



## **Nurturing Minds: Examining Caregiver-Child Interactions and Brain Development in Childcare Centers Using Low-field MRI Technology**

**By APHRC's Early Childhood Development and Uthabiti Africa**

The African Population and Health Center (APHRC) has been at the forefront of generating evidence by conducting research in Early Childhood Development (ECD). This research focuses on nurturing care practices for young children in resource-poor settings in urban areas. In recent times, there has been a growing demand for childcare services as more women, who have primarily been tasked with the responsibility of the care of young children, pursue economic opportunities.

Partner organizations such as Uthabiti Africa have effectively collaborated with APHRC to enhance the capacity of childcare service providers to improve their services in line with the guidelines outlined in the nurturing care framework. The findings from a recent study by Uthabiti Africa which examined the status of female childcare workers in Kenya showed that the majority of childcare providers are from the lower socio-economic strata and have low education levels with little training. This raises the critical question on the qualification of caregivers to support the overall development of the child and whether child-caregiver interactions are optimized based on the child-caregiver ratio.



Much of the existing evidence on associations between child stimulation and child development is mainly focused on interactions within the home environment (Hartering et al., 2017; Jeong, et al., 2016; Nampijja et al., 2018 & Onyango, et al. 2023; ), where mothers are the dominant and primary caregivers. Maternal stimulation activities, including talking, walking, playing with the child, storytelling, reading etc., have been associated with enhanced development of psychomotor, language and cognitive abilities.

Further research indicates that the brain exhibits a high degree of plasticity during the early years, allowing it to adapt and reorganize in response to experiences. Positive interactions with caregivers stimulate neural connections and promote the development of cognitive, social, and emotional skills (Shonkoff et al., 2012).

APHRC, in an effort to increase evidence in this area, is currently implementing an observational mixed methods study that will follow up children in childcare services to understand their interactions with center caregivers and to examine their brain function using a low-field Magnetic Resonance Imaging (MRI) machine. The study seeks to understand the relationship between stimulation, developmental scores, and brain function and the evidence will inform policy and practice in the childcare sector. The study will observe and follow up with children aged below three years attending childcare centers and those at home. Researchers will collect information on how caregivers interact with children, how children develop, and how the brain works to understand their relationships. Of the 980 children participating in the study, 348 will have their brain function examined using safe MRI techniques. The findings will help understand the role of meaningful interaction between caregivers and the children on child development as determined using behavioral measures and imaging techniques.

The low-field MRI machine that will be used to measure the brain function of young children in this study is considered a safe and non-invasive imaging modality when appropriate safety protocols are followed. Unlike X-rays or CT scans, the low-field MRI machine does not use ionizing radiation to produce images. Instead, it uses a magnetic field and radio waves to generate detailed images of the body's internal structures. This absence of ionizing radiation reduces the risk of radiation-related adverse health effects. Nevertheless, we will assess each child's risk factors and medical history before including them in the low-field MRI scan. Children with conditions such as epilepsy will not participate in the study. The study team will recruit qualified technicians to guide the process and assess risk factors, which will determine whether a participant qualifies for the tests.



## Conclusion

Examining brain function in relation to caregiver-child interactions (stimulation) provides invaluable insights into the foundational role of nurturing relationships in shaping neurocognitive development. Studies, using behavioral measures of ECD, have consistently demonstrated that responsive caregiving fosters secure attachment, language acquisition, emotional regulation, and cognitive skills while mitigating the adverse effects of stress.

By quantifying these interactions alongside neurobiological markers, we gain a deeper understanding of how positive caregiving practices influence brain structure and function. This knowledge will inform interventions aimed at optimizing early childhood experiences, promoting healthy development, and mitigating the long-term consequences of adverse caregiving environments. Ultimately, measuring caregiver interaction against brain changes underscores the critical importance of nurturing relationships in fostering resilient, and thriving individuals.

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