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Delivering an action agenda for nutrition interventions addressing adolescent girls and young women: priorities for implementation and research

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Adolescent nutritional behaviors are assuming considerable importance in nutrition interventions given their important relationships with medium- and long-term outcomes. This is the period when young people undergo major anatomical and physiological maturational changes in preparation for adulthood. Nutritional requirements during puberty are higher during adolescence than during the prepubertal stage and during adulthood. A significant proportion of adolescents also become parents, and hence the importance of their health and nutritional status before as well as during pregnancy has its impact on their own health, fetal well-being, and newborn health. In this paper, we describe the evidence-based nutrition recommendations and the current global guidance for nutrition actions for adolescents. Despite the limitations of available information, we believe that a range of interventions are feasible to address outcomes in this age group, although some would need to start earlier in childhood. We propose packages of preventive care and management comprising nutrition-specific and nutrition-sensitive interventions to address adolescent undernutrition, overnutrition, and micronutrient deficiencies. We discuss potential delivery platforms and strategies relevant to low- and middle-income countries. Beyond the evidence synthesis, there is a clear need to translate evidence into policy and for implementation of key recommendations and addressing knowledge gaps through prioritized research.

Keywords: adolescents; packages; delivery platforms; nutrition

Background

Adolescence and young adulthood are crucially important periods in the development of healthy adults. Adequate nutrition is key and is associated with better lives and with potential intergenerational benefits.[1] This period is also important given the major anatomical and physiological maturational changes in adolescence. This physical growth and development during puberty increases

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requirements for energy, protein, and many vitamins and minerals, and deficiencies can lead to physiological, anatomical, and functional disturbances.[2]

Nutritional requirements during puberty are higher during adolescence than during the prepubertal stage and during adulthood, and requirements are proportional to the rate of growth.[3] Because of biological differences among girls during puberty (e.g., blood loss related to menstruation), their nutritional requirements are different and in some respects higher compared with boys. A focus on young girls is also crucial because their health and nutritional status before as well as during pregnancy also influences fetal growth and newborn health. Adolescent ill-health and undernutrition is an important determinant of adverse fetal/neonatal outcomes, including small for gestational age (SGA) births, preterm births, stillbirths, and excess risk of neonatal mortality.[4,5]

Given high burdens of undernutrition and micronutrient deficiencies in childhood that may accentuate problems, adolescent nutrition needs in low- and middle-income countries (LMICs) must be addressed as a priority. A sizeable proportion of adolescents give birth: close to 10% of all births in LMICs occur during the adolescent period,[6] necessitating consideration of nutrition needs for both the adolescent mother and the fetus. Maternal and fetal undernutrition are determined by maternal short stature, low pre-pregnancy body mass index (BMI), inadequate gestational weight gain, micronutrient deficiencies, and intrauterine growth restriction (IUGR). On the other hand, maternal and fetal overnutrition is associated with maternal overweight and obesity and an unbalanced diet, as well as other conditions, such as gestational diabetes mellitus (GDM).

Pregnancy at an early age is also associated with a number of adverse maternal and neonatal outcomes.[7] Maternal short stature, often a consequence of childhood stunting, is consistently associated with lower infant birth weight.[8] Inadequate gestational weight gain is associated with low birth weight (LBW) and SGA birth.[7,9–11] Maternal micronutrient status also influences the development of the placenta and fetus and affects maternal and newborn outcomes.[12,13] Deficiencies of iron, folic acid, zinc, and other micronutrients are significantly associated with increased risk of LBW, SGA, and/or preterm birth.[13] In addition to these short-term consequences, the adolescent nutrition status also determines aspects of metabolic control and nutritional status during the life course of the next generation. These pathways to malnutrition are further aggravated by subsequent exposure of the child to an obesogenic environment and must be considered as a continuum of risks.

Such patterns and consequences of maternal undernutrition are more prevalent in LMICs, but can also occur among disadvantaged populations in affluent settings. A more common observation among adolescents in many high-income settings, as well as some middle-income countries, is overweight and obesity. Maternal overweight in pregnancy is known to be associated with detrimental effects on birth outcomes and infant health.[14] Compared with normal-weight women, obese women have a higher risk of developing GDM and of giving birth to babies born large for gestational age or with macrosomia;[15,16] these children are at risk of developing obesity in later childhood and adult life.[17]

