

A life-course approach to NCDs: Early interventions

NCD Child* and DOHaD**

Non-communicable diseases (NCDs) now pose a greater threat than communicable diseases to many human populations. NCDs are associated with more than 60 per cent of all deaths globally, necessitating a new emphasis on prevention (WHO, 2014). For many countries, NCDs constituted the greatest challenge to public health ever experienced. Unlike infectious diseases, where vaccination, elimination of insect vectors and treatment of affected individuals can effectively protect members of a population, everyone is at risk of NCDs, which develop through life and have devastating consequences for health, productivity and well-being.

Children and adolescents affected by NCDs are an under-recognised but important group. They may be directly affected through living with NCDs, but can also be indirectly affected, for example if a sibling, parent, grandparent or other family member is affected by or has died prematurely as a result of an NCD. Preventing NCDs in children and adolescents has long-term benefits. NCDs reduce the health capital of the population, making individuals, families and communities less resilient. This impacts on their ability to meet a range of challenges to health and well-being, often hastening the time at which dependence on health care resources occurs. This is

Case study 1 Malaysia

Jom Mama: A socio-ecological approach to developing public health interventions to prevent diabetes in pregnancy and the next generation

According to the International Diabetes Federation (IDF), the prevalence of gestational diabetes among women aged 20–49 years is 16 per cent. Research shows that women's health prior to and during pregnancy influences her child's risk of developing chronic diseases, such as diabetes, later in life. Therefore, pre-pregnancy care needs to be strengthened to tackle NCDs and prevent diabetes.

The Changing Future Health (CFH) programme is part of Novo Nordisk's commitment to Changing Diabetes and improving the health of the next generation. The first project is Jom Mama, launched in 2012 as a partnership between the Steno Diabetes Center, the University of Southampton, the University of Witwatersrand and Novo Nordisk. The objective of the project, which is designed to be integrated into the existing health system in Malaysia, is to explore opportunities for developing and assessing pre-pregnancy interventions to optimise women's health prior to and during pregnancy.

To gain an understanding of the behavioural factors and levers in relation to the health of young couples in Malaysia, a qualitative research design involving observation, document review and face-to-face semi-structured interviews was applied to gain in-depth understanding of the factors that affect the behaviours of young couples. Observation, document review and interviews were carried out in health care settings while qualitative interviews were conducted with the young couples and community representatives.

Health care providers informed us that current health care systems provide opportunities as a potential access point to introduce a

pre-pregnancy intervention. Several barriers were also raised including the sufficiency of human resource and training, adequacy of infrastructure and maintaining programme sustainability. Interviews with community members revealed low health literacy as one of the major health issues among young couples, while the main barriers influencing health included life issues (financial problems, unplanned pregnancy), social, cultural (unhealthy food tradition/recipes), physical environment (lack of access to exercise facilities), and lack of knowledge and awareness on health. Facilitators towards healthy behaviours included the availability of social support groups, extensive access to online information and provision of incentives, such as adequate facilities.

Views from young couples informed us that work pattern or routine has a large influence on eating habits and level of physical activity. Decisive factors for eating habits depended on the availability and accessibility of food and the influence of the spouse and extended family. Lack of support from spouse, poor physical condition and personal attitude are some of the challenges identified in performing physical activities. It was also found that young couples generally get health information from both electronic and printed media as well as from health care personnel, and the types of information sought were on pregnancy, sexual health, healthy lifestyle and diseases.

The Jom Mama study has highlighted the need but also the opportunity to introduce pre-conception interventions to improve young women's health status prior to and during pregnancy to reduce diabetes transmission in the next generation. Implementation is now being planned.

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** International Society for Developmental Origins of Health and Disease. President: Mark Hanson (lead author)

exacerbated by inadequate infrastructure and resourcing, resulting in communities experiencing social and economic deprivation, particularly in low-and middle-income countries (LMICs).

