REVIEW ARTICLE

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Consensus statement on Singapore integrated 24-hour activity guide for early childhood

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ABSTRACT

Introduction: Early childhood is a critical period for growth and development. Adopting healthy lifestyle behaviours during this period forms the foundation for future well-being and offers the best protection against non-communicable diseases. Singapore studies have shown that many young children are not achieving the recommendations on physical activity, sedentary behaviour and sleep. A workgroup was set up to develop recommendations for caregivers of infants, toddlers and preschoolers (aged <7 years) on how to integrate beneficial activities within a daily 24-hour period for optimal development and metabolic health.

Method: The Grading of Recommendations Assessment, Development and Evaluation (GRADE)-ADOLOPMENT approach was employed for adoption, adaption or de novo development of recommendations. International and national guidelines were used as references, and an update of the literature reviews up to September 2021 was conducted through an electronic search of PubMed, Embase and Cochrane Central Register of Controlled Trials (CENTRAL) databases.

Results: Four consensus statements were developed for each age group: infants, toddlers and preschoolers. The statements focus on achieving good metabolic health through regular physical activity, limiting sedentary behaviour, achieving adequate sleep and positive eating habits. The 13th consensus statement recognises that integration of these activities within a 24-hour period can help obtain the best results.

Conclusion: This set of recommendations guides and encourages caregivers of Singapore infants, toddlers and preschoolers to adopt beneficial lifestyle activities within each 24-hour period.

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Keywords: Eating habits, metabolic health, paediatrics, physical activity, sedentary behaviour, sleep

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CLINICAL IMPACT

What is New

- To our knowledge, this is the first Singapore guide to examine the relationship between all lifestyle activities integrated within a 24-hour period and their health outcomes for children less than 7 years of age.
- The inclusion of eating habits in the integrated guide provides a complete optimal metabolic cycle in young children.

Clinical Implications

- This guide provides updated evidence for healthcare professionals to promote beneficial lifestyle activities for all healthy infants, toddlers and preschoolers (aged <7 years) in the domains of physical activity, sedentary behaviour, and sleep and eating habits, as well as integration of these activities.

INTRODUCTION

Early childhood is a critical period for growth and development, setting the foundation for future and lifelong well-being.[1] Adopting healthy lifestyle behaviours in early childhood can potentially influence and shape behaviours later in life.[2] Frameworks have been developed, such as from the Center on the Developing Child at Harvard University, and are advocated for early childhood health promotion and disease prevention;[3] these form key strategies in reducing future non-communicable diseases (NCDs). The World Health Organization (WHO) global action plan for the prevention and control of NCDs (2013–2020) highlighted that exposure to risk factors of NCDs often starts early in life, and interventions in early childhood often offer the best protection against these diseases.[4]

The current Singapore guidelines on physical activity for children less than 7 years were updated in 2013.[5] This group of children includes infants, toddlers and preschoolers who have not started mainstream school, which commences as the child turns 7 years old in Singapore. Over recent years, there is emergent evidence surrounding physical activity, sedentary behaviour and sleep for this group of children, and how these concepts relate to one another within a 24-hour period, for better health outcomes.[6-10] This workgroup also integrated dietary choices and eating behaviours closely linked to movement behaviours in terms of, but is not limited to, optimising energy balance, which is important for obesity prevention.[11] Encapsulating all these elements, we developed the Singapore Integrated 24-hour Activity Guidelines for Early Childhood (0 to <7 years).

Supporting evidence for healthy lifestyle behaviours in early childhood

We present the updated evidence from local and international studies for health outcomes of physical activity, sedentary behaviour, sleep, and diet/eating habits in children under 7 years of age.

