**Do the concepts of ‘life course approach’ and ‘developmental origins of health and disease’ underpin current maternity care? Study protocol**

**Chandni Maria Jacob 1,2,3, Wendy T Lawrence 2,3,4, Hazel M Inskip 2,3,4, Fionnuala M McAuliffe5, Sarah Louise Killeen5 and Mark Hanson 1,2,3**

1 Institute of Developmental Sciences, University of Southampton, Southampton, United Kingdom

2 Academic Unit of Human Development and Health, Faculty of Medicine, University of Southampton, Southampton, United Kingdom

3 NIHR Southampton Biomedical Research Centre, University Hospital Southampton NHS Foundation Trust and University of Southampton, Southampton, United Kingdom

4 Medical Research Council Lifecourse Epidemiology Unit, Southampton University Hospital, Southampton, United Kingdom

5 Perinatal Research Centre, School of Medicine, University College Dublin, National Maternity Hospital, Dublin, Ireland.

**Study protocol**

Contact details of author:

Chandni Maria Jacob c.m.jacob@soton.ac.uk

Institute of Developmental Sciences, MP 887

University Hospital Southampton,

Southampton, SO16 6YD,

United Kingdom

**Key words:** non-communicable diseases, health care practitioners, preconception, life course, developmental origins, prevention

**Synopsis:** This qualitative study will explore knowledge and attitudes among midwives and obstetricians about preventing the intergenerational transmission of NCD risk and improving preconception health.

**Abstract**

Objective:

1. To explore the knowledge of Developmental Origins of Health and Disease (DOHaD) concepts among midwives and obstetricians; 2. To identify barriers and facilitators for clinicians to engage women and their partners before or early in pregnancy on risk factors associated with DOHaD, and thus to embed the concept of DOHaD in routine clinical practice.

Methods:

A qualitative study using semi-structured interviews will be conducted in Ghana, India, Pakistan, Brazil, the UK and USA in collaboration with the International Confederation of Midwives and the International Federation of Obstetricians and Gynecologists. Participants will be contacted via email and telephone interviews will be conducted until data saturation followed by inductive thematic analysis.

Results: Findings from this exploratory study will provide new knowledge about the perspectives of midwives and obstetricians on DOHaD and their role in preventing the intergenerational passage of NCD risk and improving preconception care.

Conclusion:

This study will help us understand the current use of DOHaD principles in international maternity care and how this can be improved. Bringing DOHaD to clinical practice will help health care practitioners adopt a long-term approach in the prevention of NCDs and childhood obesity, and will support women to enter pregnancy in optimum health.

**Introduction**

Non-communicable diseases (NCDs) have become the leading cause of death and disability in the world [1]. The incidence of many chronic diseases including cardiovascular disease, diabetes, some forms of cancer, and obesity, are increasing at an alarming rate worldwide. This is particularly troublesome in low and middle-income countries (LMICs) that now face a double burden of under- and over-nutrition and high prevalence of maternal obesity [2, 3]. The rapidly growing science of Developmental Origins of Health and Disease (DOHaD) has shown that adult risk of NCDs can originate during the early development of the embryo and fetus, due to factors such as maternal undernutrition or overnutrition, environmental chemicals and pollutants and other stressors [4]. Risks of later NCDs for mother and child are also increased by pregnancy conditions including gestational diabetes, hypertension, preterm birth and fetal growth restriction. The sensitivity of the developmental period in pregnancy to malnutrition and a range of other stressors can have long-lasting impact on cardiometabolic health, bone health and even mental health. One of the major findings of DOHaD is that risks for NCDs and childhood obesity can be transmitted across generations through epigenetic processes [5].

The rise in the prevalence of obesity globally has led to an increase in the number of women of reproductive age who are obese, and this can influence the long-term health, particularly in relation to NCDs, wellbeing and resilience of both mother and baby [5]. Similarly, maternal underweight is also associated with preterm births, low birthweight and small for gestational age babies, which in turn are associated with increased risk of cardiometabolic disease in the offspring [6].

The recommendations from intervention studies based on life course and DOHaD concepts are now supported by multiple international organizations and departments of health [7, 8]. Optimum fetal and child nutrition provides several benefits such as cognitive, motor and socio-emotional development, better work capacity and productivity, and a decreased risk of NCDs including obesity throughout the life course [2]. However, the benefits are more likely to be manifest when public health programs and policies are supported by practices in clinical settings.

