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Reviews

Implications of the Developmental Origins of Health and Disease concept for policy-making

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Abstract

With the rising burden of noncommunicable diseases (NCDs) globally and recognition that NCD risk can be transmitted across generations, there is an increasing reason for the Developmental Origins of Health and Disease concept to inform international policies and guidelines. However, the concept has not yet been widely adopted in national policies and health care settings. Appropriate dissemination of evidence and possible solutions to the challenge of NCDs is needed to build awareness among stakeholders and policy-makers. In this article, we consider the key messages from the field of developmental origins of health and disease and how they are communicated to stakeholders and policy-makers, emphasising the need for population-level interventions to be communicated in a socially just and nonstigmatising manner.

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Keywords

Developmental origins, Policy, Noncommunicable diseases, Preconception, Policy-making, Social justice.

Abbreviations

DOHaD, Developmental Origins of Health and Disease; NCDs, noncommunicable diseases; LMICs, low- and middle-income countries; BMI, body mass index.

Introduction — the need for DOHaD-based policies for NCD prevention

In recent years, research from the field of the Developmental Origins of Health and Disease (DOHaD) has suggested that events before birth can have life-long consequences [1,2]. The DOHaD concept is complementary to that of a life-course approach [3] and the first 1000 days of life [4] — all of which suggest that preventative interventions in early life could not only improve later physical and mental health but also educational attainment and economic productivity [5–7]. Although initially focused on cardiometabolic disease, DOHaD now includes other noncommunicable diseases (NCDs) such as cancer, osteoporosis and mental illnesses. Considering early life factors, in particular, the health of adolescents and young people has now become imperative to address the increasing burden of NCDs globally and is key to limiting the passage of NCD risks to the next generation [8].

Risk factors for NCDs such as obesity present a difficult problem for policy-makers [9] because of a range of interrelated causal risk factors (food policies, industry, trade, climate change, poverty, education, etc.). A recent analysis [10] showed that, globally, most countries implemented just under half of the WHO-recommended NCD prevention and control policies in 2017 [11], and that most of these were high-income countries. It is, therefore, now important to raise awareness of the relevance of the DOHaD concept to reducing NCDs [12–14]. In this article, we consider what the key DOHaD messages are and how they are communicated to stakeholders and policy-makers when developing solutions to the challenge of NCDs.

DOHaD and policy-making — an important opportunity?

Recognising the need to intervene early in the life course, several action plans and strategy documents for NCD prevention by international health organisations in the last 10 years included DOHaD-related messages [15–17]. The recent WHO–UNICEF–Lancet Commission also highlights the importance of DOHaD concepts such as health and nutrition in the preconception period, pregnancy and early childhood [18]. The economic case for DOHaD was presented in the Global Strategy for Women's, Children's and Adolescents'

Health, suggesting that investing in the health and nutrition of women, children and adolescents would lead to a 10-fold return in the form of better educational attainment, workforce participation and social contributions [19]. The DOHaD framework provides added advantage in that it can be applied to the evaluation of existing policies to estimate their long-term effects and model outcomes related to NCDs and maternal and child health [20].

However, the adoption of DOHaD in such policies has not always been sustained. Although the 2011 UN Political Declaration on the Prevention and Control of NCDs [21] stated that "maternal and child health is inextricably linked with NCDs and their risk factors", the recent UN taskforce on NCDs [22] and 2018 WHO report on NCDs [23] make little reference to improving women's and children's nutrition and young people's health as a strategy — even though these factors may influence the attainment of almost all the SDGs [14,24].

From these considerations, it would appear that a DOHaD message about NCD prevention should fall on fertile ground in the policy-making arena. The interventions indicated by DOHaD research are easy to understand — for example, to improve body mass index (BMI), physical activity and diet in young men and women before conceiving a baby, to improve nutrition in pregnancy, to prevent excess gestational weight gain, to screen early for pregnancy complications such as gestational diabetes, to increase breastfeeding rates and to improve infant weaning foods [14,25–27]. Yet, these challenges remain important (or are worsening) in most countries [28]. One of the reasons could be that, although widely credited for highlighting NCD risk factors across the life course and between generations, so far DOHaD-based intervention studies have shown small effects, and long-term longitudinal intervention studies are lacking [25,28,29]. Similarly, the operationalisation of the DOHaD agenda in the real-world has not been contextualised and communicated clearly to national-level policy-makers, health care systems or local governments, to help them implement measures in different settings.