Physical activity

Physical activity provides many health benefits including improved motor and cognitive development, and cardiometabolic, musculoskeletal and psychosocial health.[12] Children in this age group should be encouraged to regularly participate in a variety of activities regularly; those who engage in more physical activity overall and/or at a higher intensity (i.e. moderate to vigorous or vigorous intensity) consistently enjoyed favourable health benefits.[13,14] Tummy time (i.e. prone position) appears to be positively associated with motor development for infants.[15] Outdoor play (under adult supervision) is reported to confer health benefits on preschoolers, such as reducing the risk of incident myopia.[16,17] A cross-sectional study of 78 preschoolers in Singapore, using wrist-worn accelerometers, showed that the children spent a median of 7.8 hours/day in sedentary behaviour and 0.5 hours/day in moderate- to vigorous-intensity physical activity. The same study also revealed that preschool teachers were not familiar with physical activity guidelines and that parents reported very little outdoor playtime with children after preschool.[18]

Sedentary behaviour

Excessive sedentary behaviour and screen time can have detrimental health effects on children in early childhood.[19] Prolonged sedentary screen time is adversely associated with adiposity, poor motor and cognitive development, and impaired psychosocial health.[20,21] Indeed, prolonged sitting, reclining or lying are also unfavourably associated with adiposity or motor development.[22] Studies of screen time and sedentary behaviour in the Growing Up in Singapore Towards healthy Outcomes (GUSTO) cohort, a longitudinal cohort study investigating the influence of early development on body composition and metabolic health,[23] showed that the average screen time for infants (12 months) and toddlers (2 years) was 2.0 and 2.4

hours/day, respectively.[24,25] Screen time in infants was negatively associated with later cognition (composite intelligence quotient [IQ] and verbal IQ), whereas for toddlers, higher screen time was associated with less physical activity and greater sedentary behaviour.[24,26]

Sleep

Sleep is essential for growth and good health in early childhood.[27] As a newborn grows, he/she regulates his/her sleep through the establishment of a circadian cycle with less daytime naps and more night-time sleep.[28] Children of different ages require different optimal sleep durations.[29] However, shorter sleep in children could be the result of increased screen time around bedtime and collectively may be associated with higher levels of adiposity, poor growth and emotional dysregulation.[30] The sleep duration of children less than 2 years of age in the GUSTO cohort was significantly associated with body length; shorter sleep duration was also associated with higher body mass index and shorter body length for those at 3 months of age.[31]

Diet and eating habits

A healthy diet provides optimal nutrition for a child's physical and cognitive development.[32] Nutritional needs and eating patterns change with each progressive stage of childhood.[33] Setting good eating habits and shaping positive eating behaviours in early childhood help form the foundation for a healthy diet, which can reduce the future risks of overweight or obesity, as well as protect against NCDs.[34] Infants in the GUSTO cohort who were fed breast milk showed better gross motor skills at 2 years and better cognitive performance at both 2 and 4.5 years of age, when compared to formula-fed infants.[35] Higher intake of sugar-sweetened beverages in young children (18 months to 5 years) was associated with higher levels of adiposity and greater risk of overweight or obesity.[36]

Integration of activities

The GUSTO study also reviewed the adherence to 24-hour movement guidelines (Canada/Australia) in 864 children at 5.5 years old, and results showed that few children (5.5%) met all of the movement guidelines.[37] A more recent study examined the proportion of preschoolers meeting the WHO guidelines on physical activity, sedentary behaviour and sleep, and the effect on their quality of life. More than 2,000 parents of preschoolers were surveyed and only 9.6% met all of the recommendations, whereas 12.6% did not meet any of the recommendations. This study also showed that the health-related quality of life (using the Pediatric Quality of Life Inventory) increased as the preschoolers achieved more recommendations.[38] The nationally representative study in terms of ethnicity is to date the largest prevalence study in Singapore on sleep, physical activity and sedentary behaviour among preschoolers.

Aim of consensus statement

This guidance provides a holistic approach for developing and maintaining good health among children in early childhood (i.e. <7 years) in Singapore, by integrating physical activity, sedentary behaviour, sleep, and dietary and eating habits advice. It is equally important to understand that these activities are closely related in influencing health outcomes and time-use behaviour, and to organise them within a daily 24-hour period. Incorporating healthy dietary and eating habits with movement behaviours encourage children to practise and adopt these recommended habits and behaviours at a young age, thereby conferring good health.

These recommendations are for all healthy infants (0 to <1 year), toddlers (1 to <3 years) and preschoolers (3 to <7 years), regardless of sex, cultural background or socioeconomic status. Children with special needs or medical conditions should consult a qualified medical professional for additional guidance.