*Preventing the transmission of risk through preconception interventions*

There is now increased emphasis on the importance of the preconception period, with studies suggesting that intervening during pregnancy in the mother and offspring may be too late to prevent outcomes such as preterm birth, macrosomia and childhood obesity [9, 10]. Maternal Body Mass Index (BMI) before pregnancy is more closely associated with maternal and fetal outcomes than weight gain during pregnancy [11]. However, pre-pregnancy BMI may not receive adequate intervention as many women do not plan or prepare for pregnancy, and unplanned pregnancies are still common. In addition to contraception and planning the best time to conceive, weight management, diet, physical activity, folic acid intake and avoiding alcohol, smoking and recreational drugs are important preconceptional issues that are often not discussed with women before pregnancy [10, 12]. Recent reviews have shown that women who receive preconception care are more likely to adopt healthy behaviours, and therefore have better pregnancy outcomes such as weight management and birthweight [12, 13].

Furthermore, the first antenatal visit may be delayed in some pregnancies, especially in low resource settings and disadvantaged socioeconomic sections of a population. In most countries, few women are seen by health care practitioners (HCPs) before the end of the first trimester. Many intervention studies of DOHaD outcomes have focused on intervening during pregnancy, as women often access health care services after they are pregnant or face health issues during pregnancy. Hence, it is essential to include HCPs who meet women during pregnancy in the conversation on improving preconception health.

The inter-pregnancy or inter-conception period also provides an opportunity to access women with a history of adverse pregnancy outcomes such as gestational diabetes through post-partum interventions, but few studies have explored using this period to deliver preconception care [14, 15]. As women with gestational diabetes have a higher risk of recurrence in the next pregnancy and also type 2 diabetes and cardiovascular diseases in the longer-term [16], providing support through counselling and education in the inter-conception period could reduce the risk factors before the next pregnancy.

It has been shown that while women realize the importance of improving health prior to pregnancy, they often do not recall receiving relevant information or support for preparation during the preconception period [10, 17]. Additionally, receptivity (which precedes action) to information on preconception health depends on whether women were thinking about getting pregnant in the near future [17]. Thus, the low uptake of preconception interventions could be related to women’s emotions and beliefs, unplanned pregnancies, perceived absence of risk, knowledge, and accessibility (see Figure 1) [18].

HCPs such as obstetricians and gynecologists (OBGYNs) and midwives play a crucial role in implementing preventive strategies in the preconception period, and are well-placed to integrate early life risk reduction into a life course approach to health care. According to a study of Dutch obstetricians and physicians, uncertainty among HCPs about the need and effectiveness of preconception interventions appears to influence the decision to discuss preconception issues [19]. If addressed at all, preconception care is generally discussed at the end of consultations with general practitioners, and covering all risks that could affect future pregnancies is a challenge [20]. The delivery of preconception services can also be influenced by the variety of risk factors requiring communication between specialties, poor organization of preconception care systems and HCPs’ views on their professional roles and responsibilities. HCPs also want to respect the patient’s right to choose autonomously whether or when to become pregnant, which may sometimes be seen to present ethical barriers to discussing the issue of planning for pregnancy or reducing weight before conception [19].

*The need to explore health care practitioners’ views on implementing DOHaD concepts*

Most of the literature exploring barriers to implementing preconception care by HCPs focuses on issues such as folic acid intake and fertility. The idea from DOHaD research of achieving a healthy BMI and nutritional status before pregnancy and so reducing the communication of NCD risk to the next generation has not been previously explored. Apart from NCD risks, the benefits for the next generation through interventions related to micronutrient status (e.g. Vitamin D) before and during pregnancy should be communicated.

A cross-sectional survey in Australia suggested that the general concepts of DOHaD were widely accepted by HCPs with almost all (98%; n=208) accepting the link between early exposure and NCDs [21]. However, only 25% of participants described themselves as confident to give DOHaD-related advice. However, such survey methods are unable to capture practitioners’ awareness and attitudes towards DOHaD, which is essential in order to implement the concept in routine practice. The understanding of DOHaD among HCPs who provide care in the preconception, pregnancy and post-partum periods, influence the way in which they discuss and deliver preconception care to future parents. A better understanding of the views that midwives and OBGYNs hold about their role and responsibilities towards NCD prevention in the next generation and for the long term health of women may help to explain if and why the discussions about pregnancy preparation and preventing risk in the next generation do not take place.

