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## Editorial

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# Themed issue on the DOHaD workshop on Fetal, Placental and Pediatric Imaging

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The 2019 DOHaD World Congress "*Investing in a healthy future for all* – Research, Education, *Policy*" was preceded by several informative workshops. The focus of this themed issue is that of one of these workshops; a full-day workshop on Fetal, Placental and Pediatric Imaging. The Guest Editors for the themed issue were Dr Jack Darby, Dr Suresh Anand Sadananthan, Dr Navin Michael, Dr Alison Care and Prof Janna Morrison. They each acted as an Associate Editor for articles submitted to the call for papers.

This workshop brought together a range of researchers from around the world that use advanced imaging techniques such as ultrasound, magnetic resonance imaging (MRI), computed tomography (CT) and synchrotron to inform their DOHaD-related research. The workshop was organised by Prof Janna Morrison (University of South Australia (UniSA), Prof Sendhil Velan (A*STAR) and Prof Mary Wlodek (University of Melbourne). The morning session focused on Fetal, Placental and Neonatal Imaging with talks by Prof Janna Morrison (UniSA), Dr Alison Care (University of Adelaide), Dr Eric Schrauben (Sick Kids Hospital), Prof Stuart Hooper (Monash University) and Dr Justin Dean (University of Auckland). The afternoon session focused on Imaging Fat Depots and Metabolism with Prof Charles McKenzie (Western University), Dr Suresh Anand Sadananthan (A*STAR), Dr Navin Michael (A*STAR), Dr Oyekoya Ayorinde (University of Western Australia) and A/Prof Tim Regnault (Western University). The papers included within this themed issue highlight how advanced imaging techniques can provide valuable structural, functional and developmental information for DOHaD research.

Since the workshop, the presenters have worked together to write a review on the use of advanced imaging techniques that discusses how they can be used to advance DOHaD research[1]. Some of the researchers are developing and validating the use of these methods in animal models to determine the level of discrimination between normal and DOHaD-related pathology whilst others are applying them in the clinical setting for diagnosis. Regardless of the current use, all of these methods advance our fundamental understanding of biology, provide excellent opportunities for multidisciplinary collaboration and promote our ability for longitudinal DOHaD studies.

Tongpob *et al.* provide an excellent review of how advanced imaging techniques can be applied to studying the placenta[2]. This is important in advancing our understanding of the fundamental workings of the placenta and to develop diagnostic tools for identifying pregnancies at risk of poor placental function and thus complications that lead to poor fetal growth. In addition to discussion or the roles of ultrasound, MRI and electron and confocal microscopy, this review introduces light shield imaging, a technique that is being used more frequently as the commercial availability of these systems improves.

While low nephron number has been strongly linked to increased risk of cardio-renal impairments, research in this field has been hampered by lack of non-invasive tools for assessing nephron number that can avoid the need for kidney biopsies. Bennet *et al.*[3] review the current state of art in the development of radiological tools for *ex vivo* and *in vivo* assessment of nephron number and glomerular size. Brennan *et al.* investigate the use of ultrasound based fetal renal parenchymal thickness (RPT) as a novel non-invasive marker of nephron endowment[4]. The authors show that fetal RPT can be used to track the effects of fetal growth restriction on kidney development *in utero*. Fetal RPT may thus be more sensitive for early risk stratification than traditional makers of low nephron endowment like low birthweight.

Giza *et al.* review the range of non-invasive MRI tools that are now available to image the fetus *in utero*, and can provide specific structural and functional insights into fetal organ and adipose tissue development, lipid accumulation in tissues, fetal and placental oxygenation, placental microstructure, diffusion, perfusion and blood flow and metabolite concentrations[5]. These techniques can provide information on fetal and placental perturbations that can increase the cardiometabolic risk in the offspring.

The themed issue concludes with a review of the use of cardiac magnetic resonance (CMR) imaging in studies of developmental programming by Clarke *et al*[6]. Although not yet widely used in

human studies, CMR has been used in a baboon model of maternal undernutrition to non-invasively determine the adult cardiac consequences of being born small. The advantage with this approach, is that CMR could be performed at several time points throughout the life course and that molecular and morphological tissue changes could be measured and correlated with changes in cardiac function.

Ultrasound has played a key role in perinatology for many years, but other advanced imaging technologies are now emerging as methods for gaining key fundamental knowledge about fetal development, with the potential to play a role in the clinic. We see the utility of these techniques in perinatology expanding and playing key roles in longitudinal DOHaD studies in preclinical animal models as well as in the clinical research space. We look forward to seeing how these techniques will be used by DOHaD researchers in the years to come.

## References

1. Morrison J, Ayonrinde O, Care A, *et al.* Seeing the fetus from a DOHaD perspective: discussion paper from the advanced imaging techniques of DOHaD applications workshop held at the 2019 DOHaD World Congress. *J Dev Orig Health Dis.* 2020; 1–15. doi: 10.1017/S2040174420000884
2. Tongpob Y, Wyrwoll C. Advances in imaging feto-placental vasculature: new tools to elucidate the early life origins of health and disease. *J Dev Orig Health Dis.* 2020; 1–11. doi: 10.1017/S2040174420000720.
3. Bennett K, Baldelomar E, Morozov D, Chevalier R, Charlton J. New imaging tools to measure nephron number in vivo: opportunities for developmental nephrology. *J Dev Orig Health Dis.* 2020; 1–5. doi: 10.1017/S204017442000001X.
4. Brennan S, Watson D, Schneider M, Rudd D, Kandasamy Y. Can measurement of the foetal renal parenchymal thickness with ultrasound be used as an indirect measure of nephron number? *J Dev Orig Health Dis.* 2020; 1–9. doi: 10.1017/S204017442000015X
5. Giza S, Sethi S, Smith L, Empey M, Morris L, McKenzie C. The application of in utero magnetic resonance imaging in the study of the metabolic and cardiovascular consequences of the developmental origins of health and disease. *J Dev Orig Health Dis.* 2020; 1–10. doi: 10.1017/S2040174420001154
6. Clarke G, Li J, Kuo A, Moody A, Nathanielsz P. Cardiac magnetic resonance imaging: insights into developmental programming and its consequences for aging. *J Dev Orig Health Dis.* 2020; 1–17. doi: 10.1017/S2040174420001233