METHOD

The consensus workgroup consisted of physicians (neonatologists, paediatricians—including developmental paediatricians—sports physicians and family physicians), allied health professionals (dietitians, exercise physiologists), academics, educators and researchers from multiple institutions and organisations.

The workgroup assessed the evidence reviews conducted for the WHO Guidelines on Physical Activity, Sedentary Behaviour and Sleep for children under 5 years of age, and the 24-Hour Movement Guidelines for children less than 5 years of age from Canada, Australia and South Africa.[6-9] Relevant evidence for children aged 5 to less than 7 years from WHO Guidelines on Physical Activity and Sedentary Behaviour and the 24-Hour Movement Guidelines for Children and Youth/Young People from Canada and Australia were also reviewed.[39-41] The literature was updated to September 2021 through an electronic search of PubMed, Embase and Cochrane Central Register of Controlled Trials (CENTRAL) databases, and the keywords used included "infant", "toddler", "preschool", "physical activity", "sedentary behaviour", "sleep", "eating habits" and "diet". The update included systematic reviews, randomised control trials and cohort studies. Only results in English language were

considered. The health outcomes included cardiometabolic health, physical fitness, bone and skeletal health, adiposity, motor and cognitive development, behaviour development and psychosocial health.

The workgroup used the Grading of Recommendations Assessment, Development and Evaluation (GRADE)-ADOLOPMENT approach,[42] which builds on the GRADE Evidence to Decision (EtD) framework,[43] to provide a structured and transparent methodology for healthcare recommendations. It evaluates the strength of recommendations from associated guidelines and the quality of evidence supporting the recommendations. Regular meetings were conducted for workgroup members to present and discuss each recommendation, which was then revised based on the members' comments. A consensus was achieved when all members agreed to the revised recommendation for the Singapore paediatric population.

RESULTS

These recommendations are intended for healthcare professionals providing holistic care to infants (statements A), toddlers (statements B) and preschoolers (statements C), including education and the promotion of healthy activities that form the foundation for lifelong well-being. The full EtD framework is included as Supplementary Material.

Physical activity

(A) Infants should be physically active several times a day, where more is better. It should be in a variety of forms and be conducted within a safe and supervised environment.

(A) Activities should include non-screen-based interactive floor-based play and tummy time, for those who are not yet mobile.

(A) Tummy time should be commenced soon after birth, building up towards at least 30 minutes spread throughout the day.

(B, C) Toddlers and preschool children should accumulate 180 minutes of physical activity throughout the day within a safe environment.

(B, C) Daily outdoor play is highly encouraged, as is the involvement of caregivers participating in all forms of physical play with both groups and more activity is considered better.

(C) For preschoolers, at least 60 minutes should be of moderate to vigorous intensity and older preschoolers (5–6 years of age) should be exposed to a variety of age-appropriate activities that also promote muscle- and bone-strengthening, several times a week.

Supporting information

Physical activity in infants is associated with improved measures of adiposity, motor skill development, psychosocial, and cardiometabolic health indicators (e.g. blood pressure, lipid level and insulin resistance).[12] For infants not yet mobile, tummy time—defined as awake prone positioning on a firm surface—is positively associated with multiple developmental aspects.[6] Tummy time has positive effects on global development,[44] particularly gross motor development,[45] body mass index and prevention of brachycephaly.[46,47] Infants can start on tummy time as soon as they are brought home and build up from a few minutes towards a minimum of 30 minutes of prone activities spread throughout the day. During tummy time, the infant can be encouraged to play and should be supervised by a responsible adult caregiver.

Toddlers should engage in a spread of physical activities of at all intensities.[12] This should include activities that encourage exploration and involve movement skills such as walking, running, crawling, climbing, balancing, bending, dancing and playing with balls. The more active play the toddlers achieve, the better. Toddlers who engaged in at least an hour of moving freely each day had significantly stronger object and locomotor skills.[48] Caregivers should participate actively with toddlers during both indoor and outdoor play, as such positive interactions are associated with better developmental skills, reduced risk for obesity, and accumulate physical activity.[49,50]