**Conceptual framework and research questions**

The barriers to preconception care have been explored previously [17-20]. However, there has been relatively little research on the barriers to preconception care in the context of prevention of NCDs such as diabetes and cardiovascular disease, or to implementing DOHaD through health care. We aim to explore the awareness and execution of DOHaD in clinical practice with midwives and OBGYNS as crucial clinical stakeholders in the preconception period, through pregnancy and post-partum. Figure 1 illustrates the conceptual framework for the proposed study.

We will address the following questions:

1. Do the concepts of life course health, DOHaD and intergenerational transmission of risk of NCDs underpin maternity care and practice by midwives and OBGYNs in selected countries?
2. What do midwives and OBGYNs see as the barriers and facilitators to implementing these concepts in maternity care (preconception including the inter-conception period, antenatal and postnatal care)?
3. How can midwives and OBGYNs be engaged effectively to increase awareness of the need to improve health in the preconception period and to prevent the intergenerational passage of NCD risk?

**Study design**

A qualitative exploratory study design will be used, with data collected from telephone interviews. This method captures complex, experiential and context-based issues that are relevant to clinical care, but which are not captured through quantitative survey methods [22]. Data collection for this study commenced in June 2019.

The protocol for this study was co-produced by a research team that included a health psychologist and qualitative expert (WTL), health care practitioners (FM, CMJ), a dietitian (SLK) and, epidemiology and DOHaD experts (HMI, MH). In developing the project, we also consulted the International Confederation for Midwives (ICM) and the International Federation of Obstetricians and Gynecologists (FIGO) for collaboration and recruitment of participants.

*Study sample*

We will conduct a purposive followed by a snowball sampling strategy to seek information from the participants about the categories of clinicians who come in contact with women in the preconception period [11]. The participants for this study will include midwives and OBGYNs who are currently working in clinical practice. Midwives and OBGYNs are often the first health care providers a woman meets once she has become pregnant as so are best placed to deliver basic interventions based on DOHaD concepts to the widest reach of women. In addition, understanding their views on preconception and post-partum care to prevent NCD transmission will help improve the uptake of existing services and develop relevant programs. The countries selected will be Ghana, India, Pakistan, Brazil, the UK and USA, to give a global perspective, and due to the rising trends in NCD-related issues such as maternal and childhood obesity and gestational diabetes in these regions [23, 24]. Risk factors for NCDs such as low birthweight and preterm labor are highly prevalent in LMICs such as India and Pakistan [25]. Within each country, either midwives or OBGYNs will be selected to take part in the study based on the local models of maternity care, as the roles and remit of midwives and OBGYNs varies greatly between countries [26]. For example, in the UK, midwives are the main point of contact throughout routine antenatal care. The USA, on the other hand, has an obstetrician-led antenatal care system [27]. Even within countries, the point of care varies between rural and urban regions, as seen in India and Ghana [28]. Hence from LMICs, we will recruit midwives/OBGYNs according to the common model of delivery in the region. We do not aim to produce a sample matched to the general population. The stratification by country and role of HCP will help incorporate variation into the sample and thus enable the exploration of diversity within the data [29].

*Recruitment*

Recruitment in selected countries will be via professional bodies (ICM, FIGO). Information sheets and consent forms will be circulated prior to interviews via e-mail (or post when applicable) and these will include the University of Southampton General Data Protection Regulation (GDPR) data protection privacy notice. The consent forms will include questions for participation and consent to be audio recorded during the interview. Before the interview starts, participants will be asked for background information (occupation, years of experience in current role, gender, age).

*Methods*

In qualitative research, the methodology (term used for philosophical position) influences the methods (tools) adopted for the research [22]. The researcher will adopt the approach of ‘critical realism’ to guide the methods used in this study [30]. This approach suggests that the HCPs’ knowledge, beliefs and attitudes about DOHaD and its effects on health (individual factors) along with extrinsic factors such as health care systems, cultural and social norms and environment can influence the implementation of preventive interventions for NCD risk in practice. The aim of the study is not to find an absolute ‘truth’, but to describe the phenomena considering the real and complex environments in which participants live and work [31].

