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Lifestyle-Related Diseases in Adolescents: Risk Factors, Health Consequences, and Preventive Strategies

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ABSTRACT

Adolescence is a significant stage of physical, psychological and behavioural change in humans. It is also a critical time in life for developing habits that can affect adult health. Adolescents are increasingly facing lifestyle-related diseases, which are caused by changes in their lifestyle, including their diet, physical activity, sleep, screen time, substance use, etc. Obesity is a significant concern and is related to insulin resistance, type 2 diabetes, hypertension, dyslipidaemia and non-alcoholic fatty liver disease. Lack of physical activity, too much sitting, unhealthy eating, too little sleep and psychosocial stress may also be a factor in poor physical and mental health. There are many lifestyle behaviours which have a relationship with health, and it is complex, as there are several factors influencing individual choices, such as family behaviour, socioeconomic factors, school environment, urbanization, food availability, and digital media. Prevention, therefore, needs to be based on interventions that occur at the individual, family, school, community, and healthcare levels. Key elements of prevention include healthy nutrition, regular physical activity, sufficient sleep, less sedentary time, mental health care, and abstinence from tobacco, alcohol and drugs. Limiting factors must be recognized, but with digital technologies like mobile health apps or wearables, there may be other ways to educate people and track their behaviours related to health. The main lifestyle diseases in adolescents, their risk factors, health impact, prevention measures and future directions are discussed. Adolescent-early and coordinated intervention could help to prevent chronic diseases and contribute to healthy adulthood.

Keywords: Adolescence; Lifestyle diseases; Obesity; Diabetes; Cardiovascular diseases; Physical inactivity; Unhealthy diet; Mental health; Prevention; Health promotion

1. INTRODUCTION

1.1 Concept of Lifestyle Diseases in Adolescence

Lifestyle diseases are diseases that are chronic and can be caused by lifestyle adaptations, environmental and social factors. Obesity, type 2 diabetes, hypertension, cardiovascular risk factors, metabolic disorders and fatty liver disease are a few of the conditions that were more prevalent in adults but are now being increasingly identified during childhood and adolescence. Adolescence, defined as the period between 10 and approximately 19 years, is a period of life when behaviours with regard to diet, exercise, sleep,

substance use and mental health become more independent, and can last into adulthood (Neves et al. 2021). This review refers to 'lifestyle-related diseases', chronic or emerging diseases that are linked, in part, to lifestyle behaviours including diet, physical activity, sleep, sedentary behaviour and substance use. These circumstances are multifactorial, however and should not be considered simply a reflection of lifestyle options. Other factors, such as genetic predisposition, socioeconomic status, psychological variables, family environment, access to health care, neighbourhood environment, commercial influences, and other social determinants also contribute to their development. For this reason, the term "lifestyle-related diseases" and the term "lifestyle-associated health conditions" are used in this report as public-health terms to describe, but not assert, single factor causation.

Increased burden of lifestyle-related diseases in adolescents is correlated with changes in physical and social environment. Increased availability of energy-dense foods, greater intake of processed foods and sugar-sweetened drinks, decreased physical activity opportunities, extended screen time, and irregular sleep patterns have been some of the factors leading to unhealthy lifestyle habits. These factors are often co-occurring and can add up to impact health.

1.2 Changing Lifestyle Patterns Among Adolescents

Urbanization, technological advances, altered family habits, and greater academic pressures have all had a dramatic impact on the lives of adolescents. Outdoor play is gradually being replaced by sedentary entertainment such as playing with a smartphone, computer, playing online and social media interactions. Meanwhile, ready-to-eat foods and fast food are more readily available.

Low levels of physical activity are extremely problematic. A review of 298 population-based surveys across the world, including around 1.6 million adolescents, revealed that a high proportion of adolescents were not meeting physical activity recommendations, with less activity seen in girls (Guthold et al. 2020). Lower physical activity and higher energy intake are associated with increased risk of weight gain and adverse metabolic outcomes, although these relationships are influenced by multiple biological, behavioural, and environmental factors.

1.3 Importance of Adolescence as a Critical Period for Health

Adolescence represents an important opportunity for preventing chronic disease. Health behaviours that are formed at this time can last into adulthood, and unhealthy behaviours can have biological consequences in childhood. Obesity in adolescence is related to an elevated risk of subsequent obesity and cardiometabolic disease, and of youth-onset T2DM (YODT2) with rapid progression and early onset of complications (ElSayed et al. 2023; TODAY study group 2013).

