in a standardized manner. The time taken by each attending clinician to complete the administration of the screening tool was 4 – 8 minutes. The Principal Investigator (PI) and a Research Assistant (occupational therapist) conducted the full

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developmental assessments on all participants. Both were trained and licensed to administer the Bayley Scale of Infant Development, third edition (BSID-III). The PI and Research Assistant were blinded to the outcome of the RCWMCH Screening Tool results. Each full assessment lasted between 45 – 60 minutes.

Failure to have attained 2 or more milestones on any of the developmental domains and/or presence of 2 or more warning signs on the RCWMCH Developmental Screening Tool was interpreted as developmental delay. The BSID-III was administered as stipulated in its manual. The scoring and interpretation of the BSID-III was performed using the Bayley scoring assistant software. Study participants who had borderline or extremely low average scores classification (composite scores less than 70) on 2 or more domains in the BSID-III were diagnosed as having moderate to severe global developmental delay.[10]

Data were entered into statistical software – SPSS 22.0 for analysis. The sensitivity, specificity, positive predictive value (PPV), Negative Predictive Value (NPV) of the RCWMCH developmental screening tool compared to BSID-III were calculated using MedCalc for Windows, version 12.5 (MedCalc Software, Ostend, Belgium).

Results and Discussion

The number of children attending the IDC clinic aged 3 years and below during the study period was 925 with an average of 92 children seen monthly. Out of these 88 children were recruited into the study and screened with the new RXH screening tool. 47 had the BSID-III developmental assessments. Children who did not have BSID-III assessments failed to show up on the dates given for assessments despite efforts via phone calls and rescheduling of the assessments dates.

Using the RCWMCH developmental screening tool, 55.3% of study participants were shown to have global developmental delay. The BSID-III developmental assessment confirmed that 29.8% had moderate or severe global developmental delayThe 2X2 table of the RCWMCH screening results with that of the BSID-III is shown in Table 2 and Table 3 shows the diagnostic properties of the RCWMCH screening tool.

	RCWMCH		BSID-III	
	Frequency	Percent	Frequency	Percent
DELAYED	26	55.3	14	29.8
NOT DELAYED	21	44.7	33	70.2
Total	47	100.0	47	100.0

Table 1: Prevalence of global developmental delay by RCWMCH screen and BSID-III

		BSD-III		Total
		DELAYED	NOT DELAYED	
RCWMCH	DELAYED	11	15	26
	NOT DELAYED	3	18	21
Total		14	33	47

Table 2: 2X2 Table of the RCWCH and the BSID-III

Sensitivity	78.57 %	95% CI: 49.2% - 95.1%
Specificity	54.55 %	95% CI: 36.4% - 71.9%
Positive Likelihood Ratio	1.73	95% CI: 1.09 - 2.75
Negative Likelihood Ratio	0.39	95% CI: 0.14 - 1.12
Disease prevalence	29.79 %	95% CI: 17.4% - 44.9%
Positive Predictive Value	42.31 %	95% CI: 23.4% - 63.1%
Negative Predictive Value	85.71 %	95% CI: 63.6% - 96.8%

Table 3: Diagnostic properties of the RCWMCH screening tool

The tool has a sensitivity of 78.5% and specificity of 54.6%. The positive predictive value was 42.3% and the negative predictive value was 85.7%.

The sensitivity of the RCWMCH screening tool was 78.6%. Sensitivity and specificity of 70% to 80% have been deemed acceptable for developmental screening tests.[11] Thus the level of sensitivity of the new screening tool is high enough to be recommended for screening for developmental delay among HIV-infected infants by healthcare providers in busy clinics. The specificity of the tool was low (54.6%). This is due to the design of the tool with high sensitivity being the emphasis and not specificity. The identification of HIV-infected children with possible delays for early intervention is more important especially with the high prevalence of developmental delay in this population of children than exclusion of children who do not need any intervention.

The positive predictive value of 42.3% for the RCWMCH tool is low but with the high prevalence rate of developmental delay in this population, it is important to ensure that no child who could have benefited from intervention is missed. Since the screening is very low-cost and has no risks to the children, it is still worthwhile to screen all children. The high negative predictive value of the RCWMCH tool (87.5%) is reassuring that children who screened negative are highly unlikely to have any developmental delay and thus do not require any interventions.

Conclusions

CThe RWMCH developmental screening tool has a sensitivity that is sufficiently high for it to be recommended for rapid screening for moderate to severe global developmental delay among HIV-infected children. The tool can be used by low cadre health workers at the primary healthcare level. The additional advantages of the RCWMCH tool include ease of use with no need for additional tools, rapidity of administration without further prolonging consultation time and incorporation of simple recommendation of immediate interventions when screen is positive for developmental delay. This avoids the loss of therapeutic intervention window while the child is awaiting full developmental assessment by more specialised medical personnel.

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