

Time for a View on Screen Time

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Introduction

In Britain today, children by the age of 10 years have regular access to an average of five different screens at home. In addition to the main family television, for example, many very young children have their own bedroom TV along with portable handheld computer game consoles (eg, Nintendo, Playstation, Xbox), smartphone with games, internet and video, a family computer and a laptop and/or a tablet computer (eg, iPad). Children routinely engage in two or more forms of screen viewing at the same time, such as TV and laptop.^[1] Viewing is starting earlier in life. Nearly one in three American infants has a TV in their bedroom, and almost half of all infants watch TV or DVDs for nearly 2 h/day.^[2]

Across the industrialised world, watching screen media is the main pastime of children. Over the course of childhood, children spend more time watching TV than they spend in school.^[3] When including computer games, internet and DVDs, by the age of seven years, a child born today will have spent one full year of 24 h days watching screen media. By the age of 18 years, the average European child will have spent 3 years of 24 h days watching screen media; at this rate, by the age of 80 years, they will have spent 17.6 years^[4] glued to media screens.

Yet, irrespective of the content or educational value of what is being viewed, the sheer *amount* of average daily screen time (ST) during discretionary hours after school is increasingly being considered an independent risk factor for disease, and is recognised as such by other governments and medical bodies but not, however, in Britain or in most of the EU. To date, views of the British and European medical establishments on increasingly high levels of child ST remain conspicuous by their absence.

This paper will highlight the dramatic increase in the time children today spend watching screen media. It will provide a brief overview of some specific health and well-being concerns of current viewing levels, explain why screen viewing is distinct from other forms of sedentary behaviour, and point to the potential public health benefits of a reduction in ST. It is proposed that Britain and Europe's medical establishments now offer guidance on the average number of hours per day children spend viewing screen media, and the age at which they start.

Level of Consumption: Dose

Children of all ages today, are watching more screen media than ever before.^[5] Excluding any viewing time outside the home, such as hand-held screen activities, the average ST in the home for young British adolescents is 6.1 h/day, and this is rising significantly.^[6] Canadian children spend 7.8 h/day, and American children 7.5 h: 55% of their waking lives.^[7 8] The ongoing EU ToyBox study group has just reported, 'In general, parents had no formal rules about TV viewing... Remarkably, in most countries, parents of a low SES had almost no rules regarding watching TV. Children can watch TV all day long or whenever they want.'^[9]

However, ST is no longer merely a cultural issue about how children spend their leisure time, nor is it confined to concern over the appropriate/inappropriate

content of what is on the screen. It has become a medical issue, often exhibiting a dose-response relationship with disease risk.

Screen Time Guidelines

The US Department of Health and Human Services now cites reducing ST as one of its key 'health improvement priorities' in achieving its 'national 10-year health promotion and disease prevention objective': '*to increase the proportion of children aged 0 to 2 years who view no television or videos on an average weekday, and increase the proportion of children and adolescents aged 2 years through 12th grade [18 years] who view television, videos, or play video games for no more than 2 hours a day.*'^[10] The Australian Department of Health and Ageing has issued similar guidelines, as has the American Academy of Pediatrics (AAP), adding: 'media—both foreground and background—have potentially negative effects and no known positive effects for children younger than 2 years.'^[11 12] The Canadian Paediatric Society has gone further, 'No child should be allowed to have a television, computer or video game equipment in his or her bedroom.'^[13] The French Government prohibits French channels from airing all TV programmes—educational and otherwise—aimed at children under 3 years of age.^[14]

What is the basis for this concern?

Mortality and Morbidity

Numerous well designed prospective cohort studies continue to find a highly significant dose-response association between ST and risk of type 2 diabetes, cardiovascular disease (CVD) and all-cause mortality among adults, with ST identified as an independent risk factor with biological plausibility.^[15–17]

Wijndaele *et al* ^[16] recently reported that every 1 h/day increase in television viewing was associated with a 6% increased hazard for total fatal or non-fatal CVD, and an 8% increased hazard for coronary heart disease, independent of gender, age, education, smoking, alcohol, medication, diabetes status, CVD family history, sleep duration and physical activity energy expenditure.

