API Supporting the **UK Play** Industry

A Movement for Movement

Screen time, physical activity and sleep: a new integrated approach for children

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Author Background

Dr Aric Sigman lectures in child health education and publishes medical papers on child health and development subjects including excessive discretionary screen time and screen dependency disorders.

He was a keynote speaker on screen dependency at the International Congress of Child Neurology and the author of the medical papers ''Screen Dependency Disorders: a new challenge for child neurology' published in the *Journal of the International Child Neurology Association*, 'Virtually addicted: why general practice must now confront screen dependency', published in the *British Journal of General Practice*, 'Time for a View on Screen Time', the Leading Article published in the British Medical Journals' *Archives of Disease in Childhood* and *Child's Play: The new paediatric prescription*.

He is a peer reviewer for the medical journals *Acta Paediatrica, Preventive Medicine*, the *Nature* research journal *Pediatric Research* and the author of five books on child health and development-related topics, including *Getting Physical*, which won The Times Educational Supplement's Information Book Award. His biology paper on body image was the '2012 Scientific Article' for the 2012 Edexcel Biology A-level exam paper. Dr Sigman has twice been invited to address the European Parliament Working Group on the Quality of Childhood in the EU in Brussels, once on reducing alcohol misuse among children and adolescents, and again on the impact of electronic media and screen dependency. The EU Working Group published his reports on both of these subjects. Dr Sigman is a member of the All-Party Parliamentary Group on a Fit and Healthy Childhood serving as a contributing author to the chapter on screen time, social media and mental health in their recent report *Mental Health in Childhood*.

He is a Fellow of the Royal Society of Biology, an Associate Fellow of the British Psychological Society, and a Chartered Scientist awarded by the Science Council. Dr Sigman travels abroad frequently to observe child development in various cultures, often volunteer teaching. Countries include North Korea, Turkmenistan, Republic of Congo, Bhutan, Mali, Borneo, Tonga, Myanmar (Burma), Irian Jaya (West Papua), Laos, Iran, Vietnam, Bolivia, Burkina Faso, Far Eastern Siberia, Sumatra, South Korea, Cambodia, Chile, Philippines, Jordan, Mongolia, Japan, China and India.

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Introduction

By the time they finish primary school many children have the highest levels of body fat on record. Rates of child Type 2 diabetes and mental illness are also the highest in our history. Children now sleep less and have the highest level of admissions to NHS hospitals for sleep disorders. At the same time British children are spending the highest ever amount of their discretionary time in front of screens, and young children have never moved so little.

There is growing evidence that these contemporary observations are not entirely unrelated. Increasingly, interrelationships are being identified between physical activity (PA), free play, sedentary behaviour, discretionary screen time (DST), sleep, mental illness, body fat and type 2 diabetes, with some being *bidirectional* (working both ways).

Yet these health issues are often presented as separate lifestyle factors, with separate bodies of evidence and debates surrounding each one.

The evidence presented in this report points to an urgent need to reconceptualise these behaviours not as separate components but as inextricably linked, joint 24-hour movement behaviours. Parents and local and national policy-makers must now work in tandem to ensure that all of the elements of children's movement behaviours are considered together, rather than being seen as the responsibility of separate government departments and initiatives. This requires a far more muscular and visible public health approach, which may entail telling the public not what they're interested in hearing but what is in their children's best interests.

This report addresses in particular the relationship between an increasingly screen-based, sedentary, reduced-sleep lifestyle and declining outdoor physical activity, and the implications for children's physical and mental health outcomes. Although this is a complex relationship involving other lifestyle factors such as diet, it is an important yet under recognised relationship of growing concern to child health professionals.

(PHE 2018a; Candler et al 2018; Children's Commissioner, 2017; NHS Digital 2018; Patalay & Fitzsimons 2017; Ofcom 2017; Childwise 2018; PHE 2018b; Reilly 2015; Tremblay et al 2016b; Dolezal et al 2017; Broussard et al 2016; Al-Abri et al 2017; Skullin et al 2018; Lyall et al 2018; Roberts et al 2014; WHO 2018b)

Executive Summary

- British children have high levels of body fat, Type 2 diabetes, mental illness, sleep deprivation and sedentary behaviour.
- Interrelationships between physical activity, free play, sedentary behaviour, discretionary screen time (DST), sleep, mental illness, body fat and Type 2 diabetes are being increasingly identified with some being bidirectional -working both ways.
- Scientists increasingly refer to a combination or 'cocktail' of movement behaviours associated with desirable indicators of health. There is an emerging view that children's behaviours, both active and inactive, occur along a 'movement continuum' (i.e., physical activity, sedentary behaviour, DST, sleep).
- Being insufficiently physically active is not the same health risk as being too sedentary - scientists now believe that each have their own distinct health consequences: a child may engage in an acceptable level of physical activity but at the same time spend an inordinate amount of time sitting.
- All sedentary behaviours are not equal. There may be some physiological and psychological differences between different types of sedentary behaviours including DST and even between different types of DST.

- British children are part of a global pandemic of low physical activity, having very poor levels in international terms. More than 90% of British children aged 2-4 years now fail to meet even the bare minimum recommendations.
- Children are 2 – 3 times more physically active when outdoors than when indoors: they move more, sit less and play for longer. Some research has found that unstructured/'free' play can burn more calories than school and sports programs combined.
- Outdoor play is associated with better social skills in preschool children, and those aged 7 -14 spending more time outdoors are found to be less likely to have peer relationship problems and have better psychosocial health.

» Playgrounds can fulfil a unique role in improving children's levels of physical activity, social interaction, fitness and physical and mental health.

» There appears to have been a 'rapid and dramatic' change from outdoor to indoor time, with children playing outdoors far less than previous generations.

» Previous explanations for a decline in outdoor play and playground use focussed on the *disincentives*, e.g. parental concerns about children going out. Research is now focussing on the *incentives* and inducements for children to remain indoors. Specifically, 'the new human tendency to focus on sedentary activities involving electronic media.'

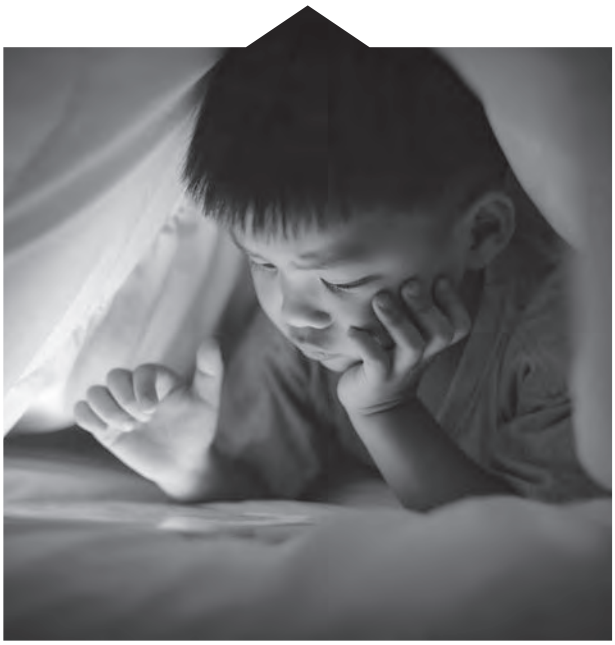
» Many health professionals now think that active play, especially in the outdoors, seems to be increasingly replaced by use of electronic screens for entertainment, and consider there to be 'a serious and widespread problem of excess screen viewing'.

» Children's discretionary screen time (DST) has risen by over 50% in less than a decade and appears to be high by any measure as British children adopt a screen-based lifestyle and at far younger ages than before.

» An average young adolescent using screen devices will spend seventy-six 24-hour days a year on DST. By the age of 8, the average child will have spent nearly one full year of 24-hour days.

» DST and child wellbeing is often misrepresented as an ongoing 'hotly debated' cultural issue reflecting a clash between generations. However, the *disproportionate* use of screens, and screen dependency disorders, are now recognised as formal public health issues by organisations ranging from the World Health Organisation to Public Health England, NICE and the NHS.

- Elevated levels of children's DST are increasingly associated with negative cardiometabolic, psychosocial and other medical outcomes, often exhibiting a dose-response relationship with health and development outcomes ranging from increased body fat, clinical depression, body dissatisfaction and eating pathologies to screen dependency disorders and ADHD. While some of these associations may be the result of what excessive DST is displacing, other associations may be more directly related to excessive DST or a combination of both displacement and excessive exposure.
- Children now sleep less and have the highest level of admissions to NHS hospitals for sleep disorders. Evening exposure to screen technology such as smartphones and tablets is consistently cited as a prominent cause.