The methods used for data collection will be semi-structured interviews (audio recorded), lasting about 30 minutes, with midwives and OBGYNs by telephone (due to geographic barriers). It is anticipated that approximately 40-50 interviews in total, or 6-8 interviews per country (or until data saturation is reached), will be conducted. Theoretical saturation is the point during code development when no new information emerges during analysis [32], at which point there is little to be gained by arranging more interviews with the same stakeholder group. Inductive analysis and coding will be initiated early in the project before completion of interviews. Saturation will be identified when three consecutive transcripts do not present any new ideas, codes or topics. The sample will be large enough to capture a range of perspectives.

Participants who have agreed to participate and returned their consent form will be invited to take part in a 30-minute telephone interview. A semi-structured interview guide was developed, piloted and modified between January and April 2019 with midwives in Southampton, UK to ensure the questions are easily understood by participants and contribute to answering the study questions. Vignettes (brief written accounts) will be included in the participant information sheet that is provided prior to the interviews to promote discussions focused on situations encountered by the participants. Vignette-based methods have been frequently used to explore judgement and decision-making in HCPs [33] and will consist of short narratives about fictional patients that will simulate a real-world scenario. The vignette is intended to stimulate discussion on DOHaD and maternal NCDs during the interview and to explore if these principles are being put to use during routine maternity care, for example, while discussing the prevention or complications of gestational diabetes to a pregnant woman. The discussions will not focus on how a patient will be clinically managed.

The interviews will consist of open-ended questions and the discussion guide will include questions on preconception, pregnancy and postpartum periods, and the level of awareness among the clinicians about DOHaD concepts. It will also include discussion of intergenerational transmission of risk of NCDs, the barriers and enabling factors (facilitators) to implementing these concepts in practice and ways to engage HCPs to initiate the conversation related to preconception health with young couples and women. The cultural contexts in which HCPs operate in each country and the influence of diverse healthcare systems will also be explored.

Data will be anonymized and stored securely by the researcher (CMJ) during transcription. Names mentioned in interviews will be replaced by aliases. The project will not share raw data with any other organizations though the anonymized transcripts may be shared with researchers involved the project.

*Analysis*

The interviews will be transcribed verbatim by the researcher (CMJ) and analyzed inductively. Inductive approaches are used in qualitative research to generate new theory emerging from the data [34]. The researcher will begin data collection and analysis concurrently, without any preconceived notions or theories about what results will be found. Coding and theme development will be directed by the content of the data. Thematic analysis is a data-driven ‘bottom-up’ method widely used in qualitative research that focuses on identifying patterned meaning across a dataset [22, 34]. The coding process involves generating short labels that identify features of the data that may be relevant to the research question. Later, these codes will be examined to identify broader patterns (called themes) in discussion with the research team. The themes will help develop the analytic narrative for presenting the results of the study. We will code themes that reoccur or appear central to the research question, guided by salience for issues that are conceptually relevant and important, not just those emerging frequently. Qualitative data management software (NVIVO 12) will be used to facilitate analysis. To ensure rigor while creating the coding framework, a proportion of randomly-selected transcripts will be double-coded by another researcher with expertise in qualitative research. Additional interviews, for clarification, with other stakeholders will be conducted if needed.

We will take a critical realist epistemological stance to our analysis as discussed above [30]. A key assumption in this stance is that the researcher and participants jointly create their understanding of the research question. Though commonalities among stakeholders are being explored in the study, individual perspectives are also valued.

**Discussion and Implications**

In contrast to the growing body of interventional and observational studies focusing on NCD prevention, no in-depth qualitative analysis of HCPs’ awareness and attitudes towards DOHaD has been conducted. This study will help us understand the barriers and facilitators for HCPs to communicate with patients regarding issues related to nutrition and body weight and their association with NCD risk in future generations. This is crucial to inform health care programmes and policies which aim to improve early life outcomes and to support clinicians in embedding DOHaD principles into their routine practice. As DOHaD research addresses several sensitive issues related to gender and weight, it has been recommended that the implementation of the concepts should take into account the social and cultural contexts that influence decisions related to health [35]. The burden of improving preconception health should not fall on individual women or HCPs alone, but needs to be integrated into a health care system that provides a continuum of care before and during pregnancy and after delivery, supported by wider public health programs and policies.

