

Epidemiological study of a developmentally and culturally sensitive preschool intervention to improve school readiness of children in Addis Ababa, Ethiopia

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ABSTRACT

Background Early childhood is a dynamic period of physical, psychosocial and cognitive development, where age appropriate intervention during the preschool years influences psychosocial, behavioural and academic achievement of children. This study evaluated the impact of a comprehensive preschool intervention on psychosocial, cognitive and behavioural school preparedness among children in Addis Ababa, Ethiopia.

Methods Employing a cluster-sampling design, 150 preschool children who received the basic preschool curriculum (non-intervention) were compared with 100 randomly selected children who received a comprehensive preschool curriculum (intervention) using the Early Development Instrument (EDI) in five domains. Sample t-tests compared means of domain scores. Binary logistic regression analysed proportions of vulnerability in domains and overall.

Result There were no group differences in gender, age, special need status or child's first language. Intervention children had higher domain scores on social competence (mean difference 0.67 (SE=0.26)), emotional maturity (mean difference 0.77 (SE=0.29)), language and cognitive development (mean difference 0.67 (SE=0.40)), communication and general knowledge (mean difference 0.82 (SE=0.34)). Accounting for confounding variables, intervention children had a lower chance of overall vulnerability to domain problems (adjusted OR (AOR)=0.38; 95% CI 0.13 to 1.15), language and cognitive development (AOR=0.21; 95% CI 0.03 to 1.64), and social competence (AOR=0.20; 95% CI 0.08 to 0.45).

Conclusion The comprehensive intervention was associated with better outcomes on early childhood development across four domains. It is recommended to extend this programme to other areas of Ethiopia, where children do not have appropriate school preparation, to reduce risk of school dropout, negative personal and societal outcomes.

INTRODUCTION

Early childhood is the most dynamic period of physical and cognitive development.¹⁻³ Optimal child development is enhanced by high-quality and sensitive caregiving including adequate nutrition, healthcare, proper socialisation and provision of encouraging and stimulating environments.⁴⁻⁶ Developmental, physical, behavioural and emotional problems in young children are strongly predictive of a variety of negative psychosocial outcomes such

as poor academic performance, lower socioeconomic and emotional and functional problems later in life.⁷ Growing children require healthy physical, mental and social functions to achieve the development of abilities that will enable them to be the future builders of a successful society.⁸ Therefore, investing in the physical, mental and social well-being of children should be regarded as a valuable investment with good returns for a nation.

The care given in early childhood by parents can be supported by teachers during preschool and elementary schooling^{9 10} to promote optimal outcomes, especially if the quality of the out-of-home care is high. In developing countries, including Ethiopia, routine traditional training of teachers may not provide the required skills to ensure high quality to enhance child development.⁸

Interventions that employ early detection and management of behavioural problems can reduce negative outcomes and prevent more serious problems later in life. Early detection of serious mental and developmental disorders such as anxiety, autism, attention-deficit/hyperactivity disorder and depression can enable timely interventions to minimise negative developmental trajectories.¹¹ Thus, interventions that enhance early detection has the potential to substantially improve long-term outcomes.

Ethiopia has committed itself to several legislations relevant to policies regarding children. The country is one of the signatories of the United Nations Convention on the Rights of the Child, the need for children's development and education. However, services in early years remained an underdeveloped sector.¹² The previous curriculum had not been updated for decades and was subject based. Since 2009, the curriculum has transformed into a competency-based one.¹³ Unlike other levels of education, formal preschool teacher training has only been available since 1986, when the first Preschool Teacher Training Institute was established in Addis Ababa.¹⁴ It involved a 3-month-long specialised training programme in which trainees were engaged in basic coursework, followed by a short practicum. Despite the fact that early child education has been recognised for decades in the country, provision of comprehensive early child development programme in Ethiopia is still lacking.

The aim of this study was to examine how a culturally and developmentally sensitive comprehensive preschool intervention (intervention group)

fares in enhancing the overall development of children from a disadvantaged community compared with a basic government curriculum (non-intervention group). The intervention was implemented by trained, monitored teachers, engaged parents and was supplemented with support by social work services. The study hypothesis was that children who participated in a comprehensive preschool intervention would demonstrate higher scores on an established measure of physical health and well-being, social competence, emotional maturity, language and cognitive development, and communication skills and general knowledge, compared with children who participated in the traditional basic preschool service.