- Sleep deprivation and subsequent fatigue may lead to less physical activity and outdoor play. Conversely, physical activity/outdoor play may result in better quality sleep. Sleep deprivation causes increased levels of a hunger hormone called ghrelin and decreased levels of a satiety/fullness hormone called leptin, which could lead to overeating and increased body fat. Sleep deprivation is associated with increased risk of Type 2 diabetes. Sleep deprivation and body clock disruption are now being cited as potential causes of some cases of mental illness through the alteration of neurological functioning. Sleep deprivation is linked with lower school performance while a good night's sleep is linked with higher school performance.
- Physical activity is increasingly found to benefit mental health and there is also strong evidence for an association between elevated DST and depressive symptoms.
- A key obstacle to redressing the imbalance between outdoor play and DST has been the enormous disparity in financial, marketing, lobbying and promotional resources available to the play-related industries when compared to the screen entertainment industries. In the last year alone, the international computer game industry earned approximately 500 times more money than the British playground industry.

- At a time when a high proportion of British parents report that they feel isolated, playgrounds can afford additional benefits, serving as 'mini communities', helping parents to feel less isolated and more supported and connected.
- Screen habits and physical activity habits are cultivated early in a child's life and last for decades and probably for life. Shaping them in a positive direction from an early stage is therefore imperative.
- A variety of recommendations are presented addressing families, schools, local and national policy-makers. Reducing children's DST and increasing the provision and use of accessible playgrounds and play areas must occur in a wider context of public health education: an understanding of *how* and *why* these screen time and physical activity behaviours should be integrated into children's lives from an early age and on a regular basis. Health professionals now advocate early interventions to ensure this happens.
- It is imperative that parents create the time and opportunity - including their own role modelling - for children to develop healthy movement behaviours and media habits in tandem from an early age. Parents must be authoritative and guide their children to a healthy lifestyle.

Children's 24-Hour Circle Of Life

Children's 24-Hour Circle Of Life

The State of [Non] Play

Health professionals increasingly refer to a '**global pandemic of physical inactivity**'. International collaborative research by 40 scientists comparing levels of children's physical activity (PA) in 38 countries representing 60% of the world's population placed **England, Scotland and Wales among the worst**. Countries were issued a 'Report Card' measuring their children's level of physical activity. England and Wales were both scored D minus, while Scotland was joint worst, with a grade of F for child 'Overall Physical Activity'.

(Reilly 2015; Reis et al 2016; Wang et al 2016; Tremblay et al 2016a)

Public Health England reports that more than 90% of children aged 2-4 years now fail to meet even the bare minimum recommendations for daily physical activity.

(PHE 2018b)

Children Move More When They Are Outside

With the above in mind, many researchers point to consistent evidence that '**when children are outside they move more, sit less and play longer**'. This is particularly true for younger children.

(Tremblay et al 2015; Wilkie et al 2018; Larouche et al 2016, 2017; Hinkley et al 2018)

A study of over 1000 children in England concluded '**that physical activity was 2-3 fold higher outdoors than when indoors**'. (Cooper et al 2010) A study of children in Scotland similarly observed that 'unstructured outdoor leisure time was associated with an increase in total daily moderate to vigorous physical activity (MVPA) almost twice that of unstructured indoor leisure time'.

(Pearce et al 2018)

A nation-wide study of Canadian children aged 7 – 14 found that children who '**spent more time outdoors are more physically active and less sedentary, and display enhanced psychosocial health, compared with those who spend less time outdoors.**'

(Larouche et al 2016, 2017)

Although PA is associated with a reduction in risk for cardiovascular and Type 2 diabetes, recent meta-analyses have found growing evidence that structured PA programs may have little impact on children's overall PA or body mass index. For example, in '**Active Play as a Strategy for Preventing Childhood Obesity**', Janssen (2015) concluded '…physical activity interventions with child populations have had a small effect on their total physical activity … and have not been associated with changes in body mass index'. An article in the *Canadian Medical Association Journal* pointed out that 'Unstructured play can burn more calories than school and sports programs combined'. (Vogel 2015) Although unstructured playtime isn't particularly intense, it's the sheer *volume* of physical movement that appears to be advantageous.

There are also other potential benefits of outdoor play emerging. For example, a recent study of 575 mothers of children 2 – 5 yrs found that '**television/DVD/video viewing may be adversely, and outdoor play favourably, associated with preschool children's social skills**'. The researchers suggest that as play and physical activity provide opportunities for social interaction, specifically conversation, cooperation and management of conflict, children may learn important social skills through their everyday play and activities. '**Conversely, participation in screen time, especially passive forms, may limit children's opportunities to interact with others. Indeed, parent-child interaction has been shown to decrease in the presence of background television**.' An additional effect may be that because excessive or night time discretionary screen time has been strongly linked to sleep deprivation, '**children who watch more television, may sleep less, or have poorer quality sleep, which may subsequently reduce their ability to be calm, disrupting their capacity to be compliant and behave appropriately in social situations**.' (Hinkley et al 2018)

Interestingly, the Canadian study above of 7 – 14 year olds concluded that '**Children who spent more time outdoors were less likely to have peer relationship problems and had better psychosocial health**.' (Larouche 2016)

Playgrounds Can Improve Children's Health & Wellbeing

Playgrounds Can Improve Children's Health & Wellbeing

Playgrounds can fulfil a unique role in improving children's PA, social interaction, fitness and physical and mental health. For example, a new European study of 4 – 12 yr olds concluded that physical and social environmental factors determine children's physical activity and outdoor play hence 'playgrounds are important requirements for being physically active.'

Playgrounds were also found to 'constitute important settings for children to play, experience and interact with their social and physical environment, recognise and test their own abilities, and develop social, physical, and motoric skills.' The researchers reinforced another aspect in that playgrounds 'facilitate positive experiences' such as fun, self-efficacy, social interaction, creativity, and physical ability and may contribute to 'increased levels of energy expenditure in children.... In summary, playgrounds seem to be places for boys and girls to be physically active and to interact with other children ... they could benefit with respect to their ... health outcomes.' (Reimers et al 2018):

In a new study on the link between outdoor play and 'internalized mental health symptoms' among 29,784 students aged 11–15 years, researchers found that even spending on average more than 30 minutes a week outdoors was associated with a 24% lower rate of 'high psychosomatic symptoms'
(Piccininni et al 2018)

Even among senior school teenage girls a new study tracking the girls' whereabouts with GPS monitoring and measuring their degree of physical activity by having them wear an accelerometer for six days at two time points, one year apart, has found that on days that they visited parks including playground areas, their level of MVPA was higher than on days when they did not visit parks. The researchers concluded 'parks were an under-used resource for adolescent girls, particularly for MVPA.'
(Evenson et al 2018)

NICE (2018) recently reported that only 23% of boys and 20% of girls aged 5 to 15, and only 10% of boys and 9% of girls aged 2 to 4 met the UK Chief Medical Officer's guidelines on physical activity. They noted that 'the environment can influence people's ability to be active', emphasising the importance of 'school playgrounds' in changing children's low PA levels.

Less Outdoor Play

Children are not only less physically active than they should be, they are also simply outdoors for less time.

The Office for National Statistics recently reported that for 8 – 15 yr olds '**the average amount of leisure time children spent in parks, countryside, seaside, beach or coastal locations was 16 minutes per day**.' However, by the time they reach age 14 this falls to 10 minutes per day. The ONS also found that children's 'participation rates' for any outdoor activities also declined almost half by the time they reach age 14 yrs. (ONS 2018)

The Department for Environment Food and Rural Affairs (DEFRA) has reported that '**12% of children (c 1.3 million) never visited the natural environment in the previous year**'. However, for those children that did venture outdoors, local natural environments were important to all groups studied regardless of ethnicity or socioeconomic status: '**in an average month, nearly half of all children visited local urban parks (48%/4.9m)**.' (Hunt et al 2016)

The above findings are part of an international trend reinforced by other British surveys. A study by the National Trust's Wild Network (2016) reported that children's time spent playing outdoors has shrunk dramatically – a fifth of children didn't play out at all on an average day. A previous study by the National Trust (2012) noted a 'rapid and dramatic' change from outdoor to indoor time, with children playing outdoors far less than previous generations.