Awareness of DOHaD concepts has been explored previously among medical students in Japan and New Zealand [36]. Results suggest that on entry most students had no awareness about the concepts of DOHaD or the ‘first 1000 days’ (period between conception and second birthday). However this improved to 60% by year 3, which is however less than ideal to address the increasing burden of NCDs. Reductionist thinking about the causes and effects of NCDs is common both among HCPs and in societies in general [36]. Viewing health through a life course lens is critical to understanding the complex presentation of NCD risk factors and to developing an understanding of why the first 1000 days presents an opportunity to improve population health.

This project will provide new knowledge about the perspectives HCPs have on DOHaD, and on integrating NCD prevention strategies into preconception care. This will include topics such as the internal and external factors that influence conversations about nutrition, preconception and pregnancy weight management, interactions with patients that influence HCPs’ decision-making, the role of clinicians in normalizing the concept of pregnancy preparation and the ways in which HCPs can be empowered to bring DOHaD into routine clinical care. Understanding prenatal health status and nutritional environment before birth, and their long-term effects on mother and baby could be improved through integrating DOHaD education into the medical and midwifery curricula [36]. Studies are now also focusing on school students and youth, who are the future parents of tomorrow, to increase knowledge of DOHaD [37]. However, knowledge alone or HCPs’ advice does not lead to behavior change [38]. Future parents need to be supported by HCPs who are aware of DOHaD and trained in communicating the messages effectively. Programs for training HCPs in ‘Healthy Conversation Skills’ show promise in supporting the initiation of conversations about prevention of NCD risk and improving nutritional status at every interaction [39].

HCPs have suggested that the availability of preconception checklists, brochures or handouts could facilitate including preconception care more routinely [20]. Risk assessments for NCDs in future parents can be conducted by midwives, general practitioners, and OBGYNs to identify people on a high-risk trajectory for NCDs. Studies exploring women’s views on preconception care have shown that preconception classes, resources in waiting rooms and letters from general practitioners would be well received [17]. Thus our findings could support the ICM and FIGO in developing resources and continuing professional development programs for HCPs to increase implementation of DOHaD.

Given the range of risk factors that affect preconception health and models of maternity care in each country, a single best model for HCPs in all countries is unlikely to arise from the findings. Rather, tailoring the implementation to the local health care system will be necessary. Similarly, policies related to the environment and food systems and cultural practices that act as a barrier to prevent NCDs can influence risk of NCDs and should be reviewed while developing population-level health programs to prevent the transmission of NCDs.

To ensure rigor of the study and prevent bias we will include double-coding during analysis, sampling from different countries and a constant reflective process by the researcher. Findings will be reported comprehensively and unambiguously using the COREQ checklist [40]. While care has been taken to include a diverse sample, the findings may not be easily extrapolated to all countries. A large sample from across the countries will not be required for the objective of this study. However, a larger scale follow up could be considered based on the results of this exploratory study. Overall, the results will help develop programs that can lead to a shift in thinking and action among HCPs for improving the health of future parents and children globally. We acknowledge the potential language bias in selection of participants as interviews will mainly be conducted in English.

Ethics approval was granted by the Faculty of Medicine Ethics Committee, University of Southampton (48281). Participants will be provided with information about the purpose and method of the study, emphasizing that participation is voluntary, that they can withdraw at any time, and that confidentiality will be guaranteed.

**Author contributions**

All authors were involved in the conception and design of the study. CMJ wrote the manuscript. CMJ and MH designed the conceptual framework with input from all other authors. MH, WTL, FM, HMI and SLK provided input into the study design and analytical methods and revisions of the manuscript.

**Acknowledgements**

CMJ is supported by the European Union's Horizon 2020 funded LifeCycle Project under grant agreement No. 733206. MH is supported by the British Heart Foundation and the National Institute for Health Research, United Kingdom, through the Southampton Biomedical Research Centre. HMI is supported by the UK Medical Research Council. We are grateful to the FIGO Pregnancy and NCDs committee and ICM board members for their input into the development of the study and support for recruitment.

