NONCOMMUNICABLE (NCDS) DISEASES AND SEXUAL AND REPRODUCTIVE HEALTH (SRH): LINKAGES AND OPPORTUNITIES THROUGH A LIFE-COURSE APPROACH

Introduction
NCDs affect all countries and people of all ages. The WHO has identified NCDs as 'the world’s biggest killers' (1). NCDs include obesity, diabetes and cardiovascular disease, musculoskeletal, mental and neurological disorders. The United Nations General Assembly on Prevention and Control of NCDs and the UK Department of Health have stressed the importance of taking a life-course approach to addressing NCDs, from pre-conception through pregnancy, infancy, childhood and adolescence, through to adulthood and preparing for older age (2, 3). A life-course approach acknowledges the opportunity to prevent and control NCDs at multiple stages of life, thus offering the best chance of primary disease prevention.

Global burden of disease and developmental contributions to later disease risk
In the middle part of the twentieth century there was a strong focus on adult lifestyle as a predictor of health and disease (4). Lifestyle factors, such as smoking and unhealthy diet, combined with genetic susceptibility to disease were seen as the strongest influences on adult health. Research over the last two decades has demonstrated the importance of the environment during early life for the establishment of disease risk in later life and in subsequent generations. This has led to a revival of interest in early life, that had diminished because of the increasing emphasis of adult lifestyle predictors of disease, and to the emergence of life-course as a distinct field of epidemiological and public health research.

During early development, adaptive responses to a range of stimuli are important contributors to risk of disease, as posited by the ‘developmental origins’ or ‘DOHaD’ concept (5). Subsequent environmental exposures during infancy, childhood and adult life may modify or condition this later risk of disease. In middle and later life, social, psychological, physical and occupational factors in the environment can cause or accentuate risk of ill health and disease.

The influence of the maternal environment on later health and disease will be modified by the environment in which a child grows up. Children are affected both by material disadvantage and by the social circumstances. Poor housing or homelessness, low income or parental unemployment and changing family structures will influence children's physical and emotional health.

Parenting is known to mediate about 50% of the impact of contextual factors, such as poverty, that influence a child's early development (7). Parenting is also one of the main influences on a child's social and emotional development. Positive, proactive parenting is associated with high child self-esteem and the development of good social skills. It is also protective against later harmful behaviours in adolescence, such as substance misuse.

During adolescence, the influence of schools and peers become more dominant than at earlier stages of the childhood and can become more dominant than the influences of the family (8). The neighbourhood environment begins to exert a strong influence as adolescents become more independent. This can have adverse effects if the food and physical environment is dominated by unhealthy influences such as fast food outlets.

For adults, a poor working environment can have adverse effects on health (9). Jobs that are insecure or low-paid and that fail to protect employees from stress and danger can cause illness. Principal among work-related ill health are mental health problems and musculoskeletal disorders.

The physical environment can influence health. Outdoor air pollution is associated with respiratory infections and with increased risk of stroke and ischaemic heart disease. The burden of disease from pollution is considerably higher in low- and middle-income countries than in high-income countries.

Behavioural factors
The health behaviours that people adopt will influence their risk of disease. Childhood and adolescence are important
stages when health behaviours become established. Most NCDs are strongly associated with four particular health behaviours: smoking and tobacco use, unhealthy diet, physical inactivity and harmful use of alcohol.

**Psychosocial factors**
There are marked associations between positive psychological states and health outcomes, including reduced cardiovascular disease risk and increased resistance to infection. These associations between positive affect or mood and later health are independent of negative affect suggesting that positive affect may have direct biological effects that benefit health (10). Levels of individual confidence and control have been linked to objective measures of lifelong health and longevity.

**Transitional phases of life which present challenges to services**

**Preconception and pregnancy**
There is increasing evidence that a woman’s health and nutritional status before pregnancy is an important predictor of outcomes in her child. Studies in Southampton have shown that women of childbearing age from disadvantaged backgrounds have diets of poor quality. The quality of maternal nutrition before and during pregnancy and the presence of specific micronutrient deficiencies predict skeletal development in their offspring (6). Intervention studies in India have shown that provision of a food-based supplement during preconception and throughout pregnancy was associated with increased birthweight in the offspring (11).