Evidence-based nutrition recommendations for adolescents

The evidence summarized here reveals an overall paucity of information, especially from well-designed randomized controlled trials in LMICs. Yet enough evidence exists to suggest a number of interventions that may improve adolescent health and nutrition. Platforms for those interventions include school- and community-based services, use of communication and information technology, health services (e.g., clinics, health posts, health centers, and district hospitals), youth organizations, and social transfer programs. ~~Table~~ 1 summarizes this evidence, classified by research quality and evidence of impact. Q2

In summary, the general evidence indicates that the means for reducing the risk of stillbirths, neonatal mortality, and LBW[18] are the same for pregnant women across all age groups, including adolescents. Iron supplementation significantly improves hemoglobin concentration and potentially reduces anemia; periconceptional folic acid supplementation can reduce neural tube defects;[19] and high-dose ($\geq$1 g daily) calcium intake among pregnant women at risk of low calcium intake reduces the risk of preeclampsia, preterm birth, and neonatal high-care

Delivery platforms utilized	Interventions	Outcomes	Impact estimates RR/SMD (95% CI)		
			Mostly from HICs	From both HICs and LMICs	Mostly from LMICs
Community school Online media	Obesity prevention	BMI	SMD: –0.05 (–0.11, 0.01)		
Community school Online media	Obesity management	BMI at 6 months	**SMD –0.24 (–0.36, –0.13)**		
Community school	Daily iron versus placebo	**Anemia**			**RR: 0.60 (0.42–0.86)**
	Daily IFA versus placebo	**Anemia** **Serum hemoglobin**			**RR: 0.52 (0.28–0.96)** **MD 2 (4.05–16.10)**
	Weekly IFA versus placebo	**Anemia** Serum hemoglobin			**RR 0.73 (0.58–0.92)** MD 2.24 (0.36–4.12)
	Vitamin A versus placebo	**Anemia**			**RR: 0.73 (0.56–0.93)**
	Calcium versus placebo	BMD change of spine Serum calcium		SMD –0.03 (–0.26, 0.20) SMD 0.17 (–0.32, 0.67)	
	Vitamin D versus placebo	Serum 25(OH)D levels at 3 years		MD 8.8 (–2.68, 20.28)	
	Zinc versus placebo	Hemoglobin **Serum zinc** **Preterm birth (pregnant adolescents)**		SMD 4.81 (0.47–8.66) **SMD 4.28 (2.49–6.06)** **RR 0.57 (0.46–0.69)**	
	Iodine versus placebo	TSH **Cretinism (pregnant adolescents)**		MD 0.30 (–0.06, 0.66) **RR 0.27 (0.12–0.60)**	
	MMN versus placebo	Serum hemoglobin			SMD 1.83 (0.59–3.08)
	MMN versus IFA	Anemia			RR 1.1 (0.5–2.2)

Outcomes in bold show statistically significant impact; moderate-quality evidence, low-/very low–quality evidence.

Figure 1. Adolescent nutrition interventions: impacts and delivery platforms. IFA, iron–folic acid; MMN, multiple micronutrient; BMI, body mass index; BMD, bone mineral density; TSH, thyroid-stimulating hormone; HICs, high-income countries; LMIC, low-income countries.

admissions.[20] Specific studies among adolescent women indicate that zinc supplementation among adolescents is associated with improvements in serum zinc and in hemoglobin concentration, and supplementation among pregnant adolescents significantly reduced preterm birth rates and LBW.[18]

Studies that targeted interventions to address overweight and obesity among adolescents, mostly from high-income settings, do show some benefits in reducing BMI,[18] but the evidence is limited, and the studies have limited generalizability to LMICs. It is, however, reasonable to promote obesity prevention programs in school/community settings and in urban populations where physical activity among young girls may be limited owing to sociocultural reasons, lifestyle behaviors, or lack of adequate facilities. Nutrition counseling, the promotion of physical activity, and behavior change should help prevent obesity, but more research is needed to improve the effectiveness of interventions across all platforms.

Undernutrition in adolescence is seldom discussed in totality and rarely in terms of consequences for adolescent health overall. Existing studies and guidelines mostly refer to micronutrient deficiencies among pregnant women and/or women of reproductive age. Since micronutrient deficiencies could coexist with overweight and obesity across all age groups, this subject needs attention across all settings.