METHODS

The study was carried out in the city of Addis Ababa. Children from families with especially low economic status get free enrolment in government preschools. The School Readiness Initiative (SRI) is a not-for-profit non-governmental organisation that works with the Education Bureau of the City of Addis Ababa and Oromia Region of Ethiopia. In 2010, the SRI started running its programme in 32 governmental preschools in Addis Ababa City which has increased to 52 government kindergartens. In 2015, according to the city Education Bureau, 42 of the 52 preschools could continue without intensive support from SRI. The bureau requested SRI to continue working in the remaining 10 preschools, and include another 10 newly established preschools.

SRI has developed 3 supplementary teachers' guidelines and 11 parent-training manuals. These guidelines and manuals have been in use in all government preschools in Addis Ababa over a span of 8 years.

Employing a cluster-sampling design, preschool children recruited from intervention government preschools were compared with children from non-intervention government preschools. While all government preschools in the city received the SRI's supplementary teacher guidelines and basic government support, the intervention preschools received in addition a comprehensive child development support involving variety of parent and teacher training and family engagement. The intervention had developed a comprehensive, innovative preschool programme incorporating a wide range of services novel to the Ethiopian education system. Preschool teachers were trained to engage children in a child-friendly, nurturing, and interactive way. The intervention also trained preschool teachers on how to perform cognitive, behavioural, language and physical/motor assessments on each child. Preschool teachers were trained to recognise signs and symptoms of mental health problems and refer children as necessary to social workers and primary health-care units. Trained Primary Health Care Workers diagnosed and managed physical ailments and common mental health disorders in children and parents referred by teachers and SRI social workers. The intervention involved deworming children annually as parasitic infestation is a ubiquitous problem in Ethiopia. Regular quarterly parent-teacher meetings were held to enhance child development, positive child discipline, management of challenging behaviours and to optimise personal relationships within the family. The intervention has also helped selected mothers in especially low economic circumstances to have business and vocational training after which SRI helped them financially to establish income-generating activities (IGAs). The aim of IGAs was to raise the families' standard of living and allow mothers to provide better nourishment and time to their kids. SRI social workers were involved in on-site observation

to counsel preschool teachers and parents on issues of rearing children, like disciplining, looking after the safety of children, and so on. In addition, biannual health and emotional screening of children was carried out throughout the years to assess the physical, speech and language, behavioural and learning function of children. The differences between the non-intervention and intervention schools are summarised in [table 1](#).

Sample selection

The study randomly selected children in senior classes from the intervention and non-intervention preschools during the study period of May-June 2016. Participants who were not in class for more than 1 month were excluded from the study.

Sample size was determined using proportion estimates for two populations to assess vulnerability for behavioural, social and learning problems. The study assumed a proportion of 20% of children to have vulnerability for behavioural, social and learning problems.¹¹ The study predicted that the vulnerability of children in the intervention group would be lower by 75% post intervention, with 80% power and a type I error rate of 5%. Sampling was determined using a ratio of 2:3 between intervention and non-intervention preschools. Based on a recommendation for cluster sampling design,¹⁵ the study used a design effect of 2 to compensate and minimise the random error. A total sample of 250 children, 100 from intervention and 150 from non-intervention preschools, were considered sufficient for the desired sample size. The response rate in each group was 100%.

Multistage sampling was used to select the study subjects ([figure 1](#)). The first stage of sampling was selection of preschools. Of the 20 SRI-supported preschools, 4 were selected using random sampling. The non-intervention sample included six government preschools nearest to the selected intervention preschools. Twenty-five children were sampled from each selected preschool using systematic sampling by taking the list of roll number of students in each senior class of selected preschools as a sampling frame.