Children also start to have more autonomy in their food, physical activity, sleep and social behaviour choices. Health promotion during this time period may thus be seen to have short- and long-term effects.

1.4 Objectives and Scope of the Review

This review summarises the major lifestyle diseases that are occurring in adolescents, and outlines key behavioural, environmental and psychosocial risk factors. It also reviews the physical and psychological impacts, available preventative and management approaches, the utility of digital health technologies, and future research needs.

2. METHODOLOGY

The objective of this narrative review was to explore evidence from the fields of lifestyle-associated health conditions, behavioural and environmental risk factors, health outcomes, prevention interventions, and digital-health interventions for adolescents. A literature search was done on PubMed/MEDLINE, Google Scholar, Scopus, Web of Science for the relevant literature published. The terms used were both singular and plural and included "adolescent health", "adolescent obesity", "youth-onset type 2 diabetes", "metabolic syndrome adolescents", "adolescent hypertension", "fatty liver disease adolescents", "physical activity adolescents", "sedentary behaviour", "screen time", "adolescent sleep", "diet adolescents", "mental health adolescents", "school-based health interventions", "digital health adolescents", and "adolescent health promotion". Studies were deemed relevant if they were primarily focused on children and/or adolescents and studied lifestyle associated risk factors, health outcomes, prevention and/or management. Where available, systematic reviews, meta-analyses, clinical guidelines, large observational studies and large population-based studies were prioritised. Studies that exclusively examined adults were generally excluded unless they were essential background studies which could not be obtained from studies conducted in adolescents. Sources which were not directly involved in the information they used to back up the claims for which they were cited were omitted or substituted. Titles and abstracts were first evaluated to determine their relevance and then the full text of potentially relevant publications was reviewed. Since this manuscript is a narrative review as opposed to a systematic review, there is no structured risk of bias assessment or quantitative synthesis or meta-analysis performed. The strength and limitations of the evidence, on the other hand, are discussed in a narrative style and focus on observational associations, intervention studies, systematic reviews and clinical guidelines.

2. MAJOR LIFESTYLE DISEASES AFFECTING ADOLESCENTS

2.1 Childhood and Adolescent Obesity

Obesity is one of the most significant health issues among adolescents that are associated with lifestyle. A multifactorial disease which is related to diet, physical activity, genetics, metabolism, psychological factors and the environment. Over the past few decades, childhood and adolescent overweight and obesity have been shown to have escalated in the global community (Phelps et al. 2024). As discussed earlier, adolescent obesity is linked to insulin resistance, dyslipidaemia, hypertension, musculoskeletal conditions, sleep issues and decreased levels of fitness. Psychological outcomes could be low self-esteem, self-image issues, bullying, social isolation and depressive symptoms. The literature confirms that there are several interacting factors that impact adolescent obesity and not just individual food and/or exercise selections (Narciso et al. 2019).

2.2 Type 2 Diabetes and Metabolic Disorders

Type 2 diabetes is becoming a significant cardiometabolic disease in adolescents especially in relation to obesity, insulin resistance, genetic predisposition, family history, dietary factors and low levels of physical activity. Clinically, the youth-onset type 2 diabetes is significant, as complication may occur relatively early in the course of the disease (ElSayed et al. 2023; TODAY study group 2013). Metabolic syndrome is defined as the combination of cardiometabolic risk factors including central adiposity, elevated blood pressure, impaired glucose regulation or insulin resistance, elevated triglycerides and low high-density lipoprotein cholesterol. In adolescents, metabolic syndrome definition and thresholds are less solid due to age, sex, and pubertal variability in normal values. However, when these risk factors occur together in the adolescent years, the risk of cardiometabolic disease is higher, and may continue into adulthood (Zhang et al. 2025).

2.3 Hypertension and Cardiovascular Risk

Hypertension in adolescents is of growing relevance, especially with the rise of the growing rates of obesity. Elevated blood pressure in adolescents is associated with factors including excess adiposity, high sodium intake, dietary patterns, low physical activity, genetic susceptibility, and metabolic abnormalities (Siddiqui and Malatesta-Muncher 2020).

Cardiovascular disease is rare in the adolescent years, but cardiovascular risk factors can develop during these years. Obesity, hypertension, dyslipidaemia, smoking, insulin resistance, and physical inactivity are factors that can lead to future cardiovascular diseases. Thus, early recognition and intervention in these potential risk factors is crucial.