**Conflicts of interest**

The authors have no conflicts of interest.

**References**

1. World Health Organization. Global Health Estimates 2015: Deaths by Cause, Age, Sex, by Country and by Region 2000-2015.

2. Black RE, Victora CG, Walker SP, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet. 2013;382(9890):427-51.

3. World health Organisation. The double burden of malnutrition: policy brief. Geneva: 2016. <https://www.who.int/nutrition/publications/doubleburdenmalnutrition-policybrief/en/>. Accessed June 2019

4. Gluckman PD, Hanson MA, Cooper C, Thornburg KL. Effect of in utero and early-life conditions on adult health and disease. N Engl J Med 2008 Jul 3;359(1):61-73.

5. Godfrey KM, Reynolds RM, Prescott SL, et al. Influence of maternal obesity on the long-term health of offspring. Lancet Diabetes Endocrinol. 2017;5(1):53-64.

6. Dean SV, Lassi ZS, Imam AM, Bhutta ZA. Preconception care: nutritional risks and interventions. Reproductive health. 2014;11(3):1.

7. Department of Health. Healthy Lives, Healthy People: Our strategy for public health in England. London2010. <https://www.gov.uk/government/publications/healthy-lives-healthy-people-our-strategy-for-public-health-in-england>. Accessed June 2019

8. World health Organisation Regional Office for Europe. Good Maternal Nutrition: The best start in life. Copenhagen, Denmark 2016 <http://www.euro.who.int/__data/assets/pdf_file/0008/313667/Good-maternal-nutrition-The-best-start-in-life.pdf?ua=1> Accessed June 2019

9. Hanson M, Barker M, Dodd JM, et al. Interventions to prevent maternal obesity before conception, during pregnancy, and post partum. Lancet Diabetes Endocrinol. 2017;5(1):65-76.

10. Stephenson J HN, Hall J, Schoenaker DA, et al. Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health. The Lancet. 2018; May 5;391(10132):1830-41.

11. Voerman E, Santos S, Inskip H, et al. Association of gestational weight gain with adverse maternal and infant outcomes. JAMA. 2019;321(17):1702-15.

12. Barker M DS, Colbourn T, Fall CH, Kriznik NM, Lawrence WT, Norris SA, Ngaiza G, Patel D, Skordis-Worrall J, Sniehotta FF. Intervention strategies to improve nutrition and health behaviours before conception. The Lancet. 2018; May 5;391(10132):1853-64.

13. Jacob CM, Newell M, Hanson M. Narrative review of reviews of preconception interventions to prevent an increased risk of obesity and non‐communicable diseases in children. Obesity Reviews. 2018; Accepted, In press.

14. DiNallo JM, Downs DS. The role of exercise in preventing and treating gestational diabetes: a comprehensive review and recommendations for future research. J Appl Biobehav Res. 2007;12(3‐4):141-77.

15. Tieu J, Bain E, Middleton P, Crowther CA. Interconception care for women with a history of gestational diabetes for improving maternal and infant outcomes. The Cochrane Library. 2013.

16. Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. Diabetes care. 2002;25(10):1862-8.

17. Mazza D, Chapman A. Improving the uptake of preconception care and periconceptional folate supplementation: what do women think? BMC Public Health. 2010;10(1):786.

18. Poels M, Koster MP, Boeije HR, Franx A, van Stel HF. Why do women not use preconception care? A systematic review on barriers and facilitators. Obstet Gynecol Surv. 2016;71(10):603-12.

19. M’hamdi HI, van Voorst SF, Pinxten W, Hilhorst MT, Steegers EA. Barriers in the uptake and delivery of preconception care: exploring the views of care providers. Matern Child Health J. 2017;21(1):21-8.

20. Mazza D, Chapman A, Michie S. Barriers to the implementation of preconception care guidelines as perceived by general practitioners: a qualitative study. BMC Health Serv Res. 2013;13(1):36.

21. McMullan RL, Fuller NR, Caterson ID, et al. Developmental origins of health and disease: Who knows? Who cares? J Paediatr Child Health. 2017;53(6):613.

22. Braun V, Clarke V. Ten fundamentals of qualitative research. In: Successful qualitative research: A practical guide for beginners: Sage; 2013.