Are screens replacing outdoor play in playgrounds?

Attempts to explain why physical activity and outdoor play including playground use has declined, have focused on the *disincentives* e.g. parental fears about 'stranger danger', traffic risks to children crossing roads, bad weather in Britain's northern latitudes, lack of places to play/playgrounds etc. However, attention is now turning to what is lurking inside the home - the *incentives* and inducements for children to remain indoors.

A decade ago biologists reporting in the *Proceedings of the National Academy of Sciences* identified 'Evidence for a fundamental and pervasive shift away from nature-based recreation …The root cause may be videophilia' which they defined as 'the new human tendency to focus on sedentary activities involving electronic media.' The scientists published an additional paper on '**Videophilia: Implications for Childhood Development**'. Biologists have more recently revisited this issue concluding that over the last 25 years, the US has experienced 'a pervasive decline in the popularity of nature-based recreation … closely correlated to videophilia', which they found applies to Japan as well. (Pergams & Zaradic 2008; Zaradic & Pergams 2007; Zaradic & Pergams 2013)

In the last decade screen technology has changed unrecognisably and the trends and concerns they identified have developed apace. Many studies and reports addressing children's lack of outdoor play now routinely cite excessive DST as a likely contributor.

The recent Children's Commissioner's report on the decline in children playing outdoors stated 'the screen can seem an irresistible way of occupying children – able to absorb

them for hours on end in the complete safety of the home. Many children told us how they expected to spend most of the summer online playing games, while others said that they would be online chatting to their friends. We know that there are serious consequences of this increasingly sedentary childhood. … How can we prevent it [playing outside] from being transformed simply into screen time, with children connecting and engaging with others only online, without the need for physical activity? (Children's Commissioner 2018)

A Norwegian study involving the UK Forestry Commission entitled 'Why do children not play in nearby nature?' studied 3160 parents of children aged 6–12 years. The researchers identified '**barriers for children's engagement with nearby nature**' noting that both the proportion of children using digital media and the amount of time they spend on it 'has increased in the last decade, and this use increases with age'. They concluded that 'the shift of media practices has undoubtedly contributed to the fact that outdoor spaces have lost much of their appeal as attractive playscapes for children and young people'. Parents in the study reported 'the child uses so much time on data and other screens that to be outside is downgraded' another reason cited was 'the child prefers being indoors'. (Skar et al 2016)

In explaining the exceptionally low physical activity grades for children's physical activity in Britain and elsewhere, the Global Matrix scientists above conclude '**Active play, especially in the outdoors, seems to be increasingly replaced by use of electronic screens for entertainment, used almost always indoors … these grades identify a serious and widespread problem of excess screen viewing**'. They believe that 'fewer attractive sedentary pursuits', in particular discretionary screen time, 'may facilitate higher levels of physical activity.' (Tremblay et al 2016a)

Research examining DST and PA and play - both indoors and outdoors - is generally finding some relationship. For example, a study of 6176 British 10 -16 year olds concluded that 'Screen time is significantly and negatively associated with PA in British youth. Screen time may displace active pursuits out of school but is also associated with lower PA during school. **Daily screen time should be limited**' (Sandercock et al 2012)

Another study of 10 – 15 yr olds concluded 'English youth have high levels of sedentary time, low levels of PA and there is a high prevalence of low cardiovascular fitness. Using social media was associated with higher sedentary time in both sexes and low fitness in girls. Boys who owned game consoles were 5 times more likely to have high amounts of sedentary time. Boys who owned digital/satellite TV receivers were almost twice as likely to have low fitness. The authors added that '**reducing social media use in youth offers one potential target for intervention**.' (Sandercock et al 2016)

A new British study of children 9 – 11 yrs old finds that 'prolonged recreational computer use has a negative association with children's outdoor time after school.' Children who had a television in their bedroom were more than twice as likely and children with a non-handheld video game player (e.g., PlayStation, Xbox etc.) in their bedroom were almost twice as likely, to spend less than an hour outside after school. (Wilke et al 2018)

The above scenario is being observed in many different parts of the world. A study of indoor and outdoor physical activity in 5,859 9 - 11 year old children in twelve socioeconomically diverse countries reported that 'children with at least one piece of bedroom electronic media had lower MVPA than those who did not.' (Harrington et al 2016)

The recurring relationship between excessive DST and reduced outdoor PA has also not gone unnoticed by the World Health Organization's Commission on Ending Childhood Obesity which recently concluded that 'the increasingly urbanized and digitalized world offers fewer opportunities for physical activity through healthy play.' (WHO 2017a)

Screen dependency disorders and reduced outdoor play

The World Health Organisation's *International Classification of Diseases* 11th Revision (ICD-11), has recently added '**gaming disorder**' to its list of diseases.

It should be noted that children with a screen dependency disorder such as gaming disorder often spend many additional hours playing games, thereby incurring a deficiency in physical activity. Diagnostic characteristics include an increased priority given to gaming to the point that gaming takes precedence over other interests and daily activities, and this is likely to mean they spend more time being sedentary indoors than children without a screen dependency disorder.

(WHO 2018; Sigman 2017, 2014)

Although the evidence for increased DST displacing or causing a decline in outdoor play is predominantly correlational, it could be argued that although correlation is not causation, as the Yale statistician Edward Tufte states 'it sure is a hint'. The relationship between DST, PA, sedentary behaviour and health is complex and nuanced. Never the less, excessive DST continues to remain implicated in lower levels of PA and outdoor activity and as such has been a focus for government health departments and medical bodies across the world.

Public Health England recently stated 'We are the first generation to need to make a conscious decision to build physical activity into our daily lives. Technology dominates … Societal changes have designed physical activity out of our lives. (PHE 2018c) And in addressing sedentary behaviours, the NHS (2016) advises:

- agree a family limit to screen time per day
- make bedrooms a TV- and computer-free zone
- set "no screen time" rules to encourage kids to be active

It isn't simply a matter of 'cutting screen time = increased outdoor physical activity' but at a sheer arithmetic level there are only so many waking hours in a child's day and an increasing number of those discretionary hours are spent looking at screens, adding to sedentary behaviour and possibly displacing outdoor PA.

Discretionary Screen Time (DST)

Accurately estimating child DST is difficult, as different surveys use different methods. Furthermore, media devices are evolving rapidly, becoming more versatile, portable and mobile, resulting in changing consumption patterns and levels. And so nowadays children can remain less active or highly sedentary outdoors as the result of using media devices outside. (Larouche et al 2017)

While most device time especially in younger children appears to be for non-homework use, there is some overlap. However, child DST appears to be high by any measure as British children adopt a screen-based lifestyle. It is important to emphasise it is the *disproportionate* amount of time, the overuse or misuse that is a medical issue, not DST per say. Beyond potential effects of excessive DST there is the potential for the effect of *displacing* vital activities for child health and development.

In order to provide a conservative estimate of current DST for children aged 5 – 15 years, a number of studies were evaluated, in particular Ofcom's 'children's media use' (2017), the Childwise Monitor Report (2018) and a conservative average estimate calculated at approximately 5 hours per day. For teenagers it's higher, for younger children, it's lower.