Information about preschool children was collected from their classroom teachers using the Amharic version of the Early Development Instrument (EDI).¹⁶ To be an eligible informer, a teacher must have worked with the child for at least a full semester. The original English-language EDI was translated and back translated multiple times until consensus regarding accuracy and adaptation to the Ethiopian context was reached with the EDI developers at McMaster University in Canada. The

Table 1 Summary of non-intervention (control) and intervention condition of preschools

Basic conditions in preschool from non-intervention (controls)	Comprehensive SRI intervention preschool (intervention condition)
<ul style="list-style-type: none"> ▶ Government funding ▶ SRI Teacher Guideline Manuals ▶ Supervision by MOE 	<ul style="list-style-type: none"> ▶ Government funding ▶ SRI Teacher Guideline Manuals ▶ Supervision by MOE ▶ On-site teacher training on SRI intervention ▶ On-site observation and feedback by senior SRI education and developmental professionals ▶ Empowerment opportunities for mothers ▶ Social worker services in the school community ▶ Medical and behavioural management services

MOE, Ministry of Education; SRI, School Readiness Initiative.

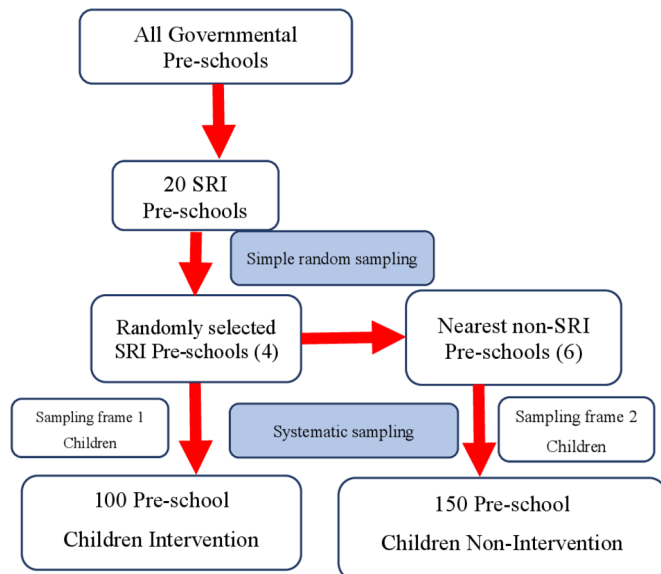


Figure 1 Schematic diagram of sampling. SRI, School Readiness Initiative.

classroom teachers were trained for 4 days on the contents of the instrument, and how to record the information using the questionnaire. The teachers were instructed to consider each child individually before recording the ratings. The trained teachers participated in a pretesting of the EDI. Based on these results, explanations were given to teachers regarding comprehension and interpretation of each item of the questionnaire.

Verbal informed consent was obtained from the parents by the teachers after parents were informed about the purpose of the study. The parents were assured of strict confidentiality with regard to any information collected from the child including not revealing any identifier.

Measures

The EDI¹⁶ is a teacher completed instrument based on several months' observation of the children. The EDI has been systematically adapted and validated for use in a number of countries,¹⁷ and is reported to have high international validity. For example, internal reliability ranged from 0.76 to 0.96 in Canada,^{18 19} 0.80–0.95 in Australia, 0.64–0.95 in Jamaica¹⁹ and 0.70–0.95 in Hong Kong.²⁰ The EDI was used to assess five developmental domains: physical health and well-being to assess motor skills and physical readiness; social competence to assess ability of children to get along with peers; emotional maturity to measure emotional well-being; language and cognitive development to measure abilities in reading, writing, numbers and shapes; and communication skills and general knowledge to evaluate ability of the child to use language for self-expression. Each domain consists of 13, 26, 30, 26 and 8 questions, respectively, for a total of 103 questions. Each item has either two or three response categories. Items are scored as either 0 or 10, for binary items or 0, 5 or 10 for three-category items. The mean score for each domain is computed as an average of the items that make up the domain. Using the distribution of scores in the whole sample, the domain scores are categorised so that children scoring below the 10th percentile are classified as vulnerable in that domain. Children scoring below the 10th percentile in one or more of the five domains are considered vulnerable in terms of their developmental status.

As part of the EDI, information was collected about socio-demographic characteristics such as sex of the child, maternal education, living conditions and means of income/employment. This information is typically collected from the schools at the start of the school year and kept in each student's folder. Teachers could consult these when completing the EDI. Teachers also routinely meet with children's primary caregiver on a weekly basis and during quarterly group meetings. Teachers are therefore considered knowledgeable of each child's family situation. The teacher's judgement regarding the child's special needs was also recorded. A child's requirement for special need support was determined based on a teacher's assessment of the child for a need of any learning assistance.