Structured and unstructured play is also important for a toddler's global development and these activities can take place in all environments.[51] In childcare centres, more than half of a toddler's indoor moderate to vigorous physical activities occur in modified open-plan spaces, which are indoor areas with modifications for segregation between activities (e.g. noisy and quiet activities, or messy and clean activities) to reduce distractions, and during class transitions. Enhancing childcare structure quality and inclusion of modified open-plan spaces can promote physical activity and reduce sedentary time for toddlers.[52]

Physical activity among preschoolers is associated with multiple health benefits, especially when it is moderate to vigorous intensity.[12,53,54] Evidence supports positive improvements in motor and cognitive development,[53] physical fitness, psychosocial well-being, cardiometabolic and bone health and lower adiposity.[7,12] In addition, a strong foundation in childhood movement competence may be associated with improved participation in physical activities later in life. Therefore, preschoolers should be encouraged to participate in a

variety of activities encompassing fundamental movement skills and age-appropriate/modified sports in a safe environment.[55,56] A Singapore study found that nearly 70% of the lower primary students failed to demonstrate age-appropriate movement proficiency, indicating a critical need for physical activity interventions at the preschool age.[57] Older preschoolers, aged 5–6 years, can also improve muscle and bone strength through weight-bearing (e.g. climbing), resistance (using their own bodyweights, e.g. knee push-ups) or light-impact exercises (e.g. running and hopping). These activities may be in the form of informal play at playgrounds or as part of organised team sports such as football.

High prevalence of myopia in Singapore is a serious health concern; daily outdoor play for at least 2 hours provides respite from excessive "near-work" (e.g. reading and screen time) and helps to reduce early onset myopia.[16,17] Moreover, outdoor play allows more playtime including moderate to vigorous physical activities and confers many other learning opportunities for children, caregivers and educators,[58] while also providing parents with time to create and strengthen bonds with their children.[59]

Sedentary behaviour

(A, B, C) A daily routine for activities, sleep and meals may be useful in reducing the amount of sedentary behaviour.

(A, B) Avoid restraining infants and toddlers for more than 1 hour at a time.

(A, B) When infants or toddlers are seated, reclined or lying down, caregivers are encouraged to engage them in singing, reading, storytelling and imaginative play.

(A, B) Screen time, regardless of the type of device, is not recommended for infants and toddlers younger than 2 years of age.

(B, C) For toddlers 2 years and above and preschoolers, screen time should be limited to less than 1 hour per day.

(C) For preschool children, limit the total daily amount of sedentary behaviour, such as sitting, reclining or lying down, and take breaks during extended periods of time spent being sedentary.

Supporting information

Infants and toddlers should not be restrained (e.g. strollers and high chairs) for more than 1 hour at a time as this is associated with high levels of adiposity and less favourable motor development.[6,19] Sedentary behaviour among toddlers also includes the use of any screen device, reading, drawing, eating, travelling in a vehicle, while seating, reclining, or lying down.[60] Screen time in both groups is associated with unfavourable measures of adiposity, decreased scores on measures of psychosocial health, cognitive development, social skills, sleep duration and quality, and gross motor development.[19] Indeed, any form of screen time, including that in the background, is not recommended in infants. International guidelines consistently recommend that toddlers should not be restrained to their seats for more than 1 hour at a time, and those of less than 2 years of age should have no exposure to screens.[6-8] When infants or toddlers are sedentary, they still require supervision. Engaging in "serve and return" activities such as reading, singing, storytelling or imaginative play with a caregiver is encouraged as this has greater potential for cognitive and social development.[19,61]

For preschoolers, while sedentary behaviour—for instance during educational periods—cannot be completely eliminated, regular movement breaks, such as in the form of active play are essential to minimise adverse health effects.[62] It is also important to limit recreational screen-based sedentary behaviour such as television viewing and handheld device use. The WHO evidence-based guidelines acknowledged that among children aged 3–6 years, these appliances bore detrimental effects on their fitness, adiposity and behaviour or sleep, regardless of the type of screen device.[6,63] Indeed, in a prospective cohort studies among young children in Singapore, screen viewing was found to have an impact on movement behaviours (e.g. moderate- to vigorous-intensity physical activity and sleep) and abdominal adiposity (quantified using magnetic resonance imaging) later in life.[26,64]

Sleep

(A, B, C) For all ages, a regular routine, consistent bedtime, conducive sleep environment and, for toddlers and preschoolers, avoiding screen time before night-time sleep, will help obtain quality of sleep.