This suggests that there has been a 51% increase in child DST in less than a decade when comparing data from the Office of Communications (Ofcom) on children's 'media consumption' 2008 with their latest report (2017), in children 5 – 15 yrs who are using screen devices (Internet, gaming, TV, mobile). [Figure 1]

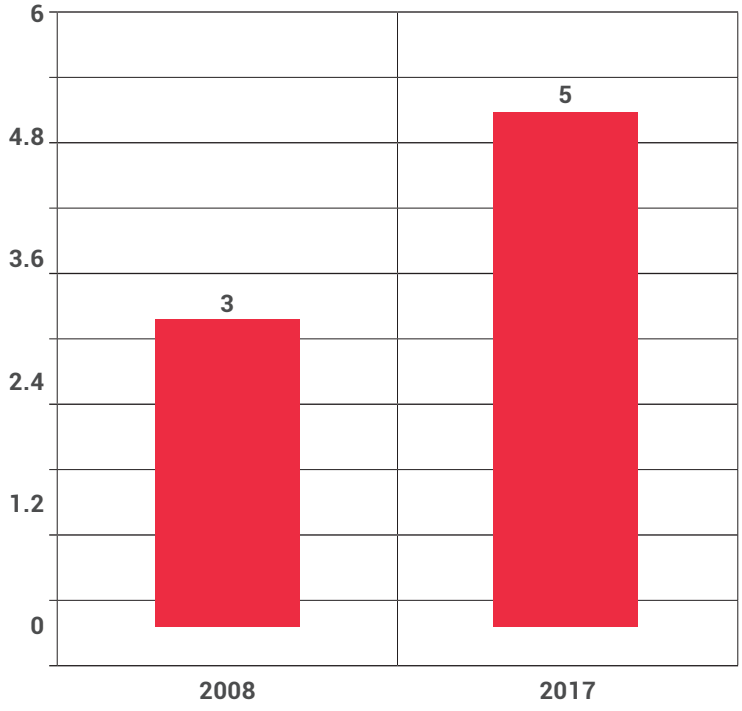
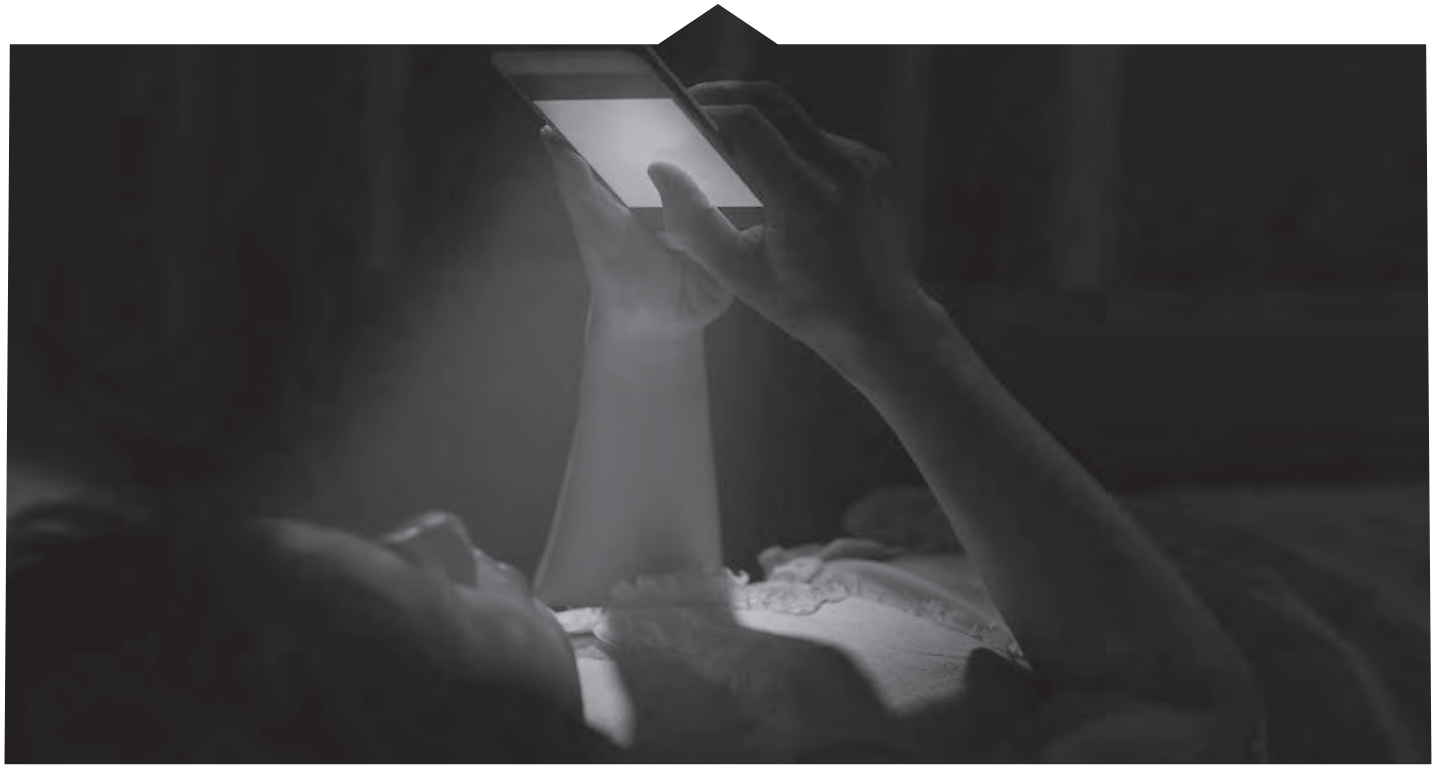


Figure1: A 51% rise in discretionary screen time among children 5 – 15 yrs who are using screen devices (Internet, gaming, TV, mobile). (Ofcom 2008, 2017)

Children's mental and physical health and related neurological development is influenced by their experiences, lack of experiences and environments. Today, discretionary (non-homework) screen time is the single main experience and environment of children, rising dramatically in recent years (Childwise 2015):

- Recent studies report discretionary screen time (DST) in children aged under two as '**high and appears to increase steadily across age groups**' (Goh et al 2016)
- There are now more **3-4 year-olds with their own connected screen device**, than there are without (54%). (Childwise 2018b)
- The latest data from the Office of Communications (Ofcom 2017) finds that more than a fifth of 3-4 year olds own their own tablet, and in terms of media use they report '**53% go online, for nearly 8h a week**' and '48% use YouTube'.
- **By age five, 73 per cent of children own a computer** (laptop, tablet/netbook, desktop) (Childwise 2018a)
- The Office for National Statistics (2017) **found a significant increase** in the proportion of 16-24 year old's 'leisure time spent using a device' calculated at 6 hours per day.
- At the other end of the youth spectrum, according to Ofcom, the average UK 16–24-year-old is now '**spending more time on media and communications than on sleeping**'. (Ofcom 2016)



At standard UK levels an average young adolescent using screen devices (Internet, gaming, TV, mobile) will spend seventy-six 24-hour days a year on DST. By the age of 8, the average child will have spent nearly *one full year* of 24-hour days on DST. By the time they reach 18, this has risen to 3 years and, by the age of 80, would account for 18 years of their lives.

In the media, the association between DST and child wellbeing is often misrepresented as an ongoing 'hotly debated' *cultural* issue reflecting a clash between generations – between internet-savvy youth and their technologically phobic elders. However, this is certainly not the case among the world's health professionals:

Medical Positions on DST and Health

While there is a current national concern over social media, health professionals are also concerned about the sheer *amount* of all discretionary screen *time* and the time of night that DST is taking place. DST is now considered a form of consumption often referred to by medical researchers as a 'dose', and overconsumption or misuse may pose risks to child health. All calories are not equal, with those calories derived from 'junk food' considered to be very different to those calories derived from 'healthy' food sources. Still, excessive calorie consumption is not considered good for health. Similarly, all types of screen time are not of equal risk/value yet high levels of consumption are not considered to be good for child health and development.

DST and screen dependency disorders (SDD) such as Gaming Disorder and Internet Addiction have become a formal public health issue. Elevated levels of children's DST are increasingly associated with negative cardiometabolic, psychosocial and other medical outcomes, often exhibiting a dose-response relationship with health and development outcomes ranging from increased body fat, clinical depression, body dissatisfaction and eating pathologies to screen dependency disorders and ADHD (World Health Organisation 2017; Nightingale, et al 2017; Howie et al 2017; Simonato et al 2018; Sigman 2012, 2017; Ra et al 2018).

A recent **World Health Organisation** study of adolescent health across 42 European countries warned of 'the detrimental associations between screen time and cardiometabolic health', concluding public health action is needed to implement interventions to reduce screen-time behaviours in young people on an international scale... These trends are alarming ... strategies to reduce screen-time-related behaviours ... are of high priority.' (WHO 2017) The global World Health Organisation report on 'Public Health Implications

of Excessive Use of the Internet,Computers, Smartphones and Similar Electronic Devices' concludes that excessive DST is a 'public health problem' and emphasises the need 'to implement interventions. Countries that are yet to experience public health concerns should be alerted of the public health risks involved … Conclusions … The observed and documented negative health and psychosocial consequences'

The **Chief Medical Officer**, in her *Annual Report: Our Children Deserve Better: Prevention Pays* states: 'Evidence suggests that extended screen time per day has an effect on health which is **independent of the sedentary aspect** … Mechanisms to reduce this effect include **age-specific maximum times set by parents**.' (CMO 2013)

Public Health England (2018c) states 'Everyone should be encouraged to reduce the amount of sedentary time by: reducing time spent watching TV, using a computer or playing video games'.