Social determinants of nutrition-sensitive interventions

Most of the sustainable development goals (SDGs), such as (1) no poverty, (2) no hunger, (4) quality education, and (5) gender equality, directly point at ways to reduce the determinants of malnutrition among the poor,[24] and no discussion of adolescent nutrition would be complete without addressing social determinants and nutrition-sensitive interventions. The latter include issues of adolescent empowerment, reduction in gender disparities, and ensuring the right of adolescents to education and social safety nets.[21,22] There is a close link between poverty, marginalization, and "lost childhoods." Too many adolescents—both boys and girls—are forced into the workplace and, in the case of girls, into early marriage or sexual exploitation. These rights, now enshrined in specific sustainable goals for gender equity, right to education, and health, need to be highlighted in national policies. Moreover, ensuring that schools have appropriate food

choices and restricted access to energy-rich foods and sugar-containing drinks could contribute to establishing healthy eating habits in this vulnerable population.[23]

We next summarize the key findings of our review, focusing on (1) the packages of care and (2) the potential delivery platforms, especially those relevant to LMICs.

Packages of care

Balanced energy/protein supplementation for underweight girls before, during, and after pregnancy. The health and nutrition status of prospective mothers is an important predictor of the health and nutrition of their offspring, and mothers' protein/energy requirements should be addressed well before conception.[25] Maternal weight gain is associated with weight and height of the newborn,[26] but, according to the World Health Organization (WHO), high-protein supplementation during pregnancy is counterindicated, as it may be harmful to the fetus, and supplementation in protein/energy-deficient pregnant women should be balanced so that proteins provide less than 25% of the total energy content.[25] In circumstances where food insecurity among adolescent girls is a dominant issue, appropriate support for procuring and consuming diverse and nutrient-rich diets through cash support or food baskets may be needed.

Micronutrient supplementation or fortification in at-risk populations. Strategies to address micronutrient deficiencies include supplementation with key micronutrients and providing access to fortified foods. Pregnancy is a special time period during which the body has greater demands for several nutrients, such as iron and folic acid. As highlighted in the systematic review on nutrient interventions,[18] while the available evidence is largely limited to a few micronutrients, it is important. Adding folic acid supplements before and during pregnancy has been shown to reduce the risks of fetal malformations, and adequate provision of iron can contribute to reducing IUGR in LMICs.[18,27–29] Similarly, vitamin D supplementation in populations living in at-risk geographies with reduced exposure to sunlight (due to latitude or extensive body coverage) has led to improvements in population-level status of vitamin D and reduction in risk of rickets or osteomalacia in populations.[30] Calcium deficiency can be associated with reduced bone density, risk of fractures, and osteoporosis in mothers. There are a variety of foods naturally rich in or fortified with bioavailable calcium, as well as multiple supplemental forms that can be effective.[28]

Prevention of obesity: education and promotion of physical activity. As indicated earlier, the rise of obesity is a problem, not only in the developed parts of the world, but also within LMICs. Education is an effective means of creating awareness in children and implementing preventive strategies from an early age onward and in their families, which may be more effective than the institution of measures during adolescence.[31,32] The importance of physical activity in controlling obesity should be highlighted through education and by getting children (and families) involved in sports and regular physical activity.[33] Recent studies from Mexico and Europe support school- and preschool-based interventions for obesity prevention through introduction of nutritious diets for school breakfast and lunch and making physical activity an integral part of the school curriculum.[34–37] Other obesity-prevention strategies include laws and regulation and taxes and subsidies to restrict marketing of unhealthy foods and beverages to adolescents.[38]

Prevention and management of prediabetes and management in pregnancy. GDM is a common pregnancy-related complication in both high-income settings and LMICs, more commonly seen in overweight and obese pregnancies, which has adverse consequences for maternal and fetal health. Although adolescent-specific evidence is limited, GDM is a major cause of macrosomia, leading to a wide variety of perinatal and postnatal complications, such as shoulder dystocia and birth asphyxia.[21] Gestational prediabetes is a relatively new term denoting elevated blood glucose in early pregnancy. Such individuals are at risk of developing gestational diabetes subsequently. These are important considerations in population settings with high rates of overweight and obesity among adolescent pregnancies. Gestational and pregestational diabetes can be prevented by controlling excess maternal weight gain and appropriate dietary advice. Moderate exercise and physical activity at least thrice weekly during pregnancy has been associated with good maternal glycemic control, but intervention studies so far have not shown major benefits on maternal and child health outcomes.[39–41]

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Further studies are needed on prevention of maternal diabetes and excessive weight gain during pregnancy, especially in LMICs, where a significant proportion of at-risk subjects are adolescents and young women.[42]