NCDs are increasingly affecting young adults and will create increased social, economic and health burdens for the individual, their families and the societies in which they live. In addition, risk factors, such as smoking (including smoking and smokeless tobacco, and second-hand smoking), and medical conditions, such as diabetes and cardiovascular disease, in women before and

during pregnancy increase the risk of NCDs in their children, and so the burden of disease is perpetuated. This is especially true of gestational diabetes, which now affects more than 20 per cent of pregnancies in some populations.

SNCDs are increasingly recognised not to be diseases of affluence. Lower socio-economic status is associated with greater risk of NCDs, whether in rural populations, where changes in agriculture, climate and migration have affected local economies, or among disadvantaged urban groups, which record higher rates of injuries and mental health issues. NCDs contribute to social inequalities in health from both economic and equity perspectives (Di Cesare et al., 2013). Most NCDs are essentially incurable and treatments needed are lifelong. Therefore, while secondary prevention when early symptoms arise, in conjunction with treatment, is essential, primary prevention is the only practical long-term solution to reducing the rapidly increasing prevalence of NCDs.

In recent years, there have been major revisions in our thinking about the origins, and thus the opportunities for prevention, of NCDs (Godfrey et al., 2010). The risk of developing most NCDs cannot have a major genetic component as the prevalence has increased so rapidly over just a few generations. In addition, while urbanisation and the adoption of a Western lifestyle increase risk in some susceptible groups, it does not explain *why* such groups are susceptible.

Interventions targeted at adults, in terms of weight loss, dietary changes and physical exercise, have variable and disappointing

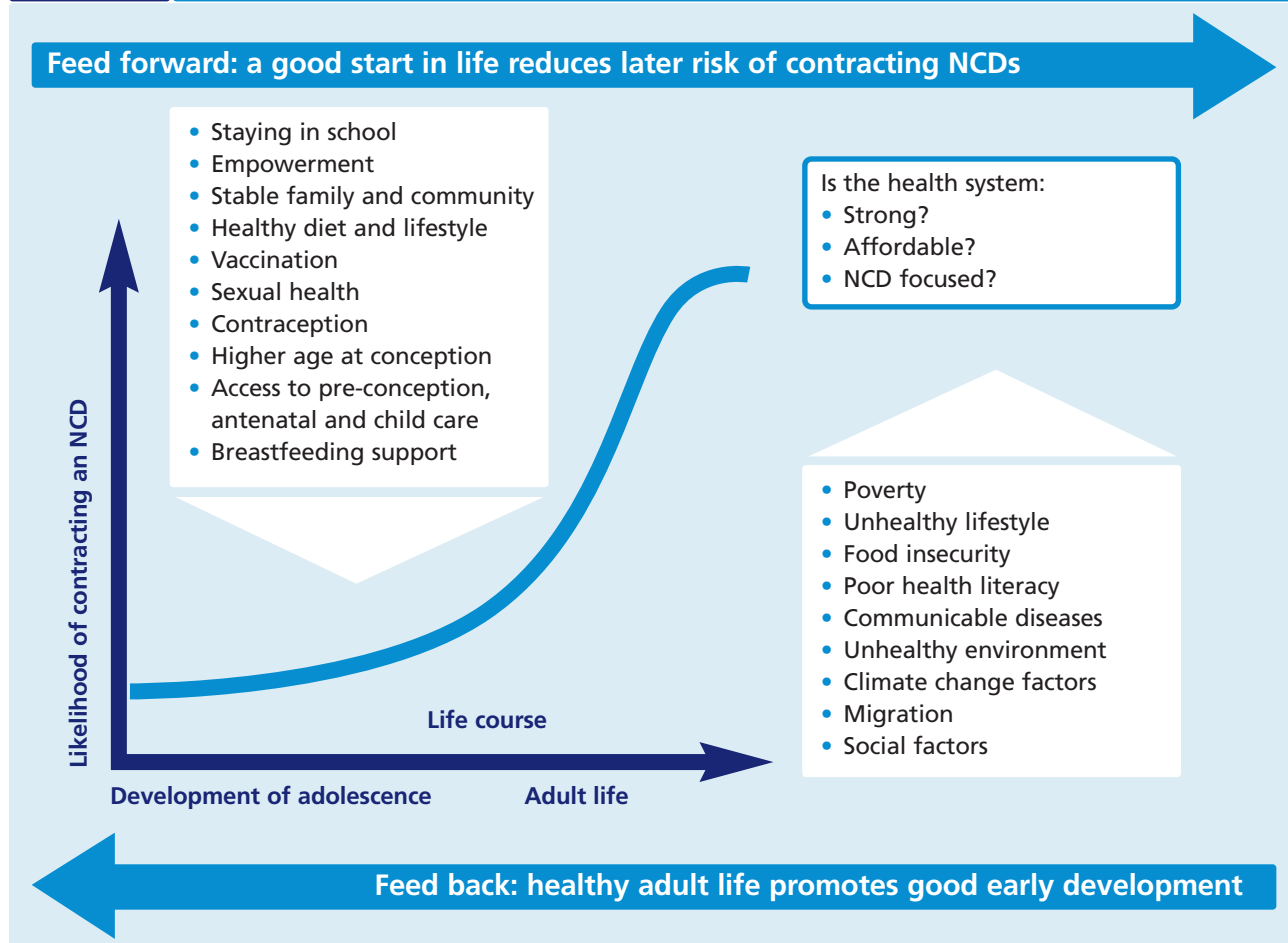
'I need to remind you that what lies ahead, especially as we tackle non-communicable diseases, is not going to be easy. Today's health challenges are vastly different from those faced in the year 2000, when the Millennium Declaration was signed. Efforts to safeguard public health face opposition from a different set of extremely powerful forces.'