The **NICE** (2017) guidelines 'Preventing excess weight gain' recommend 'any strategy that reduces TV viewing and other leisure screen time'.

The **US Department of Health** has issued 'recommended limits for screen time' as one of its national 'health improvement priorities' and a key 'disease prevention objective': 'children aged 0 to 2 years …no television, videos or play video games' children aged 2-17 years 'outside of school (for nonschool work) for no more than 2 hours a day' (USD 2018)

The **American Academy of Pediatrics** (AAP) has advised a further 50 per cent reduction in the Academy's previous recommended screen limits to 1 hour per day for 2 – 5 year olds, 'a time of critical brain development'. (AAP 2016)

The **Royal College of Paediatric and Child Health** found that 'there is moderately-strong evidence that higher television screen-time is associated with greater adiposity [body fat] and at all ages… There is moderate evidence of an association between screen-time and higher energy intake and less healthy diet quality…There is moderately-strong evidence for an association between screen time and depressive symptoms.' (RCPCH, 2018)

The **World Health Organisation's** *International Classification of Diseases* 11th Revision (ICD-11), has recently added computer 'gaming disorder' to its official list of diseases. (WHO 2018)

DST and Sleep

Children now sleep less and have the highest level of admissions to NHS hospitals for sleep disorders. (Matricciani et al 2012; BBC News 2017)

Evening exposure to screen technology such as smartphones and tablets is consistently cited as a prominent cause.(Green et al 2017; Van der Maren et al 2018) Sleep deprivation and subsequent fatigue may leave children less inclined to engage in physical activity and outdoor play. Conversely, physical activity/outdoor play may result in better quality sleep.(Dolezal et al 2017) Sleep deprivation causes increased levels of a hunger hormone called ghrelin and decreased levels of a satiety/fullness hormone called leptin, which could lead to overeating and body fat. (Broussard et al 2016) Sleep deprivation has been associated with increased risk of Type 2 diabetes. (Al- Abri et al 2017) Sleep deprivation and body clock disruption are now being cited as potential causes of some cases of mental illness through the alteration of neurological functioning. (Lyall et al 2018; Roberts et al 2014) Sleep deprivation is linked with lower school performance, while a good night's sleep is linked with higher school performance. (Skullin et al 2018)

Drivers of high DST and low PA

Twelve years have elapsed since paediatric researchers writing in the American Medical Association's *Archives of Pediatric and Adolescent Medicine* noted: 'To be sure, there has been some lack of political will to take on the enormously powerful and influential entertainment industry ... [Screen] media need to be recognised as a major public health issue' (Christakis & Zimmerman 2006).

Revenue earned this year by the international computer game industry is estimated to be nearly £100 billion, more than double that of the international film industry (Newzoo 2017).

By comparison, revenue for the British playground industry in 2017 was valued at approximately £194 million (FSPA 2018).

Last year, the international computer game industry earned approximately 500 times more money than the British playground industry. (Figure 2)

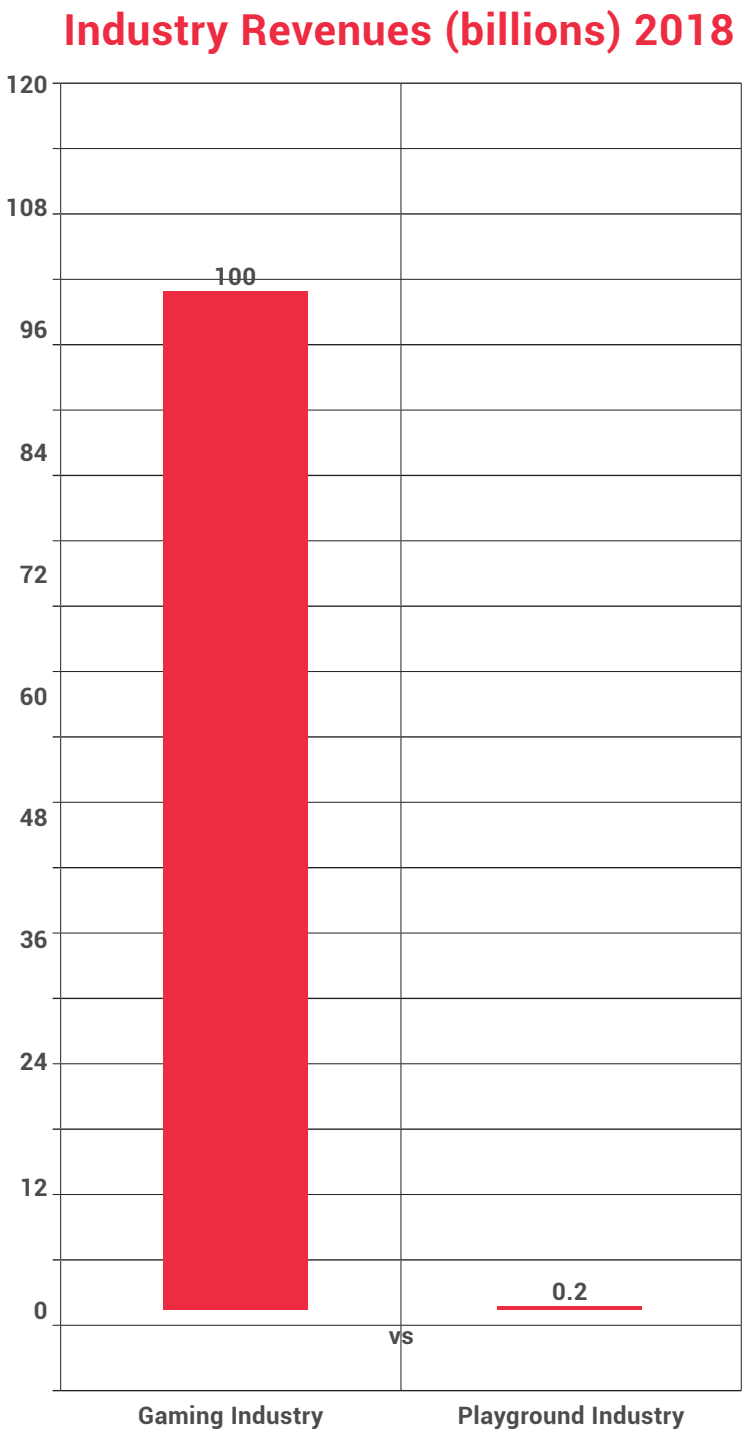


Figure2: Annual revenue earned by international computer game industry compared to UK playground industry.

One of the recommendations of a recent report by the All-Party Parliamentary Group on a Fit and Healthy Childhood was 'Policy makers to familiarise themselves with the influence of the technology industry in lobbying, funding research and influencing media depiction of Discretionary Screen Time (DST) and Screen Dependency Disorders (SDD) and be vigilant in detecting and publicising conflicts of interest. (APPG 2018) As the screen marketing ethos suggests, 'the money's where the eyeballs are' – looking at screens. Meanwhile physical activity, playground use and sleep have little lobbying and marketing influence.

Media about Media

People are informed about children's DST, screen dependency disorders and health primarily through mainstream media, social media and blogs.

In understanding the relationship between alcohol consumption, cancers and liver disease, most people would correctly assume that the health section of a newspaper as opposed to the wine tasting section would be the more impartial place to be informed. Yet, the topic of DST and child health can appear in the news, general feature, health, family, technology or science sections of a newspaper. In some cases, there will be an editor of science and technology covering the launch of new screen technology products, along with child health and development stories in the same section at the same time, often accompanied by adverts for screen technology products and services.

In addition, when covering a story about children's DST, SDD and health, the media has elevated the prominence of technology advocates and non-representative commentators, positioning them as arbiters of child well-being, thereby providing an interesting supposed ongoing 'debate' about 'screen time: is it good or bad for our kids?'. Observing that digital technologies are a necessary part of children's lives, offering intellectual and social benefits, it is proposed by such commentators that therefore advising a reduction in excessive DST may render children left behind in the digital revolution thus preventing them from developing their full potential.