Analysis

Data were entered into a computer using EPI DATA V.3.1,²¹ and exported to SPSS for Windows V.25 for analysis.²² Descriptive statistics were obtained for all demographic variables. Differences between group means for each of the EDI domains were assessed using multivariable linear regression and also adjusting for demographic characteristics that were different between the groups. The standard errors were adjusted for school-level clustering using Stata V.13.1. Differences in the proportions of children vulnerable between groups in each of the EDI domains and overall were evaluated using contingency table analysis. Multivariable analyses were performed using binary logistic regression that allowed for adjusting for demographic characteristics that were different between the groups. The standard errors used were adjusted for school-level clustering. Magnitude of the effect size of the intervention was analysed with a standardised effect size, Cohen's *d*, which takes the difference between the

Table 2 Sociodemographic characteristics of preschool children by intervention and non-intervention group

Characteristics	Intervention number (%)	χ^2 (P value)
Sex		
Male	51 (51.0)	66 (44.0)
Female	49 (49.0)	84 (56.0)
Special need		
Yes	1 (1.1)	4 (2.7)
No	94 (98.9)	146 (97.3)
Maternal education		
Not educated	38 (38.8)	49 (33.3)
Elementary	49 (50.0)	58 (39.5)
Secondary or more	11 (11.2)	40 (27.2)
Living condition		
With both parents	26 (26.0)	49 (32.7)
With mother only	49 (49.0)	47 (31.3)
With father only	16 (16.0)	37 (24.7)
With others	9 (9.0)	17 (11.3)
Parent occupation		
Both parents work	40 (40.0)	27 (18.0)
Only father works	36 (36.0)	72 (48.0)
Only mother works	17 (17.0)	39 (26.0)
Others	7 (7.0)	12 (8.0)
Child first language		
Learning language	96 (96)	146 (98.0)
Other language	4 (4.0)	3 (2.0)

Table 3 Mean scores and effect sizes of the difference in Early Development Instrument (EDI) domain scores between the intervention and non-intervention groups

EDI domain	Intervention mean (SE)	Non-intervention mean (SE)	Mean difference (SE)	Adjusted mean difference* (SE)	Effect size	P value
Physical health and well-being	9.60 (0.12)	9.60 (0.13)	-0.0013 (0.17)	-0.026 (0.18)	-0.0015	0.890
Social competence	9.03 (0.15)	8.30 (0.23)	0.738 (0.26)	0.669 (0.26)	0.4840	0.29
Emotional maturity	9.09 (0.06)	8.25 (0.31)	0.833 (0.31)	0.769 (0.28)	0.6340	0.25
Language and cognitive development	9.08 (0.25)	8.35 (0.37)	0.723 (0.42)	0.670 (0.40)	0.3375	0.126
Communication skills and general knowledge	8.47 (0.34)	7.63 (0.15)	0.848 (0.34)	0.817 (0.34)	0.4657	0.041

*Adjusted for child sex, maternal education, living condition and parent occupation.

mean scores of the intervention and the non-intervention group of preschool children per SD of the non-intervention group.²³ The effect size of each vulnerability outcome was assessed as the absolute difference to alleviate vulnerability, by taking the difference in vulnerability of the adjusted OR (AOR) of the intervention group from 1.0, the unity.

RESULTS

Sociodemographic characteristics

Forty-nine per cent of children in the intervention and 56% of children in the non-intervention group were females (Fisher's exact 2-sided $p=0.302$). Similarly, there were no differences in proportion of children with special needs or child's first language (language of instruction) between the two groups. However, children in the intervention group were more likely to have less advantageous sociodemographic characteristics (table 2). In particular, mothers of children from the non-intervention preschools were more likely to have secondary or higher education on average compared with mothers from the intervention preschools (27.2% vs 11.2%; $\chi^2=9.206$; (df=2); $p=0.010$). There were differences in the distributions of living conditions (number of parents at home) and parental occupations of

children between the two groups ($\chi^2=8.206$; (df=1); $p=0.042$; and $\chi^2=15.084$; (df=1); $p=0.002$, respectively).