From the research perspective, DOHaD has now moved beyond animal and biomedical studies focussing on 'programming' of pathological processes to consider how patterns of early development across the normal range affect later responses to challenges and wider environmental and socioeconomic factors [30]. This change in emphasis is insufficiently recognised by DOHaD researchers, with corresponding problems for communicating an appropriate message to policy-makers. Although the DOHaD concept is increasingly acknowledged as key to reducing the NCD burden at a population level [31], this does not appear to be translated to action in the context of the life course in most countries. Furthermore, the recent WHO report [32] for the European region, but more widely applicable, recommended that the implementation of such concepts needs to be monitored and measured to increase accountability for stakeholders. However, a lack of consensus on target indicators for measurement from the scientific community and key stakeholders responsible for implementing the DOHaD agenda acts as a barrier.

Policy considerations from DOHaD

The term 'policy' in the DOHaD context can range from national-level actions (e.g. ban on the marketing of unhealthy food to children), guidelines for health care practitioners and health systems (e.g. providing a continuum of care, nutritional supplementation in pregnancy) to policies that affect people's behaviours and choices (e.g. sugar taxation, product placement in supermarkets). To reduce DOHaD-related risk factors a novel approach which generates interest in good health, nutrition, pregnancy planning and preparation in the general public is needed, combined with top-down policies which enable better health behaviours [28]. NCDs are an example of a global health challenge that cannot be resolved by a single strategy [33]. Policies related to DOHaD are multisectoral, much as DOHaD is an interdisciplinary science connecting genetic, environmental, social and developmental influences. However, in communicating with policy-makers, collaboration between the disciplines has been limited [14], particularly with social scientists and economists who are increasingly presenting the evidence for DOHaD-related effects on human health and social capital [13].

Some of the most important aspects of early life interventions for policy-makers are economic [34]. For example in the Perry Preschool and Abecedarian programmes, at-risk children provided with predesigned kindergarten and home interventions showed an increase in high school completion rates and college attendance, lower rates of teenage pregnancy and dependency and welfare [6,34,35]. A recent review of early childhood educational interventions found that they led to a positive social return irrespective of the type of programme [36], including earning, maternal employment and income, and also reductions in crime and childcare and healthcare costs. The notion that capabilities of a child can have different weighting, with a deficit in one dimension potentially compensated by increased strength in another [37], has great significance for DOHaD-based policies.

Inequalities in health worsen NCD-related outcomes and place disadvantaged populations at a higher risk trajectory from early life [38–40]. Although the evidence for implementing a life-course model mostly involves maternity services [32], the DOHaD framework

extends beyond sexual and reproductive health and long-term and intergenerational effects can also be developed and evaluated — for example, paid family leave, sugar-sweetened beverage taxation and housing policies [20]. Such interventions have the potential to have knock-on effects on NCD prevention, mediated by food security, dietary habits and lifestyle/behaviours. In addition to socioeconomic inequalities, sudden economic shocks can also lead to adverse DOHaD consequences [41], and women and children's health and maternity services need to be protected during periods of austerity. Socioeconomic status, earnings and setting can determine the availability and access to high-quality foods and health care making these dimensions important from a DOHaD perspective [38,42].

Examples of the application of DOHaD concepts in policies and population-level interventions

There is an increasing focus in DOHaD research on intervention studies coupled with sophisticated analytical techniques for causal analysis from big-data projects [43]. For instance, population-based complex interventions such as the Healthy Lives Trajectories Initiative [44], which integrates interventions based on education, social support and the food environment in new cohorts starting before conception and in four countries (South Africa, India, China and Canada) are ongoing. Such long-term programmes, however, require political support and commitment: for Healthy Lives Trajectories Initiative this is shown by the respective governments of the four countries along with the WHO and the Canadian Institutes of Health Research.

At a local level, collaborations in DOHaD between schools, hospitals and universities have developed complex interventions and public engagement programmes, targeting young people [45,46]. These activities promote the awareness of DOHaD concepts and build inquiry skills among young people while also increasing understanding of factors influencing their health literacy and health behaviours. This creates a bottom-up synthesis of knowledge for NCD prevention among the adolescent group, who are becoming increasingly at risk for NCDs globally [47]. Investing in adolescent health provides a 'triple dividend' through improved growth and potential, creating healthier life-course trajectories and laying the foundations for better health of the next generation [48]. Efforts to engage adolescents to support behaviour change using the school as a platform for multicomponent interventions have shown some promise for outcomes such as BMI, especially for the management of overweight and obesity [49,50]. For dietary interventions, peer support and the use of educational media supported healthy habits such as increased fruit and vegetable consumption [51]. However, despite the rapid growth in digital interventions and mobile applications, effective use for adolescents has been low [52]. Overall, studies that involved parents and behavioural strategies such as self-monitoring and goal setting have led to an improvement in healthy behaviours [51,52].