2.4 Non-Alcoholic Fatty Liver Disease

The more common non-alcoholic fatty liver disease (NAFLD) has a strong association with obesity and metabolic dysfunction and is emerging as a problem in children and adolescents. This condition can result in fat accumulation in the liver, or inflammation and fibrosis that may result in serious liver disease later on in life (Vos et al. 2017). The key area of management is lifestyle modification. Eating healthier, getting more exercise and losing weight slowly and steadily can help achieve metabolic wellness and liver health. The challenge for early detection is that often the most common symptoms of NAFLD are few or non-existent in adolescents (Ascher Bartlett and Mittal 2021).

2.5 Respiratory and Other Lifestyle-Associated Disorders

Other factors associated with lifestyle can also affect the health of the respiratory system and other systems. There is a link between obesity and asthma symptoms, lower cardiorespiratory fitness and sleep-related breathing disorders. Being physically inactive can also lower rates of fitness levels and cause adolescents to be less likely to engage in activity. Other diseases related to poor health habits include

musculoskeletal diseases, dental disease due to sugar intake, sleep disorders and metabolic and reproductive disorders due to extreme obesity.

2.6 Mental Health Problems Associated with Lifestyle Patterns

There are strong links between mental health and behaviours related to lifestyle. Adolescents who have insufficient sleep, physical inactivity, too much screen time, poor nutrition and/or chronic stress may be more likely to suffer from anxiety, depression and decreased psychological functioning. There is an important relationship between physical activity and sedentary behaviour and mental health among children and adolescents, as shown in a systematic review (Kemel et al. 2021). It's bidirectional. Relationships between lifestyle behaviours and mental health are often bidirectional. Physical inactivity, disrupted sleep, dietary patterns, screen exposure, and substance use may be associated with poorer psychological outcomes, while existing mental-health difficulties may also influence these behaviours. Thus mental health needs to be integrated into lifestyle-disease prevention programmes.

3. MAJOR LIFESTYLE RISK FACTORS

3.1 Unhealthy Dietary Habits

Diet is one of the most important lifestyle disease modifiable risk factors. Adolescents might also overindulge in fast food, processed snacks, refined carbohydrates, confectionery, and sugar-sweetened drinks, but fail to get enough fruits and vegetables, whole grains, and other nutrient-dense foods. The evidence is consistent on the association between dietary patterns defined by high energy density, high frequency of uptake of ultra-processed foods/sugar-sweetened beverages and negative weight-related/metabolic outcomes (Lane et al. 2024). Much of this evidence, however, is observational and dietary behaviour is present in conjunction with variations in physical activity, socioeconomic status, family environment, sleep and other health behaviours. So it's important that individual food items not be understood in isolation or as necessarily contributing to weight gain. Systematic reviews have been used to help promote a reduction in the overconsumption of highly processed foods and free sugars and to ensure the consumption of sufficient amounts of fruits, vegetables, whole grains, pulses, nuts and other food sources with high nutrient density within a healthy food pattern (Della Corte et al. 2020).

3.2 Physical Inactivity and Sedentary Behaviour

Adolescent physical activity is linked to positive cardiovascular fitness, musculoskeletal health, body composition, metabolic health and psychological wellbeing. Worldwide, vast numbers of adolescents are not active enough, especially girls. However, observational studies can not determine if inactivity is the sole cause of individual health outcomes as activity levels are also dependent on other behaviours and factors, including socioeconomic factors, school environments, transport patterns, neighbourhood safety, etc. The general findings of intervention studies are that levels of physical activity are linked to improvements, but the size of the effects on body weight is variable and effects may be more apparent on fitness, psychological wellbeing and cardiometabolic health than on BMI (Guthold et al. 2020).

3.3 Excessive Screen Time and Digital Device Use

Digital-device use is a central part of the daily lives of today's teens and can have potential positive education, social and health-related consequences. Despite this, greater recreational screen time has been linked to worse sleep outcomes such as delayed bedtimes, decreased sleep duration, sleep disturbance and daytime sleepiness (Silva et al. 2022). Prospective studies also have reported links between interactive electronic-device use patterns, sleep and some mental-health outcomes. Caution should be used in interpreting these findings as physical activity reduction and screen exposure could occur simultaneously, as well as other factors such as preexisting psychological symptoms, family factors, irregular sleep patterns. The available evidence at this time indicates a relationship between specific screen behaviours and a decline in health outcomes, but that this relationship is not a direct one (Grace Olivia Dibben et al. 2023).