(A) Infants should achieve 14–17 hours (for 0–3 months) and 12–15 hours (for 4–11 months) of sleep daily and include regular naps to promote optimal health.

(A) Infants are recommended to sleep on their back in their own cot, in the same room as their caregivers to ensure sleep safety.

(B) Toddlers should achieve 11–14 hours of sleep daily, with regular sleep and wake-up times.

(C) Preschoolers should achieve 10–13 hours (for 3–4 years) or 9–13 hours (for 5–6 years) sleep daily. Older preschoolers may not need to nap if sufficient sleep has been obtained at night.

Supporting information

Infants spend most of their time sleeping, which can be up to 80% in newborns.[65] Good sleep improves cognitive,[66] physical[67] and social outcomes,[68] as well as reduces obesity and the risk of sudden infant death syndrome.[69] Adequate sleep improves family well-being and is an important predictor of maternal health.[70] Good sleep safety practices include infants sleeping supine in their own cot and in the same room as the caregivers.[71]

Recent literature supports that short sleep duration during toddlerhood is associated with greater risk of depressive symptoms and poorer temperament in later childhood.[72] Specifically, toddlers sleeping 10 hours or less per night had 1.5 times the odds of reporting high symptom scores (i.e. above 90th percentile) on the short-version Mood and Feelings Questionnaire at 8 years of age, as compared to toddlers sleeping 13–14 hours per night.[72] The symptoms reported included feelings of unhappiness, restlessness, frequent crying episodes and difficulty in concentration. Short sleep duration is also linked to obesogenic eating behaviours.[73,74]

Similarly, for preschoolers, achieving the number of recommended hours of sleep is associated with better health outcomes in terms of physical, psychological and cognitive well-being. Shorter sleep duration is associated with higher adiposity levels,[75] poorer emotional regulation,[76] more screen time,[77,78] higher risk of injuries,[79] poorer cognitive development,[80,81] increased hyperactivity-inattention,[82] reduced physical activity,[78,83] and poorer quality of life. A study by Sparano et al. on the relationship of sleep duration and blood pressure in young children (mean age of 6.1 years old) showed that children with 9 hours or less sleep had a higher prevalence of hypertension when compared to children with more than 11 hours of sleep (18.5% versus 11.6%).[84] These children were followed up prospectively for 2 years and similarly, the incidence of hypertension was highest in the former group (12.4%) and lowest in the latter group (6.0%).[84]

Although there are cultural differences in sleep duration and practices,[85] setting bedtime routines and providing a conducive sleep environment can improve sleep duration and quality.[86] A conducive sleep environment is one that is dark, quiet and of a comfortable temperature. Adaptive bedtime activities, such as storytelling or cuddling help toddlers sleep longer and have fewer parents' perceived sleep problems.[86] Consistency of this routine across weekdays and weekends reduced disruption to sleep patterns. For toddlers above 2 years and preschoolers, screen time should be avoided 1 hour before night-time sleep.[87] Screens emit blue light that suppresses endogenous melatonin production, in turn resulting in shorter sleep duration, later bedtimes and longer time to fall asleep.[88]

Diet

(A) Breastfeeding is recommended for infants. From 6 months of age, a variety of developmentally and culturally appropriate solid foods of various textures and flavours should be introduced with no added salt and sugar.

(A) A daily routine of meals consisting of appropriate portions spaced every 2–3 hours is recommended to avoid overfeeding.

(B, C) Food should not be used to soothe toddlers or be provided as a reward, and screen time should be avoided during meal times for toddlers and preschoolers.

(B) The variety of foods offered to toddlers should be progressively increased and they should wean off milk as the main source of nutrition. Healthy family meals, whole milk and water should be offered, while establishing a structured routine for meal and snack times.

(C) For preschoolers, healthy eating habits should be developed as a family, with caregivers as role models. Sugar-sweetened beverage consumption should be limited, and develop structured meal and snack times in appropriate portions to support growth and development.

(C) Preschoolers should be helped to recognise hunger and satiety cues.