'Many of the risk factors for non-communicable diseases are amplified by the products and practices of large and economically powerful forces. Market power readily translates into political power.'

Dr Margaret Chan, Director-General of the World Health Organization

Address to the Sixty-sixth World Health Assembly, Geneva, Switzerland, 20 May 2013

Figure 1 The life-course model of NCD risk



results. In contrast, a substantial body of research in epidemiology, clinical physiology and basic science has uncovered mechanisms by which early human development, in the womb, in infancy and in early childhood, establishes settings which may impact future NCD risk. These include settings of the body's cardio-metabolic control systems, the propensity to lay down fat or develop skeletal muscle, even appetite and food preference. The processes involved in determining these settings are impacted by the developmental environment in the womb, and then during infancy and early childhood. This environment includes factors associated with nutrition, exposure to toxins and stress. Before and during pregnancy, parental behaviours; factors such as smoking, exposure to toxins and chemicals; and the mother's body composition, diet and stress levels may influence these settings.

The mechanism by which this occurs, in many cases, involves epigenetics. Epigenetic factors do not change the genes, but change the way in which the switches controlling the expression of genes are turned on or off. This means that the environment during development can influence the long-term settings for particular genes or controlling factors, such as the propensity to lay down fat. We do not know how much adverse epigenetic changes can be reversed in infancy or childhood. However an insufficient period of breastfeeding and unhealthy weaning foods amplify adverse effects in the infant, setting the child on a higher trajectory of life-course risk of NCDs. This does not mean that NCDs start in

Case study 2

Australia

Student ambassadors empowered to lead action in schools

A group of high school students were the key planners and implementers in a successful whole-of-school approach to improving healthy eating and physical activity. The 'It's Your Move!' project in five schools in Geelong, Australia, resulted in a reduction of overweight and obesity by almost five percentage points over three years compared to a group of similar schools.

The student ambassadors were involved in all aspects of the intervention, including giving the project a name, identifying the healthy eating and physical activity priorities, developing the annual action plans, leading the actions in schools, and being spokespeople and advocates for the project. The ambassadors were instrumental in creating and carrying the messages and working with the principals, teachers and parents to get the policies and changes needed in schools. The lessons from this project are now being applied throughout the state as part of Healthy Together Victoria achievement programme.

Acknowledgements: *Boyd Swinburn, professor of population nutrition and global health, University of Auckland; co-director, WHO Collaborating Centre for Obesity Prevention, Deakin University, Melbourne.*

Case study 3

New Zealand

The Healthy Start to Life Education for Adolescents Project

The Healthy Start to Life Education for Adolescents Project (HSLeaP) is a partnership programme involving education, science, health, schools and the community. The project supports scientific and health literacy development by providing opportunities for adolescents to explore the impact of the nutritional environment in early life on health and well-being throughout life.