Such commentators often then go on to claim that for the established health organisations and paediatric specialists to recommend a sensible reduction in children's current levels of DST 'demonizes screens', is 'divisive and scaremongering', inciting 'moral panic' amongst parents and society. They believe that instead, it is the quality - the *content* and *context* - of screen use that may have a much greater impact than sheer quantity alone. Such statements constitute a fictitious dichotomy not shared by public health and paediatric bodies, of quality *versus* quantity of DST, who assume both are important. Excessive amounts matter and it has always been the case that medical guidelines on DST merely address the premature use (infants), overuse and misuse of predominantly recreational screen time, *not* screen use in schools or special education and most certainly do not ignore any potential benefits. And so contrived notions of children suffering from screen deprivation are a manufactured concern.

To be clear, beyond media hyperbole, it is worth considering that neither the World Health Organisation, nor any government or medical body has recommended limiting children's outdoor activity time, quite the contrary. Moreover, most recommend reducing and limiting children's discretionary screen time. It appears there is little to be lost by children having less DST but a possibly great deal to be lost by continuing to consume as much as they currently do.

The Precautionary Principle

When it comes to policy-making and guidance on child health the established position remains 'an ounce of prevention is worth a pound of cure'.

The World Health Organization considers the *precautionary principle* 'a guiding principle … for WHO and everyone engaged in public health.' Child screen time is obviously a heterogeneous, complex, multifactorial lifestyle behaviour. Unlike sugar, salt, alcohol, pharmaceuticals, tobacco or ultraviolet light, screen-based activities do not involve exposure to physical substances or forces. Producing definitive 'proof of causation' in the many domains of study from neurobiology to psychiatry will be a long time coming. However, as WHO makes absolutely clear there are times in public health when that luxury is not yet available and the accepted practice is to merely err on the side of caution and recommend restraint and moderation:

'The precautionary principle is occasionally portrayed as contradicting the tenets of sound science and as being inconsistent with the norms of "evidence-based" decision-making … these critiques are often based on a misunderstanding of science and the precautionary principle … there is no contradiction between pursuing scientific progress and taking precautionary action.' (WHO 2004)

Sedentary vs Physically Inactive

In understanding the relationship between children's DST, PA and their health and development outcomes, it is important to point out that being insufficiently physically active is not the same thing as being sedentary. While neither in excess is considered healthy, the biological consequences leading to bad health appear to be different.

Being 'physically inactive' means not doing enough physical activity (in other words, not meeting the physical activity guidelines). However, being 'sedentary' means sitting or lying down for long periods during waking hours entailing low energy expenditure. Scientists now believe that each have their own distinct health consequences, and need to be addressed separately. (ADH 2017; Lynch et al 2010; Biddel et al 2018) And so it's possible for a child to engage in an acceptable level of MVPA but at the same time spend an inordinate amount of time sitting.

All Sedentary Behaviours Are Not Equal

The Chief Medical Officer, in her *Annual Report: Our Children Deserve Better: Prevention Pays* states: 'Evidence suggests that extended screen time per day has an effect on health which is **independent of the sedentary aspect**' (CMO 2013)

There may be some physiological and psychological differences between different types of sedentary behaviours including DST and even between different types of DST.

For example, a recent study 'Violent video game effects on salivary cortisol, arousal, and aggressive thoughts in children' found that compared to an equally exciting video game, the violent game 'may activate the sympathetic nervous system and elicit a fight or flight type response in children … increased cortisol [stress hormone] and (for boys) cardiovascular arousal more'. (Gentile et al 2017) In young adults another study found that compared to playing nonviolent video games, 'violent video gamers consumed more energy[calories], sweet foods and saturated fat.' (Siervo et al 2018) A previous study found that adolescents while playing *Grand Theft Auto* ate more chocolate compared to those playing a nonviolent game. (Gabbiadini et al 2013)

TV is the most well researched DST. The RCPCH (2018) recently stated '**There is moderately-strong evidence that higher television screen-time is associated with greater adiposity [body fat] and at all ages**'. Child TV viewing has been found to exhibit what is referred to as a 'dose-response relationship' with child body fat ('adiposity') - the higher the average DST the higher the body fat. British and Australian researchers recently concluded '**there does seem to be a moderate dose response effect for TV viewing and adiposity in youth**.' They emphasised that the relationship is complex and pointed out that there may be several factors at play. Screen time, is associated with a higher consumption

of energy-dense snack foods and sugar-sweetened drinks and lower consumption of fruit and vegetables. While adverts may account for some of this, screen viewing may cause distraction resulting in a lack of awareness of actual food consumption or overlooking food cues, which may lead to overconsumption of high calorie foods.' They concluded that 'there is little dispute that associations and effects for screen time (but not total sedentary behaviour')' on body fat in children 'are significant but small. … small effects on adiposity across a large population may have significant public health effects.' (Biddel et al 2018)

In any event, **children today are both physically inactive and more sedentary** therefore interventions to make children "sit less and move more", particularly light intensity activities and/or breaking-up sedentary time are a simple way to reduce health and development risks.

Playgrounds are important for children's and *parents'* health & wellbeing

Research published in the journal *Evolutionary Psychology* provides long-term evidence that opportunities for free play during childhood provide life-long benefits.

Evaluating developmental and 'social success' in adults up to age 90, the study,' Evolutionary Advantages of Free Play During Childhood' reported 'results show that the opportunity for free play in childhood significantly predicts both social success and individual adaptability [in adulthood] … juveniles not only deserve, but in fact need, their childhood and youth in general and possibilities of free, unguided, and unrestricted play in particular. (Greve & Thomsen 2016)

Beyond the long term health and development benefits for children, playgrounds often serve as mini-communities. For families who go to playgrounds on a regular basis and see one another regularly, an ambient degree of social interaction, common experience and support may inadvertently develop in a safe, geographically defined environment.

British research has found more than two-thirds of parents 'feel 'cut off' from friends and family since having children.' (AFC 2017) Playgrounds may help parents to feel less isolated and more supported and connected while their children benefit from the free play and PA derived from being in the playground.

Lazy for Life?

Media habits and physical activity are two health-related risk behaviours, which typically develop during the crucial early childhood period.

Scientists at the Medical Research Council and Cambridge University School of Clinical Medicine now believe '**Once established, these behaviours tend to track, or remain stable, into middle childhood**.' In a 4-year longitudinal study they found significant declines in all levels of children's PA from ages 10 – 14 (Brooke et al 2016)

In a review conducted at University of Strathclyde 'When does it all go wrong? Longitudinal studies of changes in moderate-to-vigorous-intensity physical activity across childhood and adolescence' found that 'MVPA begins to decline, and sedentary behaviour begins to increase, from around the age of school entry.... efforts to promote and/or maintain MVPA should begin well before adolescence.' (Reilly 2016)