At the same time, others report that for participants engaging in 4 h/day of recreational ST (eg, TV, computers) relative to <2 h/day, there was a 48% increased hazard for all-cause mortality, and a 125% increased hazard for CVD events of which 25% was explained by cardiometabolic biomarkers.^[18]

In children and adults, ST has also been found to have an unfavourable dose-response association with a range of biomarkers for CVD, type 2 diabetes and metabolic syndrome (MetS) including LDL/HDL/total cholesterol, triglyceride, fibrinogen, systolic/diastolic blood pressure (BP) and C-reactive protein.^[16 19]

Examining television/DVD/video and computer use and metabolic risk, Hardy *et al* ^[20] found that adolescent boys who exceed 2 h/day of ST were more than twice as likely to have abnormal levels of insulin and homeostatic model assessment of insulin resistance (HOMA-IR), suggesting an increased risk of insulin resistance. Another study involving 13–18.5-year-olds in five Spanish cities found those watching more than 3 h of TV per day had 'significantly less favourable levels' of HDL-cholesterol, glucose, apolipoprotein A1 and overall CVD risk scores.^[21]

Viewing is not Merely 'Sedentary Behaviour'

Nevertheless, the association between ST and health risk appears not as simple as ST merely being a sedentary behaviour. First, sedentary behaviour as a risk factor is distinct from too little moderate-to-vigorous physical activity (MVPA) in all age groups, with the two possibly being separate constructs involving

different metabolic pathways contributing to disease.^[19 20 22 23] Prolonged ST elevates health risk independent of the level of MVPA people routinely engage in.^[22] A recent analysis of the ongoing US National Institutes of Health Diet and Health Study observed that even among people with high levels of MVPA, high amounts of television viewing remain associated with a 47% increased risk for all-cause, and a 100% increased risk for cardiovascular mortality.^[17] Another study of body composition and abdominal obesity in children across 10 European cities has recently concluded that physical activity does not attenuate the obesity risk associated with ST.^[24]

Moreover, children's ST may be somewhat distinct from other forms of sedentary behaviour in its influence on biological risk factors for disease.^[23 25 26] For example, examining a range of sedentary behaviours, screen activities and BP in young adolescents, Gopinath *et al* ^[25] reported a dose-response relationship, 'each hour per day spent in screen time, watching TV and playing video games was associated with a significant increase in diastolic BP of 0.44 (p=0.0001), 0.99 (p<0.0001) and 0.64 mm Hg (p=0.04), respectively. By contrast, each hour per day spent reading was associated with a decrease...' In prepubertal children, TV viewing and total ST, but not computer use, have been found to be positively associated with both systolic and diastolic BP, while painting or sitting were not.^[26] Additionally, different screen activities may have differing independent associations with biomarkers and chronic disease risk in youth.^[23 26 27]

A cross-sectional study of a large sample of overweight and obese adolescents concluded that time spent playing seated video games was the only type of ST associated with increased BP and total cholesterol/HDL ratio.^[27] Carson and Janssen found in a representative population of 6–19-year-olds that time spent watching TV was predictive of a higher score of an aggregated or clustered measure of cardio-metabolic risk, but recreational computer time was not.^[23] While in prepubertal children, Martinez-Gomez *et al* ^[26] found that TV viewing but not computer time was associated with increased BP.

Studies of HPA stress-regulation and ST shed further light on underlying mechanisms. Wallenius *et al* ^[28] found school-aged children who had used Information and Communication Technology (ICT) equipment for an average of 3 h the preceding day (only half the UK child norm) showed a significantly reduced cortisol increase 1 h after waking compared with children who had not used ICT at all, or for less than 1 h. '*The results suggest a stress response as a consequence of a long period of ICT use... [which] can persist over night and have an impact on the regulation of HPA-activity even the next morning.*' They suggest that child ST day after day may 'predispose some adolescents to the development of allostatic load.' There is already concern that even HPA changes within the normal range may be subtle early indicators of, and contributors to, unfavourable physical health outcomes in adolescence and adulthood.

The educational value of screen material being viewed does not preclude the significant associations reported above between ST and morbidity, mortality and associated biomarkers.

Obesogenic Mechanisms

Increased TV viewing has been consistently shown to be linked to increased body mass index (BMI) in both children and adults independent of physical activity.^[22 29] The association appears stronger in young children. A cross-sectional study assessing fat mass by Jackson *et al* ^[30] found a dose-response relationship: 'Each extra hour of watching TV was associated with an extra 1 kg of body fat... Preschool children who watch more TV are fatter and are less active ... the relation between TV viewing and fatness is not mediated by physical activity...'

ST is clearly associated with unhealthy dietary behaviours in children, adolescents and adults.^[31] However, in addition to the influence of food advertising, studies of children's ingestive behaviour in direct response to screen viewing suggest it can act as a distraction away from vital satiation food cues toward

non-food cues (screen), thereby disrupting the development of habituation to food and, therefore, increasing energy intake while children are viewing.^[32]

Eating a meal while viewing screens is also thought to disrupt the encoding and memory formation of the meal. Impaired memory for recent eating may increase food intake hours after viewing stops. A study in the journal *Appetite* found that the 'effects of television watching on food intake extend beyond the time of television watching to affect subsequent consumption'.^[33]

In a randomised crossover study, video game playing was found to significantly increase food intake in adolescents immediately after playing 'and was not compensated for during the rest of the day'.^[34] One hour of playing a video game resulted in a daily energy surplus of 163 kcal, a rate of 60 000 kcal/year, which could help manufacture almost 8 kg of body fat per year.