HSLeaP was developed in response to the need for effective interdisciplinary programmes to enable the translation of evidence of the Developmental Origins of Health and Disease (DOHaD) into community understanding. Based on a context-embedded pedagogical model, the learning programmes allow adolescents to access narratives about NCDs in their community as well as relevant research (Bay et al., 2012a). Scientific data is reimaged in age-appropriate formats to ensure that students explore the evidence for themselves. Through this exploration students are challenged to consider the impact of the NCD they are investigating on their families, community and, for older students, society (Bay et al., 2013).

Evidence has shown that the programme is positively impacting student engagement, attitudes, knowledge and understanding, and is resulting in adolescents taking and sustaining evidence-based actions relating their health and well-being. Furthermore, the programme has shown the significant potential of adolescents as the communicator of scientific knowledge about the life-long importance of early-life environment within their families (Bay et al., 2012b).

The model is designed to enable adaptation for a range of contexts. Currently, HSLeaP is active in New Zealand for 11–18-



Alfriston College students participate in a hands-on learning experience at the Liggins Institute within an HSLeaP module taught within their school

year-olds. It has been adapted for use with 13-year-olds in the United Kingdom by the University of Southampton. Following a process of collaborative consultation (Bay and MacIntyre, 2013), the programme is currently being adapted for use in Tonga for 11–13-year-olds, in the context of NCDs, and in the Cook Islands for 13–16-year-olds, exploring both NCDs and aspects of climate change and health. Work is underway to enable the programme to be adapted for use in Jamaica. Further research on programme impacts is currently underway in New Zealand, the United Kingdom, Tonga and the Cook Islands.

Acknowledgements: *Jacquie Bay, director, LENScience Liggins Institute, University of Auckland; Gravidia: National Centre for Growth and Development, New Zealand.*

Case study 4 The Caribbean

The Healthy Caribbean Coalition experience

The Healthy Caribbean Coalition (HCC), a regional network of Caribbean health NGOs and civil society organisations (CSOs), is working to raise the profile of cervical cancer throughout the region. In the Caribbean, 2,245 women die of cervical cancer each year, translating to approximately six women dying unnecessarily every day.

CSOs play a powerful role in supporting the delivery of prevention and treatment programmes at the grass roots level in hard-to-reach communities (often filling critical service gaps), mobilising public and political awareness, and shaping policy response. A Caribbean Civil Society Cervical Cancer Advocacy Initiative, initiated by the HCC, has shone a light on this regional issue in support of an integrated life-course approach to women's health.

The components of this initiative include: building the cervical cancer advocacy capacity of 21 regional cancer NGOs; an HCC/PAHO Caribbean Situational Analysis of Cervical Cancer Prevention and Treatment programmes; a CSO Cervical Cancer Advocacy Action Handbook and Planning Tool and a Social Media How-to Guide; establishment of a Caribbean Cancer Network; an online cervical cancer resource portal; the Caribbean Cervical Cancer Electronic Petition (CCCEP), supported by 10,000 Caribbean men and women, one-third of which were under the age of 30; and the multi-country Caribbean Civil Society Cervical Cancer Prevention Initiative (C4PI), funded by the Australian Government.

Our CSO members throughout the region have championed programmes that have increased access to life-saving HPV vaccines for young girls, provided screening for marginalised high-risk women and ensured that disadvantaged women living in rural communities diagnosed with cervical cancer have access to treatment.

The HCC is committed to leveraging the strengths of civil society to highlight this preventable condition in support of universal access to cervical cancer prevention, and contributing to regionally and internationally agreed goals, including 80 per cent coverage in cervical cancer screening by 2025.

Source: *The directors and manager of the HCC and the leaders of Cancer Societies and Foundations of the Caribbean.*



Maisha Hutton, manager of the Healthy Caribbean Coalition (HCC), receives a donation from Ross Tysoe, Australian Ambassador in support of the C4PI

early life: the critical point is that early life factors alter the responses of the body to the risk factors to which we are all exposed throughout our lives. Thus, whilst interventions in later life may be too late to have a major impact, those impacting early life can exert major leverage on later NCD risk and on health in individuals and the next generation (Figure 1).