Supporting information

It is recommended that infants are exclusively breastfed for at least the first 6 months of life; this provides adequate nutritional requirements and maternal antibodies to support their health, growth and development.[89] Nevertheless, medications or vitamin and mineral supplementation prescribed by the physician should continue to be provided to the breastfed infant. Mothers should adhere to food safety and hygiene recommendations, if breast milk is expressed and stored. Should human milk be unavailable, infants should be provided with formula milk. The main types of formula milk are cow's milk-based formulas (most common), soy formulas and specialised formulas (usually for infants with specific medical conditions). These types of formula milk usually contain 60–70kcal of energy per

100mL and are fortified with iron.[90] For optimal bone development, vitamin D supplementation of 400IU per day is recommended for fully and partially breastfed infants due to its low bioavailability in breast milk.[89] With increasing energy and nutrient requirements, infants should be started on complementary foods from 6 months of life, depending on their developmental readiness. Start with small amounts of solid foods and progress to recommended portions (e.g. 1–2 servings of rice or bread per day) as specified in Singapore dietary guides.[91]

Iron-rich foods should be provided to infants consuming a non-iron fortified formula, due to the risk of developing iron deficiency anaemia. These include iron-fortified cereals, pureed meat and poultry, plain tofu or legumes, with textures suited to the infant's stage of development. Salt should not be added to foods for infants as their kidneys are immature and unable to excrete excess salt, thus presenting a safety concern. Food and drink containing added sugars should be avoided, thereby reducing the risk of dental caries and a learned preference for sugar. Overconsumption of sugar-laden food has been associated with an increased risk of becoming overweight or obese.[36,92] There is no evidence that delaying the introduction of potentially allergenic food prevents food allergies.[89] Therefore, potentially allergenic foods such as dairy products, egg, wheat, crustacean shellfish, fish, soy, tree nuts and peanuts should be introduced, one at a time, as part of complementary feeding from 6 months of age once the infant is able to tolerate solid food.[93]

Guidance on responsive feeding should be provided to caregivers, so as to promote appropriate weight gain among infants.[94] Caregivers should strive to recognise hunger and satiety cues that will support responsive consumption by timely initiation and termination of the feeding process.[94] Evidence reveals that non-responsive caregiver feeding practices, such as the use of extremely controlling, restrictive, rewarding or pressure feeding, is associated with a higher risk of childhood obesity.[95]

Toddlers are reliant on caregivers to establish their feeding habits.[89,96,97] Fresh, minimally processed foods should be prepared with little or no added sugar and salt, with continual exposure and/or provision of foods across all major food groups that are in unison with healthy family eating habits. There is no clear evidence that formula milk should be continued beyond 12 months of age,[89] and pasteurised full cream milk, or fortified unsweetened soy milk, can be incorporated in the toddler's diet from 12 months of age to meet protein, calcium and vitamin D requirements, particularly when accompanied by adequate solid foods.[89,97] Sugar-sweetened beverages (e.g. juice drinks, sports drinks and regular soft drinks) and caffeinated beverages (e.g. tea, coffee and cola drinks) should not be given before 2 years of age, and should be avoided as much as possible thereafter.[89] Plain water is recommended.

A structured routine for meal and snack times for toddlers is an important component of effective responsive feeding practices, where caregivers also recognise and react to hunger and fullness cues of the toddler.[96] Moderate evidence from randomised controlled trials suggests that providing responsive feeding guidance to teach mothers to recognise and respond appropriately to children's hunger and satiety cues can lead to "normal" weight gain and/or "normal" weight status in children aged 2 years or younger, compared with children whose mothers did not receive responsive feeding guidance.[94] Picky eating is also a natural occurrence in the feeding process, and toddlers should not be pressured to consume new foods.[89,97] Instead, they should be provided with regular and frequent exposure to non-preferred foods to increase familiarity and promote acceptance. Using food to soothe toddlers is associated with poor dietary quality and increased risk of obesity in early childhood,[97] and is therefore discouraged.