3.4 Inadequate Sleep and Irregular Sleep Patterns

During adolescence, sleep is critical for physical and cognitive development, emotional control, and metabolic health. The effects of sleep in terms of mood, attention, dietary behaviour, physical activity and metabolic risk have been reported for short and/or irregular sleep.Short or irregular sleep has been linked to changes in mood, attention, dietary behaviour, physical activity and metabolic risk. But often these relationships are two-way streets. Excessive night-time device use or psychological distress, for instance, can lead to poor sleep, which can then impact upon emotional functioning and daytime behaviour. Sleep should therefore be thought of as one element in a larger pattern of interrelated adolescent health behaviors, not as a single cause.

3.5 Tobacco, Alcohol, and Substance Use

Alcohol, tobacco and other drugs are significant health risks for adolescents. Factors such as peer influence, curiosity, stress, family situation, social norms and marketing exposure can be a part of initiation. Adolescent drug and alcohol use can increase the risk of dependence and health issues as adults. It can also be associated with other lifestyle risks, such as poor sleep, decreased physical activity, psychological issues and poor dietary habits. It should be a combined effort between education, family support, mental health and the necessary public health measures.

3.6 Academic Stress and Psychosocial Factors

Academic pressure, stress from exams, the expectations of family, peer relationships, bullying, body image and worrying about the future are all factors that can affect adolescent health. Emotional eating, physical inactivity, sleep disturbances and substance abuse can be associated with chronic stress. Additionally, a lack of social and environmental conditions can affect the ability of adolescents to have healthy behaviour. There may be significant challenges to health choices due to lack of safe recreation sites, access to affordable nutritious foods and socioeconomic disadvantage.

4. IMPACT OF LIFESTYLE DISEASE ON ADOLESCENT HEALTH

4.1 Physical Health Consequences

Adolescent physical-health consequences may be linked together and may be influenced by lifestyle-associated risk factors. Insulin resistance is especially significant because it often occurs in combination with obesity, dyslipidaemia, raised blood pressure, fatty liver disease, musculoskeletal disorders and sleep-related disorders. In particular, youth-onset type 2 diabetes represents a significant concern as the primary cardiometabolic and renal complications of the disease can arise relatively early in the course of the disease. These findings illustrate the need to view adolescent risk factors in a multi-faceted way rather than as distinct factors (ElSayed et al. 2023; TODAY study group 2013).

4.2 Psychological and Mental Health Consequences

There are psychological implications of lifestyle diseases. Adolescents with obesity may feel concerned about their body image, be stigmatized, bullied, have diminished self-esteem, feel socially isolated, and have depression. The psychological challenges can then impact the way that individuals eat, exercise, sleep and follow treatment.

4.3 Academic and Social Consequences

Concentration, school attendance, school performance and social participation may be impaired due to poor sleep, mental health issues, health problems related to obesity, and a sedentary lifestyle. Higher recreational screen exposure may displace time available for physical activity, sleep, or in-person social interaction in some adolescents, although the extent of this displacement varies considerably between individuals.

4.4 Long-Term Health Risks in Adulthood

Adolescent lifestyle-related diseases can have a life course impact. High rates of obesity in adulthood are linked to persistent obesity in childhood, diabetes, hypertension and cardiovascular disease. Additionally, metabolic liver disease can develop over time, so it is particularly important to prevent it early on (Vos et al. 2017; Ascher Bartlett and Mittal 2021).

5. PREVENTION AND MANAGEMENT STRATEGIES

5.1 Healthy Nutrition and Dietary Interventions

Nutrition interventions should be directed at a sustainable healthy eating pattern instead of a very restrictive eating pattern. Educating adolescents on eating a balanced diet, increasing fruits and vegetables, choosing whole grains and healthy protein, staying hydrated by drinking water and limiting highly processed foods.

The school nutrition interventions can have positive effects on dietary behaviours. Systematic review and network meta-analysis showed that the effect of various school-based nutrition interventions on diet and anthropometric outcomes may differ, depending on the design of the nutrition interventions (Nury et al. 2022).

5.2 Promotion of Regular Physical Activity

Programmes of physical activity should be fun, accessible, age-appropriate and culturally accepted. Physical education, sports, active transportation opportunities and frequent movement breaks are offered at school. Walking, cycling, dancing, outdoor play and sport can all be encouraged within the family. There is a message to be heard here, and it's not just about weight loss. There is evidence of positive impacts on the physical, mental and social wellbeing of youth (Kemel et al. 2021). Physical activity interventions have also been shown to have benefits for mental health aspects (Rodriguez-Ayllon et al. 2019).

