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PREVENTING NON-COMMUNICABLE DISEASES IN LOW-AND MIDDLE-INCOME COUNTRIES: A LITERATURE REVIEW

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ABSTRACT

Background: Both the older adult population and the number of patients with non-communicable diseases (NCDs) have rapidly increased in low- and middle-income countries in recent years. This has added to the burden of health issues, such as communicable diseases and conditions related to maternal and child health. **Results**: Approximately 90% of premature deaths in low- and middle-income countries are due to NCDs. Individuals with NCDs are also more susceptible to severe illness or death from infection with the severe acute respiratory syndrome coronavirus 2, which causes the coronavirus disease (COVID-19), and older adults with NCDs have a particularly increased susceptibility to COVID-19. Insufficient nutrition and maternal metabolic status during pregnancy are causes of metabolic disorders and cardiovascular disease during adulthood. **Conclusion:** A holistic approach with integrated multi-specialized systems-such as early intervention to develop healthy behavior among children, improvements in women's educational opportunities, and training that enables health care workers to handle multiple health issues in the community-is needed to address health issues at various stages of human development. In this manner, the vicious circle of hindering sustainable development will be broken not only in low- and middle-income countries but also worldwide, allowing humans to coexist with other living beings.

Keywords: Non-Communicable Diseases; Low-Income Countries; Middle-Income Countries

INTRODUCTION

More than 90% of premature deaths due to common behaviors such as tobacco use, unhealthy diet, and low physical activity attributable to non-communicable diseases (NCDs) occur in low-and middle-income countries and are largely preventable. More than 70% of people worldwide die due to NCDs, and the cumulative economic loss ascribed to NCDs is estimated to surpass 7 trillion United States dollars in low-and middle-income countries between 2011 and 2025, which is equivalent to approximately 4% of the countries' current annual budget expenditure (Bloom *et al.*, 2011).

Amid the growing body of evidence, it is becoming increasingly clear that senior citizens with pre-existing NCDs are also more susceptible to severe illness or death from infection with severe acute respiratory syndrome coronavirus 2, which causes the coronavirus disease (COVID-19) (Centers for Disease Control and Prevention, 2020; WHO, 2020c). Older adults with NCDs are particularly more susceptible to COVID-19. Both the older adult population and the number of NCD patients have rapidly increased in low- and middle-income countries in recent years, adding to the burden created by health issues such as communicable diseases and conditions related to maternal and child health (Well, 2018). These burdens put financial pressure on governments, while also increasing the rate of premature deaths due to NCDs, thus further hindering the economic development of low- and middle-income countries. A holistic approach with integrated multi-specialized systems addressing health at various stages of human life must be applied for low- and middle-income countries to achieve sustainable development. Thus, this paper aimed to clarify the obstacles that must be addressed to reduce the incidence of NCDs and COVID-19 in low- and middle-income countries, based on a review of the current literature on sustainable development and population health.

METHODOLOGY

We reviewed the published literature on PubMed and Google Scholar using the text search items "Non-communicable Disease," "NCD," "Low-income countries," and "Middle-income countries." The official websites of some international organizations and white papers emanating from certain countries were also used to attain the purpose of the study in this field.

Literature Review

Prevention of NCDs via early Intervention

The physical, mental, social/emotional, and language/cognitive domains of development are equally important for a healthy child. All four domains strongly influence well-being, obesity/stunting, mental health, heart disease, competence in literacy and numeracy, criminality, and economic participation throughout life (WHO, 2018). Studies have shown that a lack of nutrition and poor maternal metabolic status during fetal development increase the risk of metabolic syndrome and cardiovascular disease in adulthood (Barouki *et al.*, 2012; Gale *et al.*, 2006).

An infant who is approximately six months old needs energy and nutrients. Therefore, complementary foods are necessary to meet these needs (WHO, 2020a, 2020b). If complementary foods are not introduced at approximately the age of 6 months, or if they are given inappropriately, an infant's growth may falter (WHO, 2020a, 2020b; WHO, 2017).

It was found that dietary composition and feeding patterns have the potential to influence the early development of obesity, which in turn predicts later obesity and NCD risk. In contrast, there is a negative association between underweight in infancy and impaired glucose tolerance or diabetes among young adults (Adair, 2012; Jacob *et al.*, 2019).