Dietary habits shaped at a young age persist later into life. Positive caregiver role-modelling, regular household eating routines, coordinated family meals and regulation of appetite influence the overall quality of diets among preschoolers.[89,98] Limiting the consumption of sugar-sweetened foods and beverages (including those naturally present in honey, syrups, fruit juices and fruit juice concentrates) to no more than 10% of total energy intake lowers the risk of overweight or obesity and dental caries.[36,89,92] Consuming a nutritious breakfast with a good combination of carbohydrates, fibre and protein is strongly encouraged, as it has been associated with better diet quality and healthy body weight.[99] Structure-based or limit-setting strategies, such as serving appropriate portions, disallowing screen time during meals (to avoid overeating and learning unhealthy food habits from advertisements and programmes), and a balance of caregiver guidance versus children's autonomy, helps children to self-regulate their eating behaviours. Excessive restraint of a preschooler's food intake may unintentionally teach him or her to use food to manage negative emotions.[98]

Integration

(A, B, C) Aim to achieve most or all recommendations on physical activity, sedentary behaviour, sleep and diet for the best results.

Supporting information

The recommendations for physical activity, sedentary behaviour, sleep and eating habits are closely related in terms of health benefits and making up the 24 hours of a child's day. The greatest health benefits can be achieved by meeting all the recommendations: more physical activity, less sedentary time, longer sleep duration, healthy eating habits and positive dietary choices.[10,38,100] However, in situations where all cannot be optimised, different combinations can be considered, such as more physical activity with longer sleep duration, or less sedentary time with longer sleep duration, which can improve cognitive development and reduce risks of adiposity.[6,10] Replacing sedentary time with physical activity is associated favourably with fitness and motor development.[6,10] Healthy and sensible dietary habits promote growth, development and maintenance of a healthy weight.[32,34]

CONCLUSION

Recent evidence has shifted the international trend towards integrating physical activity, sedentary behaviour and sleep within a 24-hour period for better health outcomes in young children (i.e. infants, toddlers and preschoolers). The inclusion of diet and eating habits complements these recommendations in supporting growth and development, as well as obesity prevention. Establishing these healthy behaviours in early childhood offers them the best protection against future NCDs. However, studies have demonstrated that a significant proportion of young children in Singapore do not adopt these recommendations and show poorer health outcomes. Therefore, it is timely to introduce and promote these guidelines to young children and their caregivers to give them the best start in their lives.

As these young children may be cared for by various caregivers (e.g. parents, grandparents and teachers) and transit through different environments as they grow (e.g. home, infant care, nursery and kindergarten), there is a role for these recommendations to be adopted as daily habits in family units and also as policies in childcare and preschool centres. In conclusion, infants, toddlers, preschoolers and their caregivers are recommended to adopt all domains of these guidelines to achieve the best health outcomes. As a first step, families and schools should start by identifying a domain in their child's daily life that they can feasibly embed or modify, thereby aiming to progressively integrate all the aforementioned recommendations to confer protection against NCDs from early childhood.

Annexes

1. *Consensus Statement on Singapore Integrated 24-Hour Activity Guide for Early Childhood: Consensus Statements*
2. *Practical Reference for Activities for Early Childhood*
3. *Consensus Statement on Singapore Integrated 2 4-Hour Activity Guide for Early Childhood: Summary Guide*

About the workgroup

This document was developed by the Singapore Integrated 24-Hour Activity Guide for Early Childhood Study Workgroup, which comprised key members from the Singapore community, including members from the College of Paediatrics and Child Health of the Academy of Medicine, Singapore; Singapore Integrated Platform for Research in Advancing Metabolic Health Outcomes in Women and Children (IPRAMHO), led by KK Women's and Children's Hospital (KKH), in partnership with SingHealth Polyclinics (SHP) and the National Healthcare Group Polyclinics (NHGP); National University Hospital and Yong Loo Lin School of Medicine, National University of Singapore. The initiative is supported by the research group of IPRAMHO, a National Medical Research Council-funded joint collaborative pot centre grant of KKH, SHP and NHGP. This multidisciplinary group is initiated by Prof Lee Yung Seng, Assoc Prof Ng Kee Chong and Prof Tan Kok Hian, and chaired by Dr Benny Loo Kai Guo.

Disclaimer

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for consideration by practitioners for incorporation into their practice. It is acknowledged that management may vary and must always be responsive to the need of individual patients, resources and limitations unique to the institution or type of practice.

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Conflict of Interest

There was no conflict of interest for all authors

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