Child development domain scores

The children from the intervention schools had higher scores in the domains of social competence, emotional maturity, language and cognitive development, and communication skills and general knowledge (adjusted differences in means ranged from 0.669 to 0.817). The difference between the two groups in the mean score for physical health and well-being was -0.026 (SE=0.18; $p=0.890$). The effect size of intervention ranged from 0.337 for language and cognitive development to 0.634 for emotional maturity (table 3), and was comparable to the effect sizes of preschool-based interventions in other studies (eg, gains ranging from 0.32 to 0.48 in cognitive measures in Kenya, Zanzibar and Uganda).²⁴

Vulnerability in EDI domains

Comparison of the two groups regarding the proportion of vulnerable children in each domain and overall is shown in table 4. Results of the analysis accounting for group differences

Table 4 Comparison of Early Development Instrument (EDI) domain vulnerability with the lowest 10th percentile of the Ethiopian Pilot sample between intervention and non-intervention preschool children

EDI domain vulnerability	Intervention number (%)	Non-intervention number (%)	Crude OR (95% CI)	Adjusted OR* (95% CI)	Risk difference	P value
Physical health and well-being						
Yes	4 (4.0)	10 (6.7)	0.58 (0.10 to 3.37)	0.48 (0.06 to 3.75)	52%	0.488
No	96 (96.0)	140 (93.3)	1.00	$p=0.488$	52%	1.00
Social competence						
Yes	4 (4.0)	22 (14.7)	0.24 (0.09 to 0.63)	0.20 (0.08 to 0.45)	80%	<0.001
No	96 (96.0)	128 (85.3)	1.00	1.00		
Emotional maturity						
Yes	3 (3.0)	14 (9.3)	0.30 (0.06 to 1.50)	0.32 (0.07 to 1.40)	68%	0.129
No	97 (97.0)	136 (90.7)	1.00	1.00		
Language and cognitive development						
Yes	3 (3.0)	16 (10.7)	0.26 (0.06 to 1.07)	0.21 (0.03 to 1.64)	79%	0.138
No	97 (97.0)	134 (89.3)	1.00	1.00		
Communication and general knowledge						
Yes	5 (5.0)	18 (12.0)	0.39 (0.11 to 1.38)	0.46 (0.09 to 2.31)	54%	0.344
No	95 (95.0)	132 (88.0)	1.00	1.00		
Overall EDI vulnerability						
Yes	11 (11.0)	39 (26.0)	0.35 (0.12 to 1.05)	0.38 (0.13 to 1.15)	62%	0.086
No	89 (89.0)	111 (74.0)	1.00	1.00		

*Adjusted for child sex, maternal education, living condition and parent occupation.

showed that the intervention group had a lower proportion of vulnerable children in each of the developmental domains. After accounting for the potential confounding variables, children from the intervention group were less likely to be vulnerable to problems in social competence (AOR=0.20; 95% CI 0.08 to 0.45), language and cognitive development (AOR=0.21; 95% CI 0.03 to 1.64) and overall vulnerability (AOR=0.38; 95% CI 0.13 to 1.15). The effect size calculated based on the relative difference showed risk differences of 80%, 79% and 62%, respectively, for vulnerability in social competence, language and cognitive development and overall vulnerability in the intervention group. Although the intervention group had lower percentages of vulnerable children across all domains, the risk differences were smaller for the physical health and well-being, emotional maturity and communication skills and general knowledge domains.

DISCUSSION

This study set out to examine whether a culturally and developmentally sensitive comprehensive preschool intervention implemented by trained teachers, combined with parental engagement and social worker involvement, was associated with better child developmental outcomes across a variety of domains compared with the basic preschool programme in Addis Ababa. The results of the analyses showed that the intervention group had better developmental outcomes than the non-intervention schools. The findings of the study emphasised the importance of the intervention in possibly reducing the vulnerability rates in children for problems in developmental domains, including vulnerability to problems in social competence, language and cognitive development and in overall vulnerability.