5.3 Sleep Hygiene and Screen-Time Management

Adolescents' regular sleep patterns should be encouraged, and they should avoid stimulating activities in the lead-up to bedtime. Families can help set up sensible nighttime technology habits, and urge teens to not bring digital devices to bed. The emphasis should be on balance, not technology bans, in screen management. It is not a sufficient substitute for sleep, exercise, learning, family time, or social interactions, especially when accessed regularly.It should not routinely be used in place of sleep, exercise, learning, family time or social relationships, particularly when used on a regular basis.

5.4 Mental Health Promotion and Stress Management

Mental health promotion needs to be a part and parcel of the prevention of lifestyle diseases. Educate about stress management, relaxation, time management, healthy coping and emotional regulation with healthcare professionals or in schools. Persistent anxiety, depression and/or disordered eating or other psychological symptoms during adolescence should be addressed by suitable professional support. Physical activity may also help to boost your mood and mental health (Kemel et al. 2021; Rodriguez-Ayllon et al. 2019).

5.5 Family-Based Interventions

Parents/caregivers have an impact on the availability of food, eating and drinking habits, physical activity, sleep and weight attitudes. Family-based interventions, in particular, may be helpful as adolescents are likely to engage in sustainable behaviours when healthy behaviours are also engaged in within the family. Interventions should not include blame, and too much attention should not be given to body weight. Role modelling and providing support with communication would be more suitable for encouraging healthy behaviour.

5.6 School-Based Health Promotion

Schools are an important point of intervention for health promotion, as they can target large numbers of adolescents and impact their behaviours and the environment. There is evidence from systematic reviews that some school-based programmes have an impact on obesity-related behaviours, such as physical activity and food intake. The impact on BMI and other anthropometric outcomes tends to be relatively small, though, and depends greatly on the type of intervention, the length of time it lasts, its intensity, and the characteristics of the people who participate in the programme. Education alone is less likely than multicomponent programs that include the school food environment and physical-activity environment to be successful. The evidence available therefore suggests that schools are a valuable context for prevention, but does not suggest that school-based interventions are enough to prevent lifestyle associated conditions (Hodder et al. 2022; Jacob et al. 2021).

5.7 Role of Healthcare Professionals

Lifestyle-related risk factors can be identified by assessment of growth, body composition, blood pressure, diet, physical activity, sleep, mental health and substance use by healthcare professionals. Obesity and/or metabolic abnormalities in adolescents may need to be managed by a multidisciplinary team of physicians, dietitians, psychologists and physical activity professionals. Healthcare services should be adolescent-friendly, confidential, respectful and not be stigmatising. Early detection and treatment can help limit progression of the disease and help achieve better long-term results.

6. ROLE OF TECHNOLOGY AND DIGITAL HEALTH

6.1 Health and Fitness Applications

Mobile health apps can deliver health education, reminders, tracking physical activity, dietary information, setting goals and feedback on behaviour. These tools may support adolescent health promotion, although accessibility, sustained engagement, and effectiveness vary across populations.

6.2 Wearable Devices and Activity Monitoring

Wearable devices can track physical activity, heart rate, sleep, as well as other health-related activities. These technologies may help some adolescents monitor behavioural patterns and establish health-related goals, although evidence for sustained behavioural or clinical benefit remains variable. But for some users, too much monitoring could lead to anxiety or an unhealthy fixation on weight or exercising.

6.3 Digital Health Education

Online platforms can offer online videos, interactive programmes, social media campaigns, and remote counselling. Digital solutions can also enhance the health information available for the adolescent population and those who are facing geographical and social barriers.

6.4 Opportunities and Limitations of Digital Interventions

Digital-health interventions may provide scalable health education, behavioural prompts, self-monitoring, goal setting, and personalised feedback. Measurement of physical activity, sleep and other behaviors can also be supported via mobile applications and wearable devices. The presence of these functions does not mean that they are effective and proven to work in the long term, however. Although there is some evidence of continuing improvement in adolescent clinical outcomes, engagement typically wanes over time.