Children who were preterm at birth have been shown to have higher odds of being obese than children who were full-term babies. There is an elaborate link between the maternal gut environment and the developmental origin of metabolic syndrome (Kimura *et al.*, 2020). Crossing into higher body mass index (BMI) categories after 2 years of age is also associated with these disorders (Bhargava *et al.*, 2004). Breastfeeding shapes the gut microbiota in early life, both directly by exposure of the neonate to the milk microbiota and indirectly via maternal milk factors that affect bacterial growth and metabolism, such as human milk oligosaccharides, secretory IgA, and antimicrobial factors (van den Elsen *et al.*, 2019). Furthermore, the intestinal microbiome plays an important role in modulating the risk of several chronic diseases, including inflammatory bowel disease, obesity, type 2 diabetes, cardiovascular disease, and cancer (Singh *et al.*, 2017).

Therefore, babies who are adequately breastfed are less likely to become obese later in life than children who have never been breastfed or breastfed for a shorter period (Rito *et al.*, 2019).

Early childhood interventions aimed at preventing NCDs with evidence of efficacy and effectiveness tend to target multiple levels of the socio-ecological model, with emphasis on people who care for children and continue for long periods (Reilly *et al.*, 2018). Exercise- and diet-based interventions are useful in reducing weight gain during pregnancy, reducing postpartum weight retention, and improving the prevention and control of gestational diabetes. Pre-gestational diabetes mellitus increases the risk of adverse maternal and fetal outcomes (Wahabi *et al.*, 2012). Balanced protein energy supplementation during and before pregnancy reduces the likelihood of low birth weight in babies.

Interventions aimed at preventing obesity in early life include classes on parenting skills, alterations of playgrounds in pre-schools, and integration of financial incentives into the system. However, evidence from low- and middle-income countries is scarce, and researchers have indicated that evidence of the effects and effectiveness of interventions on obesity-related NCDs is lacking (Reilly *et al.*, 2018). Furthermore, deaths among 1-year-old infants more often result from environmental conditions, sanitation, nutrition, immunization, and childcare practices. These exogenous or external factors are more likely to be influenced by maternal education (Martinson & Choi, 2019; Mensch *et al.*, 2019; Barrett & Browne, 1996).

Challenging Opportunities for Education among Women

Maternal factors such as education and empowerment of women are most strongly related to completing vaccination schedules, which reduce the risk of child mortality (Khan *et al.*, 2017; Oyekale & Maselea, 2018). Barnett & Browne (1996) argued that

the health care services in villages, which are oriented toward traditional agriculture in the Gambia, where women are educated, indirectly affect domestic hygiene practices and subsequent access to health care services. These researchers reported that more educated mothers have a better understanding of health education messages. Therefore, health education and health systems should be developed and provided depending on women's educational background.

Another study that examined the role of maternal education levels reported a high correlation among maternal education, food portions, and nutrition offered to children. Mothers with lower education levels gave their children larger portions, particularly if they had increased appetite. Moreover, these mothers, compared to others, were more concerned about taste preferences and less about health regarding their child's diet (Rigal *et al.*, 2019).

Maternal education has also been found to be an important factor in the health of adopted children, after controlling for other variables, such as income, number of siblings, health environment, and other socioeconomic factors. The available evidence on the relationship between maternal education level and the nurturing effect on child health may shed light on the need to focus on education for women as part of public policies for developing countries (Chen & Li, 2009).

Worldwide, 132 million girls between the ages of 6 and 17 years are out of school; of the 15 million girls of primary-school-age in sub-Saharan Africa, half will never enter the classroom (UNESCO, 2020). There is a significant link between a child's educational background and health. However, approximately half of low-and middle-income countries have failed to conduct surveys regarding education among children, particularly children with disabilities. Figures on learning are mostly taken from schools; thus, they fail to consider those who do not attend these educational centers (UNESCO, 2020). Based on these known barriers to information transmission and the interventions known to be effective, we propose that a household survey on learning among children should be conducted immediately in the communities of low- and middle-income countries, and health education on NCD prevention should be included in maternal-child clinic programs throughout the pre- and post-natal periods.

Challenges of Appropriate Allocation of Health Workers in Communities

One approach to improving health in many countries is to increase their limited capacity to train health service specialists. Members of a trained healthcare workforce can be allocated to fulfill their health needs within a community. In some countries, such as China, tasks have shifted recently, as more health care specialists are engaged in reducing the rising rates of NCDs in low- and middle-income countries.

In China, community health workers (CHWs) are frequently engaged in implementing diverse public health intervention programs that do not only address NCDs but also cover general services, including reproductive health, tuberculosis, child health, and vaccinations (Huang *et al.*, 2018). CHWs in China are well trained and have sufficient capacity to provide the populace with NCD preventive interventions. This suggests that studies with robust designs are needed to explore the effectiveness of CHW-led programs and intervention strategies, to improve these programs, and to learn how the work of CHWs may be best utilized in various settings (Long *et al.*, 2018).