The health and well-being of fathers is an important determinant of the health and development of their children. Disease can be passed from father to children by virtue of shared genes but also because of shared environment and lifestyle. The health and well-being of fathers will be influenced by their social circumstances, and factors such as stress at work or unemployment, and will influence the way in which they parent and interact with their children. Fathers can also influence the nutrition of their partners and children: studies of women of childbearing age from disadvantaged backgrounds showed that a lack of support for healthy eating from women’s partners was a barrier to a healthy family diet.

During pregnancy, maternal health has a significant influence on foetal development. Influences including stress, nutritional status, drug, alcohol and tobacco use can adversely affect early brain development. The complex interplay of both genetic and environmental factors is fundamental in determining exposure to risk, susceptibility to risk and future outcomes for pregnant women (5). In particular, some pregnant women will be much more susceptible to the effects of certain risk factors than others.

Research in the United Kingdom (UK) has shown that women of childbearing age with lower levels of educational attainment have diets of poorer quality and that their individual psychological characteristics, specifically control over their lives in general and their diets in particular, predict their compliance with dietary recommendations (12). These findings highlight the need for initiatives that empower women to improve their health behaviours. One such approach, the Southampton Initiative for Health, implemented a behaviour change intervention (‘Healthy Conversation Skills’) in UK Sure Start Children’s Centres with the aim of improving the diet quality, well-being and physical activity levels of women of childbearing age from disadvantaged backgrounds. The intervention had a protective effect on women’s sense of control and self-efficacy, intermediate factors on the causal pathway between exposure to the intervention and change in diet and physical activity (13).

Most pregnant women want to do their best for their baby and so pregnancy presents an opportunity to tackle unhealthy lifestyle choices, such as smoking, and promote healthy ones, such as breastfeeding (14). A woman’s social circumstances can be a barrier to healthy choices, leading to poorer pregnancy outcomes of pregnancy and less optimal child development. Intervening in the preconceptional period presents even greater challenges. Evidence shows that many women do not plan or prepare for pregnancy (15).

Teenage pregnancy is a particular challenge. In many cases, pregnancy is unplanned and unwanted. This applies to 90% of pregnancies occurring in girls and women aged 15 to 19 years (9). This means that preparation for pregnancy is not possible. Initiatives that aim to improve the health and nutrition of teenage girls and boys have great potential to improve the health and well-being of babies. In the UK, educational initiatives, such as the Lifelab intervention, are targeting teenage boys and girls with the aim of improving their health literacy and understanding of the long-term influences of their health behaviours on their subsequent health and that of their children (16). Such interventions work through an empowerment approach by improving the self-efficacy of teenagers in order that they can improve their own health behaviours with respect to diet and lifestyle.

Interventions during pregnancy have tended to focus on improving the nutritional status and lifestyle of mothers in order to optimize the development of the foetus as well as improving the health of mothers themselves. There are two principal approaches to improving nutritional status: nutritional supplementation (multiple micronutrient supplementation, and single vitamin supplements to correct deficiencies) or behaviour change interventions that aim to improve the health behaviours of pregnant women.

Multiple micronutrient approaches have been trialed in developing countries. In Mumbai, India, for example, a food based supplement started preconceptionally and given throughout pregnancy halved the prevalence of maternal gestational diabetes (11). Correction of specific vitamin deficiencies during pregnancy has improved outcomes for pregnant women both in the UK and India. In the MAVIDOS study vitamin D supplementation during pregnancy corrected mater-
nal vitamin D deficiency and optimized infant levels of vitamin D (17).

**Infancy and childhood**

Childhood is a formative time for biological development and for shaping health behaviours. Risk factors for NCDs, such as raised blood pressure, can develop during childhood and then track into adulthood. Behavioural risk factors for later disease such as smoking, poor diet and insufficient physical activity are also established early in life and track through the life-course. A child’s physical, socio-emotional and cognitive development during the early years strongly influences their educational attainment, economic participation and health across the life-course. Low birthweight, a marker of poor growth in utero, is associated with poorer long-term health and educational outcomes. Socioeconomic disadvantage is an important risk factor for mortality. In a study of infant deaths in England and Wales (excluding multiple births), higher levels of deprivation were associated with increased risk of death independent of other factors known to influence infant mortality (9).

Nutritional status is an important determinant of health during early childhood. The early years are a key time for establishing healthy eating and activity patterns that will promote health and protect against later chronic disease (7).