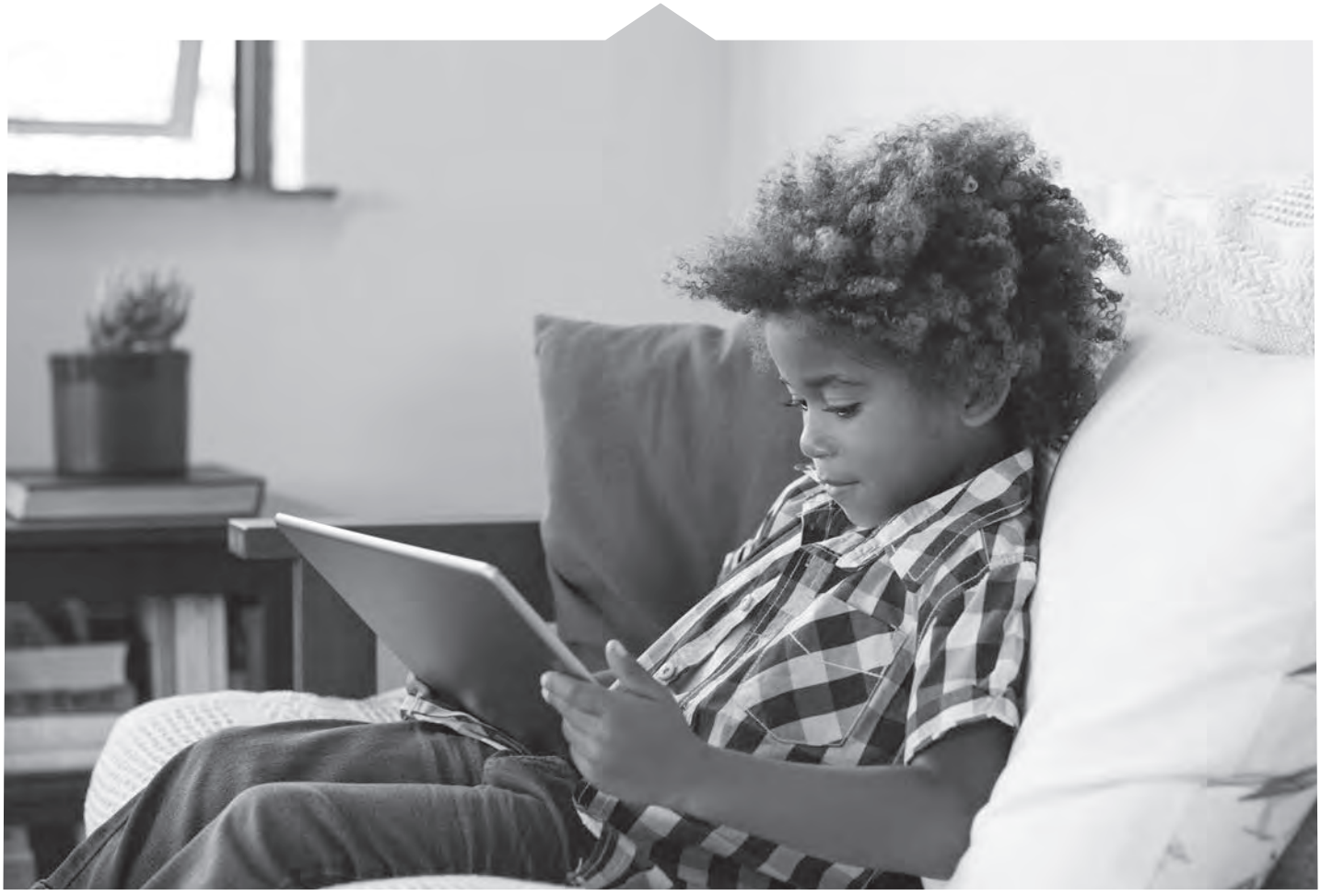
A British study involving 6188 subjects concluded that '**childhood TV viewing time tracks into adulthood.... TV viewing time [at 10 yrs.] ... associated with high TV viewing time at aged 42 years**.' We may be planting couch potatoes three decades ahead of time. (Smith et al 2015)

A new study of 2000 children, appearing in the journal *Preventive Medicine* assessed the amount of TV children watched at age 2 and health outcome measures at 13 and found that those watching higher levels of TV at age 2 were likely to have higher DST of all types at age 13. Among other negative outcomes they reported that high TV time at 2 was linked with 'eating unhealthy foods' at age 13. (Simonato et al 2018)

Screen habits and PA habits are embedded early and last for decades and probably for life. Shaping them in a positive direction from an early stage is therefore imperative.

The MRC and Cambridge scientists above point out that 'These behaviours are also associated with important health and developmental outcomes, such as weight, bone health, cardiovascular disease risk factors, cognitive development, academic achievement, and psychosocial well-being from early childhood through to adolescence. That is, higher levels of physical activity and lower levels of screentime are supportive of more favourable outcomes.' (Brooke et al 2016)

Although there is evidence that children have an inherent physical 'activity temperament' linked with them being naturally more or less active or sedentary, it is still imperative to ensure that all children develop healthy PA habits. (Schmutz et al 2018)



Mental Health

While PA is normally considered a physical health issue, there has been a recent interest in the relationship between PA, sedentary behaviour and mental health. For example, the World Health Organization recently stated 'strong evidence demonstrates that individuals who are more active have lower rates of … depression' (WHO 2018b)

A new multinational study of 42,000 people conducted by Kings College London found that higher levels of sedentary behaviour '**are associated with an elevated prevalence of depression**.' (Stubbs et al 2018) In addressing 'physical activity and mental health' Public Health England recently stated 'physical activity can boost mental wellbeing … The link between physical activity and depression is well established. … people who are inactive have 3 times the rate of moderate to severe depression of active people.' (PHE 2018c) **A recent review found evidence that higher levels of physical activity were associated with a reduced response to psychosocial stress** including lower 'cortisol and heart rate reactivity'. (Mucke et al 2018)

A paper in the *British Journal of Sports Medicine* is entitled 'Dose–response association of screen time-based sedentary behaviour in children and adolescents and depression: a meta-analysis of observational studies'. (Liu et al 2016)

A study just published in *Preventive Medicine Reports* involving over 40,000, 2 – 17 year olds concluded 'these results show a negative association between screen time and psychological well-being among children and adolescents. Across a diverse array of well-being measures, including measures of self-control, relationships with caregivers, emotional stability, diagnoses of anxiety and depression, and mental health treatment, psychological well-being was progressively lower from 1 h a day of screen time to 7 or more hours a day of screen time, particularly among adolescents. The significant association between screen time and well-being may have important clinical implications for the mental and physical health of children and adolescents and for developing guidelines for specific screen time limits'. (Twenge & Campbell 2018) The Royal College of Paediatric and Child Health recently reported that 'there is moderately-strong evidence for an association between screen-time and depressive symptoms.' (RCPCH 2018)

Spending more time outdoors and therefore looking at things a greater distance away is thought to lower children's risk of myopia. There are concerns that increased 'near visual activity' including spending a lot of time looking at small screens at close distance, may cause axial length elongation, along with changes in the Axial Lengthto - Corneal Radius Ratio in children's eyeballs leading to myopia. The researchers believe '**this effect may be due to increased near visual activity or reduced time outdoors**.' (Ku et al 2019 in press; Tideman et al 2019 in press)

Solutions & Recommendations

Solutions & Recommendations

Scientists studying physical activity and sedentary behaviour in children are now adamant that 'the way school-aged children and youth spend their time over a 24- hour period has important health implications.' (Tremblay et al 2016c) However, we need to reconceptualise how physical activity, sedentary behaviours, sleep and DST affect children's health and development outcomes.

Scientists increasingly refer to a combination or "cocktail" of movement behaviours associated with desirable indicators of health. There is an emerging view that children's behaviours, both active and inactive, occur along a 'movement continuum' (i.e., physical activity, sedentary behaviour, sleep). Until recently these behaviours and their relationships with various health indicators have largely been considered in isolation of one another, yet they interact such that their combined effects extend beyond the individual contributions of each behaviour. There are now calls for an integrated approach to understand and promote movement behaviours in children. (Carson et al 2016, Tremblay et al 2016; Biddel et al 2018)

Reducing children's DST and increasing the provision and use of accessible playgrounds must occur in a wider context of public health education: child, parental and school awareness and understanding of *how* and *why* these movement behaviours should be integrated into children's lives from an early age and on a regular basis, to be accompanied by basic understanding of nutrition.

As an example, the new NHS 'Physical activity guidelines for children' states that toddlers (who can walk) 'should be physically active every day for at least 180 minutes (3 hours) … Active play, such as using a climbing frame, riding a bike, playing in water, chasing games and ball games, is the best way for this age group to get moving.' But at the same time the NHS guidelines address sedentary behaviour separately: 'All under 5s should minimise the amount of time spent being sedentary (being restrained or sitting) for extended periods … Reducing time spent watching TV, using the computer or playing video games. (NHS 2018b, 2011)

Family and peers

Increasing parental awareness and influence through role modelling are of increasing importance for public health interventions.

Research funded by the Australian National Health and Medical Research Council found that practicing daily '**tummy time**' (placing baby on his or her stomach while awake and supervised at 6 months old), the mother's physical activity level, and having been informed about the importance of playing with the child at the beginning of the 5.5-year study 'predicted children's [later] outdoor playtime across ages 2 to 5 years.' **Interestingly, young children's screen-time was significantly influenced by their mothers' screen-time and parenting practice on screen viewing**.