Considering the wide range of stakeholders who make decisions related to DOHaD outcomes for the public, the following groups were selected as vital stakeholders who influence maternal and Fetal outcomes related to NCDs — policy-makers, health care practitioners (especially midwives, obstetricians, general practitioners) and young people in the general population. Table 1 presents examples of key priorities and needs along with examples of interventions for NCD prevention in the first 1000 days viewed through a DOHaD lens.

It has been suggested that resources to prevent NCDs and build health capital in the population must be mobilised from the 'disease-by-disease' model to important periods in the life course, which can be achieved through an integrated system, providing a continuum of care from preconception through pregnancy and into childhood [8,13,60]. Effective multisectoral organisation for DOHaD communication can be achieved through alliances with other interested stakeholders including community leaders, NGOs, clinical organisations, social workers, industry, consumer advocates, education and employment sectors [13].

Barriers to communicating DOHaD messages and considerations for framing

Although scientists contributing to evidence-informed policy-making often work on the assumption that high-quality evidence will lead to better decision-making for evidence to manifest as policy, awareness of how to implement it in a timely manner using appropriate knowledge translation mechanisms is necessary [61,62]. Factors such as varying policy objectives, resource constraints and political interests at a high-level along with public opinion and values, timing and circumstances at the population level can impact the utilisation of DOHaD research into national-level programmes [14,63,64].

A hurdle for policy-makers to implement DOHaD-related policies is that very few studies have articulated clearly what needs to be achieved through policy and how this can be measured [32]. Suggested outcomes to be monitored should go beyond biological outcomes such as BMI and birth weight and need to consider socioeconomic factors, along with measures to evaluate long-term outcomes (e.g. childhood obesity). Policy-makers need to provide practical and acceptable solutions to the public, often within a short timeframe, and are limited by 'cost—benefit' and popularity considerations. Interdisciplinary syntheses, impacting on

Table 1

Evidence-based priority areas and next steps for three key stakeholder groups for implementing DOHaD policy to prevent NCDs.

	Policies and national-level programmes	Health care practice	General population
Priority areas	• Planning obesity and NCD prevention interventions together with structural interventions, for example, targeted food taxes, subsidies, food labelling [53] • Maternal mental health (before, during and after pregnancy) [54] • Investing in disadvantaged children [55]) • Better workplace policies • Breastfeeding friendly environments • Early childhood development and school readiness [26,27]	• Considering the whole family and early childhood development [37] • Focus on missed opportunities in the health care system for a continuum of care — particularly for young girls and women who are not pregnant. These include women seeking fertility, approaching endocrinologists, GPs, cardiologists [8], nurses, pharmacists, community midwives and postnatal health visiting teams [28] • Better detection and management of NCDs through clinical pathways: this can be facilitated by adherence to guidelines by the International Federation of Obstetricians and Gynaecologists' (FIGO) (e.g. Hyperglycaemia in Pregnancy, Adolescent, Preconception and Maternal Nutrition guidelines) [55,56,57], RCOG 'Better for Women' report, to adopt a life-course approach [58]. • Particular attention to maternal mental health and stress • Developing tools to enable the discussion of nutrition by health care practitioners • Focus of consultation on fitness and nutrition and not weight loss • Workforce development, training to engage women effectively	• In developing interventions, consider social determinants of health [40] • Embedding prevention in policies beyond maternal and child health, for example, environment, education, economic stress climate change, pollution, environmental toxicants • Consider wider outcomes to measure effectiveness of interventions — educational achievement, earnings, employment, human capital [35] • Engaging wider public in population-level programmes and generating demand for action on NCDs [28] • In LMICs effective measures before conception will have added benefit because of lower rates of attendance for antenatal care
Next steps needed	• Increase leadership and commitment from political agencies • Develop monitoring and reporting mechanisms for these initiatives to increase accountability [9] • Develop mechanisms to collect good quality data from routine systems (as used to develop the Lancet report card on preconception health [59])	• Increase the focus on collective (e.g. family, communities) and not only individual-level advice for balanced diets in pregnancy, avoidance of alcohol, smoking, unsafe foods, violence and drugs in pregnancy, managing GDM, supporting breast-feeding and care of the newborn [14,37]	• For research, improve follow-up for sustained effects [12]

NCDs, noncommunicable diseases; LMICs, low- and middle-income countries; GP, general practitioners; RCOG, royal college of obstetricians and gynaecologists; GDM, gestational diabetes mellitus.

multiple domains beyond health, are thus useful in such scenarios [14]. While DOHaD concepts such as the link between low birthweight and later NCDs have been widely publicised, translation of the DOHaD for policy-makers can be accelerated by focussing the message on relevant and timely issues such as childhood obesity, neurocognitive and emotional development.