Interventions for sexual and reproductive health education and access to contraceptives to prevent unwanted early pregnancies and optimize interpregnancy intervals. Major health-related problems arise in LMICs because of lack of knowledge of complications associated with initiation of reproduction and child birth at an early age. Because of early child bearing, young mothers and their newborns are at risk of developing malnutrition and adverse birth outcomes. Preconception care is potentially effective, as it reduces the exposure of the fetus to adverse effects and can improve health and nutrition in expecting parents.[43] Given the challenge of reproductive health–related issues in this age group, family planning needs to be a core component of adolescent health and nutrition packages of care. Reduction in unwanted pregnancies through education and appropriate access to family planning services and contraception is a fundamental right of all adolescents, and, when possible, this needs to be accompanied by sexual and reproductive health education. Couples should be made aware of the potential adverse health risks for mother and child of short interpregnancy intervals and repeated pregnancies.[44] These goals can be achieved while respecting sociocultural norms and integrating such strategies across diverse settings.[45] Given recent policy-level changes and funding challenges for organizations engaged in adolescent sexual and reproductive health issues in the United States, this is an issue that will require financing and global support.

Interventions to promote education and to delay age at marriage among girls. Educating girls is one of the most important means of protecting their health and nutrition. Time in school has been linked to age at marriage and at first child bearing. UNICEF has proposed to prioritize the provision of access to education and the building of requisite infrastructure.[46] At least primary education should be made absolutely free so that children from low-income families can enroll freely.[47] Adolescents' economic importance is not only limited as future workers. They are often used in household-based economic strategies and are expected to carry out income-earning activities over which they have no control; sometimes this is at the cost of their schooling. Therefore, there should be a defined minimum age for working children all over the world, just as in high-income countries, to promote the safety and access to education for all children and adolescents.[48] Evidence shows that countries that have implemented strict laws for the minimum age of marriage as 18 years have succeeded in lowering the fertility rates in adolescents.[49] This leads to improved health and nutrition outcomes for adolescents and women through education, awareness, and empowerment.

Potential delivery platforms and strategies of relevance to LMICs

A range of delivery platforms may be used in LMICs to reach adolescent women. Nutrition education can be made an essential part of the preschool and school curricula so that children from a very young age are made aware of the lifestyle and dietary choices they face. This can extend to families[50] and to the larger community through community-engagement programs that include caregivers, children, adolescents, and policy makers—ideally a "circle of care" in which adolescents are empowered, caregivers better informed, and policy makers made more sensitive to issues at hand.

Community delivery platforms. The interventions for any developmental projects start by targeting adolescents and youth through community delivery platforms using youth health workers and special community days, such as child health days.[51,52] Working through such platforms and programs can improve outreach to marginalized populations and the equity of service delivery. Empowering youth and equipping youth with essential tools can improve reporting and influence outcomes, but requires a referral chain as well as well-trained youth health workers. There is evidence that training appropriate cadres of health workers and educating them in the nutritional requirements of the mother and the newborn can lead to improvements in key practices during pregnancy and childbirth, including diet during pregnancy, uptake of antenatal care, and breastfeeding practices.[51] The role of youth organizations should be to work in an integrated manner on issues of adolescent girls, pregnant women, lactating mothers, newborns,

and family health in general.[53] Given that these programs and community health worker platforms are being increasingly used to reach marginalized populations and address inequities, we strongly recommend using these existing platforms to facilitate the integration and inclusion of nutrition-related packages into activities specific to that age group.

School and educational outreach programs: formal education versus other approaches. Education has a pivotal role, as one can target children at preschools and schools, where they learn the importance of good nutrition, healthy eating, and regular physical activity.[54] These interventions should start at a very early age by raising awareness among teachers, the caregivers of children, and children themselves. Among adolescent boys and girls, these nutrition educational strategies can be integrated with sexual and reproductive health education. New concepts of health promotion through science literacy approaches in students outside of school are being developed.[55] Educational initiatives should also be accompanied by strategies to address gender empowerment and reduction of gender disparities,[56] an important component of the SDGs (Goal 5). Over time, through inclusion of sexual and reproductive health education, including knowledge of contraception, prevention of teenage pregnancies must be regarded as an integral component of promotion of good health, nutrition, and well-being across all global populations, both in schools and out-of-school settings.[57]

Workplace outreach programs. The goal of any intervention that seeks to influence people should choose venues in which people gather in one place. Like other community-based steps, directing energy to the workplace is an effective means of reaching a section of the population. In Africa, the importance of healthy eating was delivered by influencing people in churches, neighborhoods, restaurants, summer programs, and healthcare workshops.[58] Similarly, providing employees with healthy food at the same time can develop healthy nutritional behaviors. Advocating for such behaviors and practices from religious platforms has also been shown to be effective.[59]

