Developmental origins of health and disease in Africa—influencing early life

It is well established that Africa is undergoing rapid transitions resulting in a triple burden of malnutrition, infectious diseases, and non-communicable diseases (NCDs).[1,2] That health systems are unlikely to be able to cope with this burden is also widely noted.[1,2] What is less often discussed outside academic circles is the degree to which infectious diseases and malnutrition in Africa are exacerbating the burden of NCDs, and the implications of this exacerbation for individuals and populations.

As described in the developmental origins of health and disease paradigm (DOHaD), and backed up by ample epidemiological data,[3] early-life exposures influence later life likelihood of NCDs, because of probable epigenetic changes. These effects are inter-generational.[4] Populations in Africa have been exposed to undernutrition for decades, but few studies have looked at the effect of early-life nutrition on later-life or cross-generational NCD risk on the continent.[1,5] The potential magnitude of the effect of malnutrition is therefore unknown. Additionally, populations in Africa have been affected by a high burden of infectious diseases, including HIV. Whether inflammation or other physiological factors related to infections and their treatments affect NCD risk,[6] and how these factors could interact with exposure to malnutrition, is also not known. Predictions of NCD prevalence in Africa have generally been modelled under the assumptions either that the rise in NCDs will reflect trends in urbanisation and demographics (producing conservative estimates), or that it will follow past trends in NCD prevalance.[7] A problem is that past trends data only capture recent history,[8] perhaps before the effects of malnutrition and infectious disease exposure in early life have manifested, and before widespread exposure to overnutrition has occurred. These predictions might be accurate, but they could also be gross underestimates. If countries in Africa are to achieve the UN's Sustainable Development Goals targets 3.4 and 3.8, to reduce premature mortality from NCDs by a third and to achieve universal health coverage, more information on the interaction between malnutrition, infectious diseases, and later-life NCDs is urgently needed.

To address gaps in knowledge and policy, we formed the Africa Chapter of the DOHaD Society, with support from the Stellenbosch Institute for Advanced Study (STIAS) and the African Academy of Sciences. The broad rationale for the Chapter is fourfold: first, to highlight the massive effects that early-life exposures will have on future burden of disease; second, to emphasise the dearth of knowledge around this subject and advocate for research funding to address this gap; third, to form a network of African scientists and collaborators from elsewhere to develop and study research questions relevant to DOHaD; and fourth, to build local capacity by encouraging and supporting young scientists in DOHaD-related research.

Importantly, a key mission of the Africa Chapter is to highlight the need for urgent policy action to implement public health solutions that are transferrable from other contexts. In this regard, South Africa is leading the way with the introduction of a sugar-sweetened beverage tax.[9] Such policies need to be enacted in many more African countries, but there are other initiatives that could potentially be scaled up to ensure that future generations' early life and subsequent exposures are more favourable. Ensuring an optimal maternal environment during pregnancy is crucial for reducing deleterious early-life exposures. However, to achieve this optimal maternal environment, interventions should also be targeted to other life stages. In particular, we believe that children represent an important and currently undertargeted population. Because knowledge and behaviours learned in adolescence influence lifestyle choices in adult life,[10] investment in young people's formal and informal education targets those at a key age point in the DOHaD trajectory. But just as there is little understanding of NCD trajectories, our understanding of how to provide messages that affect young people is also poor.[1] Given the strong association between childhood body-mass index and later-life obesity and type 2 diabetes, and the subsequent adverse effects of these diseases on future generations' health, we desperately need to understand how to communicate more effectively with children. Using implementation science[12] to upscale the results of initiatives that we

Panel: **Key priorities for research and policy change**

- Discover the attributable effects of early-life exposures on later life NCD burden in Africa
- Ascertain how a DOHaD framework can aid achievement of the sustainable development goals
- Assess the best strategies to improve maternal health during pregnancy
- Test solutions for optimising child and adolescent health
- Increase awareness of DOHaD across Africa.
- Ensure multisectoral collaboration to address DOHaD across governments, industry, civil society, and academia.
- Advocate for innovation and funding agencies to include DOHaD in Africa in their calls for proposals
- Use, and study the results of, fiscal policies to promote healthy living at all ages
- Foster a new generation of young African scientists to address DOHaD research questions

know, from elsewhere, might work in this domain will allow scientific learning, adaptability, and transferability to go together with rapid policy change. The effects of delivering educational messages that children have indicated resonate with them and might change their behaviour, and using innovative messaging such as celebrity endorsed music videos,[11] are prime targets for implementation and study.

We have outlined our key priorities for research and policy change (panel). We recognise that there are many more priorities and welcome suggestions from others working in this area. Our main recommendation is that we need to act now and we need to collaborate multisectorally if we are to temper the epidemic of NCDs in Africa.

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We declare no competing interests.

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