The researchers along with many others now advocate 'early interventions'. If parents understand why it's vital that their child goes out to a park or playground regularly their child is more likely to do so and be physically active. (Xu et al 2016)

The Global Matrix research team above emphasised that 'the role of peers and parents in creating supportive environments for physical activity is unequivocal' and that the importance of positive role modeling of parents and their support of childhood physical activity is well known.' (Tremblay et al 2016b)

As a case in point, a new study of 247 families concluded 'sedentary behaviour and physical activity levels of parents can strongly influence those of their preschool children'. (Xu et al 2018) And another study found that both the PA and TV viewing of both parents 'are significantly associated with these behaviours in preschool children. The influence of the sex-matched parent appears to be important longitudinally for children's TV viewing.' (Abbot et al 2016) While a study of children up to age 5 found a strong relationship between parental physical activity and screen time behaviours and the behaviours of their young children'. (Carson et al 2015) Influences are also found elsewhere - a study in the *BMJ Open*, of parents drawn from 53 primary schools in England found that 'friends and siblings influence young children's physical activity and screen viewing behaviours.' (Edwards et al 2015)

It is clear that parents must create the time and opportunity for children to develop healthy movement behaviours and media habits in tandem from an early age. It would not surprise many parents to discover that given the choice, their child would prefer sweets over sprouts. Therefore, it should not be surprising that given the choice between watching television, films, YouTube, playing a computer game, or going outside (especially between October and April), many children opt for the 'non-movement behaviours' of discretionary screen time. Addressing this proclivity will entail some limits and boundaries and at times requires limiting a child's choice and options. Parents must be authoritative and guide their children to a healthy lifestyle, greater self-discipline and independence.

Limiting Discretionary Screen Time

Screen habits are established early and last for decades. Parents who have high levels of discretionary screen use themselves have children many times more likely than other children to do likewise.

Parental monitoring and the establishing of discretionary screen time limits can shape long-term media consumption habits and may prove a major preventer of mental health problems including screen dependency disorders. (Sigman 2017) Family doctors in the US are now encouraged to take a 'media history' from patients and discuss connections between a child's health and behaviour and their screen use. Doctors, nurses, midwives, pre-schools and primary schools can provide pre-emptive guidance to families about **limiting media use** in the home, raising the age for screen use, reducing the degree of exposure and discouraging screens in children's bedrooms.

There is good evidence that children's DST can be reduced through parental measures. Considering the existing empirical research and position of medical bodies and governments, the following guidance on discretionary screen time (e.g., before and after school) are only *ideals* for parents. Even if they are not adhered to, it is **important to establish such ideals** as a reference point to work from.

- Encourage no screens in children's bedrooms.
- Parents should be encouraged to monitor and control the time their children spend on hand-held computer games/media/Smartphones with justification that DST is now officially a health and development issue not merely a lifestyle/cultural one.
- Children should have a no DST gap of at least 1 hour before bedtime (except reading books on a Kindle Paper White).

Parents must take into consideration how much time their children are spending doing homework on computers before coming to a decision on discretionary ST for their child.

- Parents should be aware of the role modelling influence their own viewing habits may have on their children.
- If challenged by their children, parents can justify their own adult DST because of the simple fact that parents' brains and bodies are not still developing – they are fully formed.
- Schools can feel justified in adopting a guidance position on the recommended amount of recreational screen time children spend out of school and communicate this to pupils and parents. Home life affects academic achievement and is therefore a school matter.

Schools

Given that children spend a vast proportion of their lives in school, this presents opportunities for changing a culture of more sedentary time to include more physical activity, especially unstructured outdoor activity.

However, it has been noted that both in Britain and in many other countries, to reduce costs and/or create more time for other subjects, a trend toward a reduction in the quality and/or quantity of PA and physical education has been observed in many countries in recent years. (Tremblay 2016b)

A survey of 82 councils in England found that **play areas have been reduced** at schools across the country as local authorities build additional classroom space to cope with an increasing demand for school places due to the rise in the number of children in primary schools over recent years as the result of an increasing birth rate and the effects of migration in some areas. Therefore, more pupils will use the same area in 54% of these schools, according to the survey. (BBC 2014, Malnick 2014)

This is a missed opportunity as research suggests that school playground interventions '**can have a significant, positive long-term intervention effect on children's physical activity**.' (Hyndman et al 2014) A report by the U.S. Department of Health and Human Services was unequivocal on this matter: 'there is substantial evidence that physical activity can help improve academic achievement, including grades'…School boards, superintendents, principals, and teachers can feel confident that providing recess [including playground time] to students on a regular basis may **benefit academic behaviours**, while also facilitating social development and contributing to overall physical activity and its associated health benefits. There was no evidence that time spent in recess had a negative association with cognitive skills, attitudes, or academic behaviour.' (USDH 2010) In urging doctors to promote outdoor play in a new clinical report the American Academy of Pediatrics states 'school recess [usually in playgrounds] becomes an essential part of a child's day. It is not surprising that countries that offer more recess to young children see greater academic success among the children as they mature'. (AAP 2018) An international meta-analysis of 26 studies of over 10,000 children aged 4 – 13 concluded that PA 'improves classroom behaviours and benefits several aspects of academic achievement, especially mathematics-related skills, reading, and composite scores in youth.' (Álvarez-Bueno et al 2017)

In addition to formal PE classes, schools should promote in-class and outdoor playground physical activity breaks.

Community and the Built Environment

While playground provision must consider factors such as design, such an approach is part of the solution which some scientists feel 'will require more social engineering than built environment engineering.' (Tremblay 2016b)

Society must also provide children with greater independent mobility and freedom to play, reducing restrictions (e.g., over-protectionism) for active play, which may be more effective at increasing habitual PA than more structured approaches. Interestingly, this may have a beneficial effect on reducing excessive DST. A neighbourhood study found that providing alternatives to screen use by ensuring access to a variety of neighbourhood places for structured and unstructured activities may be an important strategy for decreasing children's DST. (Christian et al 2017)

In preventing or treating substance addictions, exercise is reported to have protective effects. Individuals who engage in regular aerobic exercise are reported to be less likely to use and abuse drugs (Smith et al 2012; Thompson et al 2018). Exercise produces neuroadaptations and epigenetic changes that may influence an individual's vulnerability to initiate drug use through acting as a non-drug reward that competes with the drug and decreases the likelihood of its use (Lynch et al 2013). Park (2014) has reported 'a negative association between level of physical activity and risk of problematic

Internet use' concluding 'physical activity may be helpful to improve adolescent mental health.' A further study found that 'physical education class in school can be used to prevent and lessen Internet addiction'. (Park 2016) Research by the Centers for Disease Control and Prevention [CDC] found a negative dose-response relationship between weekly physical activity and the risk of exceeding recommended screen time limits, recommending that 'programs that encourage limit-setting by parents and promote physical activity may reduce screen time among youth.' (Carlson et al 2010) There may be a sound neurological basis to these findings. Exercise produces increased activity in brain cells that receive the reward chemical dopamine. (Fisher et al 2013) Physical activity may also improve brain structure and function in children within brain areas related to self control, a key element in preventing addiction. (Chaddock-Heyman et al 2014)

Local and national policy-makers must now work to ensure that all of the elements of children's movement behaviours are considered together. A modest investment in greater play and playground provision must also be accompanied by a more muscular and visible public health approach. This may entail telling the public not what they're interested in hearing but what is in their children's best interests.

Sit Less and Move More

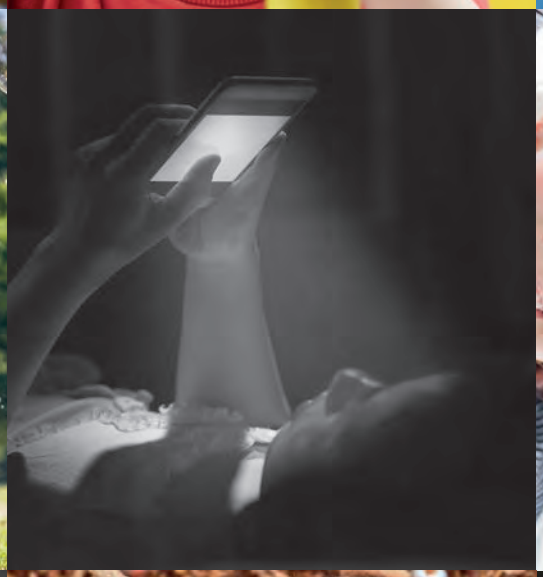
The need to move has a long history. **Five hundred million years ago** the nervous system first enabled coordinated movement allowing an organism to find food, instead of waiting for the food to come to it.

There is growing evidence that children are 'hardwired' to move and play. Evolutionary biologists believe that the need for a child to play is embedded in their biology and their brain. We mustn't let anything stand in the way.









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