Adolescent-friendly health and nutrition services: integrating services to provide consistent care. There are few adolescent-friendly health services globally, especially in LMICs. Often, health services in LMICs do not have adequate privacy or dedicated services for adolescents, a major barrier for care seeking. This is also true for some adolescents of lower educational or socioeconomic status in HICs who do access primary health care. In many situations, first access to health care occurs in pregnancy, sometimes not until late in the first trimester or later still. A life course approach that provides continuity of care from pregnancy prevention to parenthood is needed. Efforts to ensure universal health care and improve access to essential services and medicines must recognize the need for services for children, youth, and families, and should deliberately and specifically include adolescent care needs in systems planning. Though important, the integration of adolescent health and nutrition services in appropriate facilities in LMICs has fiscal and human resource implications. Given the volume and burgeoning needs for adolescent care, however, and taking advantage of the enhanced focus on adolescents in the new global strategy for women and children, these should be prioritized for action and could well have an impact on improved adherence to the health and nutrition services by adolescents at the population level.

The role of healthcare professionals at all levels: making every contact count. Healthcare professionals (HCPs) are key players in developmental programs and have a special responsibility to promote preventive interventions. HCPs' interaction with people can be made informative and influential by screening for over- and undernutrition, supporting adolescents during pregnancy and lactation, and providing timely information.[60] To do this adequately, they need guidelines and training modules for education, including how to engage the public in conversations about health.[61] There is a clear role for increasing capacity and quality of training of dietitians and nutrition counselors in appropriate health facilities within health systems. The International Pediatric Association and the International Federation for Obstetricians and Gynecologists have come together to develop and implement strategies for improving nutrition support for adolescent girls and young women, an initiative that promises to have impacts on several of the goals of the SDG era.

Role of mass media and social media: involving young people in the initiative. With access levels

rapidly rising even in LMICs, the utility and role of social media for today's youth is much greater than other forms of communication. The power of electronic media would be put to good use if it increased awareness of young people at scale about the importance of healthy nutrition. For example, a recent reality television series featuring Mexican families combatting overweight and obesity among their children (generated by a private–public engagement: United for Healthier Kids) reached a weekly audience of 30 million. There are "youth to youth" educational and awareness campaigns that can provide education and promote healthy eating. However, these are also strategies than can be targeted by inappropriate marketing and promotion of potentially useless and at times harmful practices.[62–64] The utilization of mainstream social media for promoting healthy practices and behaviors has special potential for reaching adolescents, especially if the messages can be tailored to promote key practices. These social marketing campaigns use multiple channels and either paid or non-paid content to spread their message widely. Similarly, using text messaging to augment the other education and health services is a promising approach.

Policy initiatives. General knowledge about adequate food production and appropriate diets to meet the supplies and demands at the population level also needs to be improved, as does ensuring access of all households to nutritious foods.[65] Working with the food industry to address reduction in the intake of sugar-containing drinks and inappropriate foods and to limit inappropriate marketing and advertising, appropriate consumer education, and adequate availability of foods are additional important measures. Adolescents are exposed to many market forces from an early age. The co-occurrence of obesity and food insecurity is a paradoxical phenomenon in the modern world, recognized even in high-income settings. Low-resource populations that do not have access to appropriate and nutritious foods, which could well be fruits and vegetables in some settings, should be targeted for financial support strategies. Linking appropriate diets and nutrition with poverty alleviation strategies and cash transfers (conditional or broad food basket support) is a promising strategy in addressing the SDGs 1 and 2 for eliminating extreme poverty and hunger by 2030 and SDGs 4 and 5 for providing quality education and promoting gender equality.[24]

Making it happen: translating evidence into guidelines for policy and implementation

Translating evidence-based findings into procedural guidelines for policy and implementation depends on the evidence base underlying such guidelines, their adaptation or acceptance by normative bodies such as the WHO, and their operationalization by governments. However, HCPs adopt best practices through a range of normative processes, including evidence syntheses and the development of guidelines by expert groups, including additional processes like national institutes (NICE and IOM are examples). Guidelines provide practical ways to perform certain actions for an HCP working in a certain setting, and recent reviews offer an opportunity for selecting a set of best practices to guide routine practice. It must be recognized that governments of member states make decisions on actions based on considerations that are broader than just evidence, particularly financial considerations and levels of acceptance and popularity among the electorate. For this reason, considerable work remains to be done in making the economic case for nutritional and health interventions in adolescents and for generating wider popular advocacy movements for change.[66]