23. Abarca-Gómez L, Abdeen ZA, Hamid ZA, et al. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128· 9 million children, adolescents, and adults. The Lancet. 2017;390(10113):2627-42.

24. Zhu Y, Zhang C. Prevalence of gestational diabetes and risk of progression to type 2 diabetes: a global perspective. Curr Diab Rep. 2016;16(1):7.

25. Black RE. Global prevalence of small for gestational age births. Low-Birthweight Baby: In Born Too Soon or Too Small. 81: Karger Publishers; 2015. p. 1-7.

26. ten Hoope‐Bender P, Campbell J, Fauveau V, Matthews Z. The state of the world's midwifery 2011: delivering health, saving lives.
Int J Gynaecol Obstet. 2011;114(3):211-2.

27. Hollowell J, Oakley L, Kurinczuk JJ, Brocklehurst P, Gray R. The effectiveness of antenatal care programmes to reduce infant mortality and preterm birth in socially disadvantaged and vulnerable women in high-income countries: a systematic review. BMC Pregnancy Childbirth. 2011;11(1):13.

28. Afulani PA, Phillips B, Aborigo RA, Moyer CA. Person-centred maternity care in low-income and middle-income countries: analysis of data from Kenya, Ghana, and India. Lancet Glob Health. 2019;7(1):e96-e109.

29. Palinkas LA, Horwitz SM, Green CA, Wisdom JP, Duan N, Hoagwood K. Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. Adm Policy Ment Health. 2015;42(5):533-44.

30. Madill A, Jordan A, Shirley C. Objectivity and reliability in qualitative analysis: Realist, contextualist and radical constructionist epistemologies. Br J Psychol. 2000;91(1):1-20.

31. Bhaskar R. A Realist Theory of Science (Brighton, Harvester). 1978.

32. Saunders B, Sim J, Kingstone T, Baker S, Waterfield J, Bartlam B, et al. Saturation in qualitative research: exploring its conceptualization and operationalization. Qual. Quant. 2018;52(4):1893-907.

33. Bachmann LM, Mühleisen A, Bock A, ter Riet G, Held U, Kessels AG. Vignette studies of medical choice and judgement to study caregivers' medical decision behaviour: systematic review. BMC Med Res Methodol. 2008;8(1):50.

34. Braun V, Clarke V. Using thematic analysis in psychology. Qualitative research in psychology. 2006;3(2):77-101.

35. Penkler M, Hanson M, Biesma R, Müller R. DOHaD in science and society: emergent opportunities and novel responsibilities. J Dev Orig Health Dis. 2018:1-6.

36. Oyamada M, Lim A, Dixon R, Wall C, Bay J. Development of understanding of DOHaD concepts in students during undergraduate health professional programs in Japan and New Zealand. J Dev Orig Health Dis. 2018;9(3):253-9.

37. Woods-Townsend K, Leat H, Bay J, Bagust L, Davey H, Lovelock D, et al. LifeLab Southampton: a programme to engage adolescents with DOHaD concepts as a tool for increasing health literacy in teenagers–a pilot cluster-randomized control trial. J Dev Orig Health Dis. 2018;9(5):475-80.

38. Anderson RM, Funnell MM. Patient empowerment: myths and misconceptions. Patient Educ Couns. 2010;79(3):277-82.

39. Lawrence W, Black C, Tinati T, Cradock S, Begum R, Jarman M, et al. ‘Making every contact count’: evaluation of the impact of an intervention to train health and social care practitioners in skills to support health behaviour change. J Health Psychol. 2016;21(2):138-51.

40. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care. 2007;19(6):349-57.

**Legend Fig 1:** Conceptual framework of factors affecting the intergenerational transmission of risk for NCDs. The life-course model of NCDs and DOHaD both suggest that the mother’s nutritional status and health behaviours, before and during pregnancy, can have effects on fetal growth and development. This has further long term consequences on mother and child's health. For example, pre-pregnancy BMI is a risk factor for both gestational diabetes and future type 2 diabetes in the mother and childhood obesity for the baby. OBGYNs and midwives are stakeholders who come in contact with women during these stages most frequently. Knowledge and understanding of DOHaD among health care practitioners will determine the extent to which these issues are communicated with women or couples.