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Maternal anaemia investigated as a global health priority

University of Cape Town (UCT) PhD candidate Jessica Ringshaw is investigating the impact of maternal anaemia and iron deficiency during pregnancy on the child brain through her recently awarded Wellcome Trust International Training Fellowship.

As a fellowship awardee, Ringshaw will be registering for her PhD and working as a research fellow at UCT's Faculty of Health Sciences' (FHS) Department of Paediatrics and Child Health, in a research group connecting medical, para-medical and sociological personnel concerned with child health. This will be completed in co-affiliation with UCT's Neuroscience Institute (NI), a world-class facility and the first of its kind in Africa.

"It is an incredible honour to be awarded this prestigious fellowship and to be offered such a life-changing opportunity for training, career development, community engagement, and research. With this award, I look forward to doing important and meaningful work with the potential for global impact and recognition while contributing towards capacity building and skills development in South Africa," said Ringshaw.

Technological advancements pave the way
Although maternal anaemia during pregnancy has consistently been associated with adverse birth outcomes and poor child development, little is known about how it affects child brain structure and connectivity due to limited research using brain imaging techniques such as magnetic resonance imaging (MRI). This clinical question drives Ringshaw's work, which aims to investigate the impact of antenatal maternal anaemia on brain structure and neurodevelopment in very young children from the two South African birth cohorts.

The purpose of Ringshaw's work is to gain insight into the neurobiological pathways of maternal anaemia and iron deficiency as drivers of poor child development, focusing on the antenatal period as a critical window for child brain development. This has the potential to inform strategies for the management of iron deficiency and anaemia before and during pregnancy, and the timing of simple and accessible intervention strategies for improved child outcomes.

Potential impact of maternal anaemia and iron deficiency on child brain development
Anaemia is indicated by a low concentration of serum haemoglobin, an iron-rich protein found in red blood cells that plays a critical role in the delivery of oxygen to the body.

"Anaemia is a prevalent global health concern affecting approximately 273 million people worldwide. This is largely due to chronic iron deficiency, the most common nutritional deficiency

and the most prevalent underlying cause of anaemia, accounting for approximately 50% of cases," said Ringshaw.

During pregnancy, the risk of iron-deficiency anaemia (IDA) in mothers is particularly high due to the mother's expanding blood volume to support the haemoglobin-facilitated delivery of oxygen to the foetus, the increased placental and foetal metabolic demand for iron during gestation, and foetal iron loading for postnatal life. This risk is exacerbated in mothers who are iron deficient before pregnancy. Given the high oxygen consumption needs of the foetal brain, it is particularly vulnerable to IDA during this critical window of development.

"Although antenatal maternal anaemia is a global health priority, it is particularly prevalent in LMICs (low- and middle-income countries) where approximately 42% of women are estimated to be anaemic and 60% to be iron deficient. This is due to multiple risk factors, including food insecurity, malnutrition, and infectious disease," said Ringshaw. South Africa is no exception with many children in this context not reaching their developmental potential due to the high prevalence of these overlapping risk factors.

Interdisciplinary research

Ringshaw holds unique insight into this work and has gained a specialised skill set in paediatric neuroimaging and neurodevelopment as a qualified neuropsychologist and in her role as neuroimaging research coordinator on two large South African birth cohort studies: The Drakenstein Child Health Study (DCHS) and the DoLPHIN-2 Plus Study (D2-Plus).

Ringshaw explained that: "Women and children in LMICs bear the greatest burden with the recognition of IDA as the leading cause of years lost to disability, and the emergence of antenatal maternal anaemia as a significant driver of poor developmental outcomes in South African children."

The prevalence of antenatal maternal anaemia is particularly high in South Africa with recent findings from the DCHS indicating that 31% of children in this high-risk community were born to anaemic mothers. This preliminary work co-authored by Ringshaw and colleagues also suggests that long-term, persistent consequences of anaemia on child brain structure may be strongly driven by antenatal maternal anaemia during pregnancy.

Globally relevant research

In South Africa and many other LMICs, researchers are faced with the ongoing challenge of addressing various intertwined health priorities in a resource-limited setting. This has been worsened further by the COVID-19 pandemic, which has introduced additional challenges with less funding being available for other health priorities despite the negative impact of the pandemic on socio-economic status and psychosocial risk.

Ringshaw's Wellcome Trust fellowship has provided her with a unique opportunity to conduct globally relevant and impactful research which is needed in the LMIC context. As a research fellow, she will also receive advanced and specialised training with a particular focus on neuroimaging and neurodevelopment.

Jessica Ringshaw Photo: Supplied

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