Health care providers (HCPs) involved in grassroots preventative efforts have expressed the need for skills training to help the general population as well as to fill their own gaps in knowledge and improve NCD prevention practices. These HCPs have struggled to provide NCD prevention services to the people, even though they are expected to play a leading role in NCD prevention. Thus, health policies regarding the role of NCD prevention in the community have not been applicable at the grassroots level (Higuchi & Liyanage, 2016).

Sri Lanka is a lower- and middle-income country in South Asia, that has seen a rapidly increasing prevalence of NCDs, particularly obesity and diabetes (WHO, 2020c). However, there are indications that Sri Lanka has achieved a certain level of improvement in maternal-child health and a reduced death rate at birth, similar to developed countries, due to the maternal-child healthcare-oriented and communicable diseases-oriented allocation of HCPs. In Sri Lanka, the Reproductive, Maternal, Newborn, Child, Adolescent, and Youth Health (RMNCAYH) Program has reached almost all families, and the country is divided into several Medical Officer of Health areas (Ministry of Health, Nutrition and Indigenous Medicine, 2017,

2019). The RMNCAYH concepts are child-oriented; pregnant women regularly have their weight and BMI checked for the sake of their baby's growth.

DISCUSSION

The present study describes the current issues in preventing NCDs in low-and middle-income countries by analyzing the literature. Three aspects were identified, including "early prevention of NCDs via early intervention," "challenging opportunities for education among women" and "challenges of appropriate allocation of health workers in communities". The Abecedarian project provided full-time, high-quality educational intervention in a child care setting from the age of 4 months through 8 years and monitored children's progress at ages 12, 15, 21, 30, and 35 years. After entering primary school, the project supported the mother by providing the curriculum at home. As a result, the children who received special education from the project had a lower incidence of obesity and pregnancy in adolescence and graduated from the university more often (Campbell *et al.,* 2014; Sparling & Meunier, 2019). The Abecedarian approach has been practiced in several countries worldwide; however, the number of countries is still limited. Mothers share much more time with their infants than any other human being. Maternal educational backgrounds influence child health outcomes (Vikram & Vanneman, 2020). However, the literacy rates in low-and middle-income countries are much lower than those in other countries worldwide (World Bank, 2020), and there is a large disparity in literacy rates between women and men in South Asia, Sub-Saharan Africa, and other countries (Sadasivam *et al.*, 2018). There is a vicious circle in which less education among women leads to child marriage and impoverishment and unhealthy behaviors that will cause their child to suffer NCDs in the future. Multiple and long-term strategies, that is, promoting maternal education and financial development among women and eliminating child marriage, are needed to get out of the vicious circle.

Meanwhile, we should be concerned to challenge the appropriate allocation of health workers in communities as short-term and middle-term strategies not only for mothers but also for all people who have already developed unhealthy attitudes and behaviors to prevent NCDs.

Health workers who are at the frontline to support mothers through maternal and health care programs daily should be allocated in appropriate numbers and fulfill their competency with financial support (Ojo *et al.,* 2017). These strategies should be adopted to each country's cultural background and health system. In particular, in low-and middle-income countries, integrating NCD prevention into maternal and child health programs (Kapur, 2015) can be expected to reduce the risk of developing NCD in future generations. These concepts can be used by health workers for training on the job to fulfill their competencies.

CONCLUSION

Health is an important component of human rights. Human beings have prolonged their lives and reduced several kinds of illnesses; meanwhile, there are growing health status disparities among countries and regions worldwide. The COVID-19 pandemic teaches us to consider the importance of solidarity among all people and to reduce all kinds of discrimination; however, efforts must be made to resolve these conditions in normal times. The solutions that directly address the problem of NCDs represent only the preliminary steps toward prevention. Given the pivotal role of parents, particularly mothers, in early intervention to prevent NCDs in their children, a household survey on women's literacy should be conducted immediately in all communities, so that real health needs related to NCD prevention can be identified, and actions can be taken to improve women's education, which affects children's health. In addition, existing health services related to maternal-child health should be integrated into NCD prevention activities, and the concept of the program should be modified to make it women-oriented.

Health issues worldwide have drastically shifted from communicable diseases to NCDs and emerging infectious diseases; yet, the allocation of health service providers has not adapted to meet current health challenges. Furthermore, additional HCPs are required. We must educate and train the appropriate number of qualified HCPs, and continuing education programs should be adapted to include NCD prevention and health promotion strategies for intervening in and changing health behavior.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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