Some practical and ethical restrictions need to be taken into account, as well. Digital-health programmes can gather information that impacts on behaviour and health, raising privacy, data security, consent, and commercialisation concerns. Access to smartphones, wearable devices, proper Internet connectivity and digital literacy are uneven which can contribute to further existing socioeconomic inequalities. For some users, too keen an eye on self may lead to anxiety or an unhealthy focus on weight, exercise and sleep.

A further paradox is that interventions provided via smartphones or screens can actually increase overall digital exposure, even when interventions are designed to increase sleep or decrease sedentary behaviour. Digital interventions should therefore be developed with a focus on reducing unnecessary screen time, and assessed to ensure adherence, acceptability, equity, safety, and effectiveness. Currently, they are considered as add-on measures to be used alongside, and not as substitute for, health promotion measures taken at the family, school, community, and health service levels (Silva et al. 2022; Grace Olivia Dibben et al. 2023).

7. CHALLENGES AND FUTURE PERSPECTIVES

The evidence contained in this manuscript includes a wide range of evidence levels. Cardiometabolic risks and physical activity are relatively well known as factors associated with adolescent obesity and physical activity and health benefits, respectively. In contrast, associations with mental health and with individual dietary behaviors are often based on observational studies and may be bi-directional or confounded by residual confounding. In the same way, school-based, family-based and digital-based preventive interventions sometimes have positive effects on behavior, although this is not always the case for long-term clinical outcomes. Such differences should be noted when moving from the evidence to making public-health recommendations, and should underscore the distinction between plausible mechanisms and observed associations and causal relationships.

7.1 Barriers to Healthy Lifestyle Adoption

Adolescents may understand the benefits of making healthy choices but still have challenges to overcome, like time constraints, expensive healthy foods, not having access to recreational facilities, unsafe neighbourhoods, peer influence, family habits, or aggressive marketing of unhealthy foods.

7.2 Socioeconomic and Environmental Influences

Social and environmental factors are associated with lifestyle-related diseases. Factors such as food availability, school environments, neighbourhood safety, family income and access to recreational facilities could affect adolescent behaviour. The school food environment has been shown to be related to adolescent overweight (Gonçalves et al. 2021).

7.3 Need for Multidisciplinary and Community-Based Approaches

It is a lifestyle disease with a number of causes, and therefore needs coordinated interventions. Prevention needs to be shared between families, schools, health and other professionals and community groups, as well as policy makers. Indirect efforts for behavioural change should be complemented by environmental and policy interventions.

7.4 Future Research Directions

Future studies should focus on measuring longer-term behavior or weight outcomes, as well as determining if adolescent interventions have long-term effects on cardiometabolic health, mental health, education enrollment, and adult disease risk. More focus is required on socio-economic inequalities, culturally appropriate interventions, long-term adherence, effectiveness of digital-health interventions, and how digital health impacts physical and psychological health. Research should also determine the elements of multi-level interventions that have the most impact and if effects persist beyond the end of structured programmes. Adolescent involvement in programme design and evaluation can enhance relevance, acceptability and adherence.

8. CONCLUSION

Lifestyle-related health conditions are an important and growing part of the public health of adolescents. There are complex interactions between behavioural, biological, genetic, social, economic and environmental factors which influence obesity, youth-onset type 2 diabetes, elevated blood pressure, metabolic abnormalities, fatty liver disease and mental-health difficulties. As such these conditions should not be taken to reflect solely individual lifestyle.

Multiple studies have consistently shown that eating a healthy diet, exercising regularly, getting a good night's sleep, avoiding tobacco and harmful substance use, and having a supportive mental health environment are important. But there is variation in the strength of the evidence for each risk factor. Observational studies have reported many relationships between screen time, sleep, dietary behaviours, sedentary time and psychological outcomes; these relationships may be bidirectional and/or confounded. Such relationships should not necessarily be taken as causal relationships.

Individual behaviour change is most likely to be effective if supported by family, school, community, healthcare and policy environments. Health behaviours can be enhanced by school- and family-based programmes, with modest or variable changes in body weight and clinical outcomes in most cases. Digital

health technologies can offer some valuable additional support, but their effectiveness, availability, privacy impact, use and potential to increase screen time must be carefully considered.
Future studies should consider long-term health effects, sustainability of behavioral changes, socioeconomic inequities, culturally-relevant interventions, and effectiveness of multilevel prevention strategies. Better knowledge of interventions that have long-term effects will be necessary to lower the cardiometabolic and psychological risks of adolescents and facilitate a healthy transition to adulthood.

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