Another barrier is that while awareness of DOHaD concepts can be high among health care professionals, few feel confident to communicate DOHaD-related advice [65]. The DOHaD may not accord with their perception of their roles, and competing clinical priorities, lack of resources and time constraints may hamper its uptake [66]. The recent obesity and pre-conception guidelines published by the International Federation of Gynaecologists and Obstetricians' Pregnancy Obesity and Nutrition Initiative recommend that clinicians who come in contact with women in the reproductive age group (e.g. general practitioners, midwives, obstetricians and gynaecologists) should assess and discuss nutritional risks and healthy weight, making the best of every contact with this group [67,68]. Improving the uptake of this information will require reframing of objectives: for example, as weight loss is hard to achieve and sustain [69]

clinicians need to support individuals in setting realistic expectations of lifestyle modification. Comprehensive educational material for health care practitioners such as 'healthy conversations' about behaviour change in a nonstigmatizing manner [70] and checklists to flag up nutritionally at-risk women [71] are available to empower clinicians in supporting the DOHaD agenda. However, acting on DOHAD information will require a shift in the priorities set in the health system, which has predominantly focused on short-term fixes and treatment of NCDs.

With novel multisector interventions emerging as important for addressing DOHaD issues, DOHaD researchers have been critiqued for focussing mainly on individual responsibility for action, especially among women [42,72,73]. The DOHaD community should consider adopting a more reflexive approach, bearing in mind the unintended effects on society, how the risk factors for NCDs are perceived by stakeholders and the effects on the public. For example, the focus on breastfeeding or women's BMI as part of the DOHaD agenda for NCD prevention may clash with other social values such as gender equality and women's decisions about their own body or when to return to work after delivery [42,74]. Similarly, most of the DOHaD literature has focused on maternal factors [73]. With emerging evidence for paternal risk factors affecting offspring health [75], risks from both mother and father must be taken into account while developing preventive interventions and male partners also need to be encouraged to make behaviour changes before conception.

The wider social and physical environment — which is beyond the control of individuals — in the form of food security, natural disasters, economic shocks and environmental toxins all significantly contribute to NCDs via DOHaD processes. However, the narrative framed and presented to the general public about preventing NCDs, for instance, through the media, largely emphasises individual behaviour change (particularly mother's lifestyles) and diminishes the role of other agencies (e.g. food industries, marketing) [42,73].

Taking the perspective of social responsibility in the field of the DOHaD is not limited to the research community, but also clinicians and policy-makers. For example, the need to present evidence related to obesity as an NCD risk factor in a nonstigmatizing manner has been recommended by organisations such as the World Obesity Federation and recently by the UK government [76]. The damaging effects on public perceptions of attributing blame for obesity to individuals, through media and in clinical settings [77,78], highlight the need to raise awareness about the complexity of risk factors [55,74]. Both women and their partners need to be involved in research on risk factors and interventions [79]. Similarly, policy advocacy must be congruent with 'maternal and Fetal rights' [13,80].

Conclusion

The DOHaD concept has gained international attention in recent years, although clear strategies to use it in practice are still lacking. This influences the ability of the next generation to develop, grow, learn and work and contribute to the long-term health, wellbeing, resilience and productivity of a society. Despite this knowledge, the translation of DOHaD to policy, clinical care and population-level programmes has been limited. Collaborative efforts between academics, clinicians, policymakers and civil society are crucial to developing novel programmes to address DOHaD within the larger societal and environmental context. The DOHaD agenda, through its effects on maternal, child and adolescent health, and to NCD risk across the life course, is at the heart of achieving the SDGs. It can support national and local governments to achieve progress in using a holistic approach. Messages from the DOHaD community should be framed and communicated effectively to generate political will for policy change as well as a wider demand in the public for such changes. A combination of these strategies will support an emphasis on prevention rather than treatment for NCDs and raise awareness that NCD risk is communicable to the next generation and disproportionately affects those at a lower socioeconomic position. This involves a social justice framing of DOHaD.

Conflict of interest statement

Nothing declared.

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