Many of the aforementioned interventions and preventive strategies need to start early, before and at school age, to be effective. The early education of children and adolescents and raising their awareness about healthy food choices, the importance of physical activity, and the consequences of nonhealthy choices, should be a prime focus.[67,68] While the emphasis of many papers is nutrition-specific interventions, nutrition cannot be improved without the promotion of healthy lifestyles and of nutrition-sensitive interventions, and HCPs should play a major role in this regard. Improving literacy and education is a critically important step toward community education and raising awareness against teenage or early marriages. The agriculture sector can focus on gender-sensitive policies to ensure that women and young girls, as well as young boys (especially in the work force), have adequate access to a variety of affordable and healthy foods. Social welfare systems and safety nets can also be made adolescent and gender sensitive.[69]

Governments and national bodies should foster partnerships with other governmental and nongovernmental organizations, professional associations, and the private sector to devise implementation strategies that support the delivery of adolescent-friendly health care and nutrition services. Programs should be developed to increase community access to healthy foods through retailers close to school, work, and community settings. Schools and workplaces should integrate physical activity and healthy eating to create a healthy food environment; establish nutrition standards that restrict fat intake; and reduce the intake of sugar-sweetened beverages. In LMICs with at-risk populations, schools and workplaces should offer food and micronutrient supplementation to disadvantaged young girls and women. Such guidelines may involve guidance and opportunities for employers and the social sectors to work together.[70] Most importantly, targets for healthy nutrition should be set and progress toward achieving them should be monitored to maintain accountability, possibly by independent organizations. Researchers and academics working on adolescent nutrition issues also have an obligation to aid in shaping the policy and addressing health advocacy for adolescents.

Knowledge gaps and research priorities

Notwithstanding the guidance available, most of the studies and outcomes reviewed recently[18] were rated as low or moderate in methodological quality because of small sample size and lack of rigorous study designs. The methodological quality of many of the included studies was also compromised because they lacked adequate randomization and allocation concealment, which was not always possible owing to the nature of the intervention. Studies that focused on behavior-change interventions lacked reported standardized outcome measures and therefore could not be pooled. Second, because such studies require a longer duration to achieve an impact, they might not have been able to capture the actual impact. There was a relative paucity of trials from LMICs specifically on interventions to tackle undernutrition and micronutrient deficiencies. In contrast, many of the studies on interventions to tackle overweight and obesity were conducted in high-income countries, and therefore the results from those domains cannot be readily extrapolated for other settings. We urgently need better and more coordinated research efforts to improve the evidence base for policy and action in the right settings.

Future studies should specifically target adolescent populations from LMICs or at-risk and marginalized populations in high-income settings to evaluate the effectiveness of interventions to tackle undernutrition, overnutrition, and micronutrient deficiencies. Further studies with longer-term follow-ups are required, and study authors should be encouraged to use standardized and validated measurement instruments to maximize the comparability of results. It is also vital to deliver interventions through appropriate and cost-effective platforms to access hard-to-reach and marginalized population.

There is an ethical imperative to intervene and change the status quo while continuing to gather additional and higher-quality evidence, so research should not delay action. But there is a clear need for further implementation research as well as mechanisms to assess progress. Monitoring and evaluation and tracking adolescent indicators in the Every Women Every Child initiative is an important component of Goal 3 for health within the SDGs. Some efforts are underway to define research priorities for research and action among adolescents.[71]

Conclusions

Each country's economic growth will depend on having a healthy cohort of young people becoming economically and socially productive adults. Compromised health among young people also affects the health of future generations; therefore, strategies that can improve their health are good investments in both the short and longer term. The recent pledges on SDGs have provided a renewed agenda to improve the health of adolescents and young people by strengthening the delivery mechanisms of healthcare interventions. Nutrition-specific and culturally sensitive interventions channeled through clinics, health centers, schools, youth organizations, workplaces, and the wider society, coupled with information and communication technology to involve young people themselves in the co-creation of appropriate interventions, can potentially produce a dramatic improvement in the health of adolescents.[21] However, alterations will be required in service delivery, health workers' capacity, and financing. Lack of intervention

strategies with proven efficacy requires careful evaluation of benefits, potential adverse effects, and benefit-to-cost ratios. These innovation and development mechanisms should engage young people themselves for ownership and prioritization.

Competing interests

The authors declare no competing interests.

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Q9

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