Breastfeeding protects children from a range of later problems including ear and lung infection, obesity and diabetes and sudden infant death syndrome. Interventions that increase the initiation and duration of breastfeeding have been identified. Cochrane systematic reviews have shown that one-to-one health education and support for new mothers effectively increase breastfeeding initiation rates and that appropriate support can prolong breastfeeding duration (18). The WHO/UNICEF Baby Friendly Hospital Initiative, which encourages hospitals to introduce breastfeeding policies and educate staff to promote and support breastfeeding, has been shown to prolong exclusive breastfeeding.

Iron and vitamin deficiencies are common in early childhood. There is also evidence that many children consume inappropriate energy-dense foods during the preschool years, that have been introduced in infancy and which increase the risk of obesity (7). Parental feeding practices and control over eating affect children’s early eating patterns and risk of childhood obesity. Parental levels of physical activity and sedentary behaviour have also been shown to predict levels of activity in their children. Fewer than half of children aged 11 to 15 years engage in at least one hour per day of moderate to vigorous physical activity and the rate decreases with age (19). In the UK, over 20% of children entering school at age 4 to 5 years are overweight or obese. This puts them at increased risk of ongoing overweight and obesity and of developing physical health problems such as diabetes, coronary heart disease and early osteoarthritis in later life (19). Physical activity, which is an important contributor to optimal weight, is also associated with physical and mental health gains in the short and long term. The early years are an important time to intervene to prevent obesity and to establish healthy patterns of eating and physical activity that are known to track into adulthood. There is evidence that multi-component behavioural interventions, such as the HENRY intervention in the UK, can prevent the development of obesity in infants and toddlers. Maintenance of appropriate dairy intake and weight bearing physical activity in childhood are also important for bone development and have been linked to optimum attainment of peak bone mass and reduced risk of osteoporosis and fracture later in life (6).

Parenting is one of the main influences on a child’s social, emotional development and health (7). Interventions that support parents to provide positive proactive parenting have the potential to optimize children’s socio-emotional development. In the UK, the Healthy Child Programme offers every family a programme that includes guidance to support parenting and healthy choices as well as screening tests, immunizations and developmental reviews (20). The delivery of the programme is based on a proportionate universal approach that involves adapting interventions according to the risk factors of the community, with the aim of achieving equitable outcomes for all children.

Targeting interventions to vulnerable groups can also improve the health and well-being of infants and children. In the UK, the Family Nurse Partnership offers intensive targeted support for the most vulnerable first-time mothers. It provides intensive and structured home visiting delivered by specially trained nurses, from early pregnancy until the child is aged two (7).

**Adolescent health**

Adolescent health and development is key to the prevention of adult NCDs. Adolescence is the most significant period in the life-course for the initiation of a wide range of health behaviours that are associated with the burden of disease in adult life (8). Rapid development of the brain and biological changes to other organ systems during puberty and adolescence interact with social development to set up a range of new behaviours that can have adverse effects on health. Smoking in the UK increases from a population prevalence of 1% at age 11 years to around 20% at 15 years. Similarly, approximately 80% of lifetime alcohol or cannabis use is initiated before people reach the age of 20 years, with the proportions initiating other illicit drugs in adolescence closer to 50%. Once initiated, these behaviours track strongly into adult life, highlighting the importance of intervention in adolescence to prevent health burden. Factors such as deprivation, poor parental connection, peer pressure, low self-esteem and poor mental health increase the likelihood that adolescents will explore behaviours that pose a risk to their health.

**Scope for action**

The application of a life-course approach should incorporate holistic values that integrate the training of healthcare provid-
ers, the organization of systems structure and delivery of health care. For example, such an approach has the potential to augment the planning and integration of services for the mother and unborn child and cement strong existing linkages between health and social services.

This approach also marks a strengthening of sexual and reproductive health (SRH) and its broader linkages to areas within NCDs that to date have received less attention, such as, for example, mental health. The life-course approach to health focuses on prevention (3). In order to help people prioritize their own health and well-being there needs to be an increased emphasis on giving them the appropriate tools and education about health matters starting at a young age. In the area of SRH, this will require increased prioritization of sexuality education for young people.

Conclusion
NCDs do not fit the medical model in which an individual is healthy until they contract the disease. The trajectory is set much earlier, being influenced by factors such as the mother’s diet and body composition before and during pregnancy, and foetal, infant and childhood nutrition and development. Adopting a life-course perspective allows identification of phenotype and markers of risk early, with the possibility of nutritional and other lifestyle interventions. Timely, relatively modest interventions in early life can have a large effect on disease risk later. Early life preventive measures require a long term investment, but are more likely to be effective than population screening programmes that identify the early stages of disease or treatments initiated after the disease is manifest.

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References