Many government public health bodies, non-governmental organisations and health professionals have been slow to appreciate this important change of thinking and the necessary actions which must follow on from it. While culturally normative, blaming individuals for behavioural factors that affect their health is inappropriate if risk trajectories are set early in life or for the next generation, when choice does not operate. We have to avoid attributing blame if we are to improve behaviour in at-risk individuals.

As Figure 1 shows, interventions to promote healthy development and those to encourage healthy lifestyle in adults are not alternatives: they are inextricably linked and both are necessary, because a healthy start to life will favour better responses to behavioural interventions later.

A focus on early development to reduce the risk of NCDs draws attention to the need to work with adolescents and young adults, especially as some components of risk (such as body composition and diet) are passed across generations and established before pregnancy. Recent evidence reveals that smoking and poor diet can produce epigenetic effects on the sperm, so attention needs to be given to men as well as women. These factors relate to long-term health behaviours, often established during adolescence, and can affect the developing embryo before women know they are pregnant. The opportunities to improve health and nutritional literacy, eliminate smoking and second-hand smoke exposure, and impact behaviour and physical fitness in adolescents and young couples will not only favour their future health but pass health capital on to their children.

Adolescents have been less well served by public health initiatives than younger children and this period of life offers an important opportunity to address inequities (*The Lancet*, 2013). Governments and health care systems will have to devise innovative ways of doing this, as adolescents are usually a relatively healthy section of the population and many do not access routine health care. In addition, NCD risk factors present new challenges to those related to communicable diseases (see Case study 3), and actively involving young people in discussions, planning and actions focused on NCDs is an extremely powerful way to overcome some of these inequities and challenges.

To achieve sustainable engagement leading to the development of health literacy and appropriate behaviours in these target groups, it is essential that we look to those professionals who work most closely with adolescents, pregnant women and their partners, and the parents of infants and children. Educators within the compulsory education sector, midwives, community-based early childhood health workers and early-childhood educators should have a key role in developing and sustaining appropriate interventions. However, this must be approached from a partnership perspective, utilising the combined knowledge of the health, science, education and social service sectors to co-construct interventions that enable target groups to learn about the benefits

of early-life prevention of NCDs and respond to this information within their personal, social and cultural setting.

Potential also exists to build on existing successful platforms addressing communicable diseases, such as HIV/AIDS and cervical cancers due to human papilloma virus (HPV). Many of these programmes have utilised a cross-sectoral approach and include social, health and education agencies appropriate to the target population. The addition of add-on initiatives within successful campaigns would emphasise the benefit of linking communicable and non-communicable disease prevention. Such opportunities to overcome artificial separations should be investigated.

The global response to the challenge of NCDs post-2015 has to encompass economic and environmental goals as well as social and health components. A wide range of factors operating across the life-course, from poverty to climate change, increase the likelihood of NCDs. These are enormous social questions and addressing them, whilst necessary, will take time. There is, however, an *immediate* opportunity to promote a healthy start to life for individuals in many populations. Promoting adolescent health literacy and empowering young people to adopt healthier and safer behaviours will ensure that young adults have the best chance to prevent NCDs, and that parents-to-be give the next generation the best start in life, demonstrable through markers of healthy growth and development at birth and in childhood. The approach will also address newly emerging NCD challenges, such as that posed by gestational diabetes.

This goal is achievable and can show results over a short time period. The approach will feed forward into a cost-effective reduction in NCD incidence, which will help reduce disparities and will return wide social and economic benefits. The intergenerational approach also feeds back health capital from adults and older members of the community into healthier development for the next generation. It provides a truly holistic approach to health across the life-course, applicable and adaptable to all societies and cultures, because it supports the fundamental human values that we all share. This approach is fundamental to the SDGs.

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Endnote

1 See: *Lancet* series on adolescent health, *The Lancet*, 379(9826), 28 April–4 May 2012.

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