The sociodemographic characteristics in the two groups were relatively similar, though there were some differences. Compared with the intervention group, the non-intervention group had a higher proportion of parents of participants with secondary-level education and a lower percentage of participants who lived in single-parent households. Therefore, children in the intervention group came from slightly less advantageous households. These group differences could have underestimated the variations in EDI scores between the intervention and non-intervention group, as higher socioeconomic status is associated with better child development outcomes.²⁵ It should be noted that the adjusted multivariate analyses accounted for some of these potentially confounding effects.

The finding of the positive association of the intervention with the various developmental domains is similar to reports from other studies.²⁶ The major explanation for the finding of better developmental outcomes in the intervention group may be that the enhanced training given to teachers and parents in age-appropriate approaches helped to improve nurturing and early detection of psychosocial problems in children for timely management.¹¹ The consistent onsite visits and teacher–parent interaction through quarterly meetings during this intervention could be contributing factors by increasing detection of difficulties and their monitoring.

In this study, the intervention group did not differ from the non-intervention group on mean scores of physical health and well-being. This needs to be examined further considering the preintervention difference in socioeconomic status between the groups. Moreover, aspects of physical well-being may be in future added to the teacher and parent engagement in the intervention. Domain-specific vulnerabilities were lower in the intervention group in physical health and well-being, emotional maturity and communication skills and general knowledge

compared with the non-intervention group. This could be due to the sample size of the study, which might have been insufficient to detect meaningful difference in vulnerability, even though the study was adequately powered based on the hypothesis that the intervention group would have a reduction of 75% in vulnerability. As the mean scores of children in the intervention groups were better in two of these domains (emotional maturity and communication skills and general knowledge), the discrepancy between mean and vulnerability results indicates that while on average the scores were better, the proportion of children at the lower end of the distribution was not different. Therefore, it is possible that the intervention worked better for children with smaller lag in their abilities. This brings another recommendation for the delivery of the intervention, in terms of a more focused approach on children who struggle in those three areas. Participants in the intervention group would have received the intervention for approximately 4 months at the time teachers completed the EDI. It is possible that with more time, differences between groups would be even larger.

A limitation of this study was the absence of detailed information regarding some major sociodemographic characteristics of the study subjects. Since information was obtained from the teachers, information about level of income and educational achievements of parents might not approximate realistic amounts or levels. Moreover, due to lack of random assignment to the intervention group, the differences in scores cannot be interpreted as a direct impact of the intervention. Nevertheless, as mentioned above, since more children in the intervention schools came from slightly less advantageous households, the fact that they scored higher than children in the non-intervention schools in some domains suggests that the intervention may have played a role. Future investigations employing a randomised design should be conducted in order to replicate these findings and address this limitation of the current study.

The strengths of the study are in the prospective nature of the design, the representative sampling method to choose study participants based on lists of students from each randomly selected school in each arm and the use of an instrument (EDI) that enables comprehensive assessment with high reliability and validity.^{27 28}

What is already known on this subject

- ▶ Interventions aimed at early detection and management of behavioural problems can reduce negative outcomes and prevent more serious problems later in life. In Ethiopia, however, services in the early years remain an underdeveloped sector and the provision of a comprehensive early child development programme is lacking.

What this study adds

- ▶ This study, using the Early Development Instrument, showed a positive association between a culturally and developmentally sensitive comprehensive preschool intervention and functional improvements in young children. The findings indicate that such interventions have the potential to enhance overall child development and early learning even in children from resource-constrained countries.

CONCLUSION

Children participating in a culturally and developmentally sensitive comprehensive preschool intervention, delivered by trained and monitored teachers and engaged parents, coupled with social work intervention, had better outcomes in their overall development in a disadvantaged community, compared with the status quo. The comprehensive intervention was associated with better outcomes on early childhood development across four of five developmental domains. It is recommended to extend this programme to other areas of Ethiopia, where children do not have appropriate school preparation, to reduce the risk of school dropout, as well as negative personal and societal outcomes. The wider scale-up and testing of this intervention in different languages and geographic settings are necessary to determine its universal use. A broader involvement of teacher training institutes in Ethiopia in the future scale-up would also be highly desirable and beneficial.

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Competing interests None declared.

Patient consent for publication Not required.

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