All these effects are taking place at a time in our history when 68% of dinners in the UK are eaten while watching television.^[5]

Interestingly, a randomised controlled clinical intervention trial divided 4–7-year-olds into two groups: one had its TV and computer viewing reduced by half; the other did not. After 3 years, there had been a significant reduction in the BMI of those who had halved their screen viewing, and relatively little in those who had not.^[35]

The above findings may have significant public health implications. Children 9–12 years with a high BMI are more likely to have high BP, cholesterol and blood insulin levels by adolescence.^[36] Even marginally elevated BMI in adolescence constitutes a substantial risk factor for early occurrence of angiography-proven coronary heart disease.^[37] The EU ToyBox study has in its 'Evidence-based recommendations for the development of obesity prevention programs targeted at preschool children' just called for 'Limitation of leisure screen time to <1 h/d (or the amount of time recommended by appropriate national guidelines, if less than 1 h/d)'.^[29]

Brain and Cognition

ST is associated in a dose-response manner with subsequent attention problems in a variety of age groups. A longitudinal study of 2623 children reported that children who watched television at ages 1 and 3 years had a significantly increased risk of developing attentional problems by the time they were 7 years old. For every hour of television a child watched per day, there was a 9% increase in subsequent attentional problems consistent with a diagnosis of ADHD.^[38] A longer-term dose-response association has been found between television viewing at the ages of 5 and 11 years, and subsequent attention problems in adolescence independent of early attention problems and other confounders.^[39] Similar associations have been reported in 14–22-year-olds, and in a study of 8–24-year-olds, Swing *et al* concluded, 'Viewing television and playing video games each are associated with increased subsequent attention problems in childhood... late adolescence and early adulthood...'.^[40 41]

In addition to ST, screen 'speed'—the pace of editing and degree of novelty within screen material—is increasingly thought to be an important factor in the above findings. Lillard and Peterson 'found that 9 minutes of viewing a popular fast-paced fantastical television show immediately impaired 4-year-olds' EF [executive function], a result about which parents of young children should be aware'.^[42]

Dopamine is central to the ability to pay attention and implicated in attention problems. It is produced in response to screen novelty. Significant dopamine release within the striatum is found to occur quickly in young adult brains while playing computer games.^[43 44] Dopamine is also a key component of the brain's reward system, and is heavily implicated in the formation and maintenance of addictions. There are growing concerns that extensive computer game

playing may lead to long-term changes in the reward circuitry that resemble the effects of substance dependence.^[44] In addition to computer games, screen viewing by youngsters begets more viewing and, unlike other sedentary behaviours, most of the criteria of substance dependence apply to people with higher levels of ST.^[45] Screen 'addiction', once a populist catch phrase, is increasingly being used by physicians to describe the growing number of children engaging in screen activities in a dependent manner.^[46]

Psychosocial Health

ST is strongly associated with measures of child mental well-being.^[47–50] The AAP has recently published a report on The Impact of Social Media on Children, Adolescents and Families, which contains a section entitled 'Facebook Depression', which is 'defined as depression that develops when preteens and teens spend a great deal of time on social media sites, such as Facebook, and then begin to exhibit classic symptoms of depression.'^[51] A British study found that children who spent more than 2 h/day watching television or using a computer 'were at [60%] increased risk of high levels of psychological difficulties and this risk increased if the children also failed to meet physical activity guidelines. ... Both television viewing and computer use are important independent targets for intervention for optimal well-being for children, irrespective of levels of moderate/vigorous physical activity (MVPA) or overall sedentary time.'^[50] A cross-sectional analysis of 9–10-year-old girls found ST to be 'negatively associated with self-esteem'.^[49] A survey of 3461 North American girls aged 8–12 years found a significant association between ST as well as measures of media multitasking, and negative psychosocial well-being.

Conversely, face-to-face communication was strongly associated with positive psychosocial well-being.^[48] A study of Japanese children aged 5–14 years reports ST had a strong association with negative feeling upon awakening and recommends guidelines for child ST as a preventive measure.^[47]

Adjusting for pre-existing individual and family factors, a prospective longitudinal study of 1314 Canadian children found significant negative associations between ST at 29 and 53 months of age, and psychosocial well-being at age 10 years. Each 1 h increase in early childhood exposure corresponded to a 7% unit decrease in classroom engagement and 10% unit increase in victimisation in middle childhood. Researchers reported 'Higher levels of early childhood television exposure predicted greater chances of peer rejection experiences such as being teased, assaulted, or insulted by other students ... our results suggest that reduced time for critical social interactions in early childhood owing to displaced time spent watching television may present later specific risks of developing inadequate social skills.'^[52]

In understanding the above associations, several mechanisms have been proposed. Humans require a certain amount of 'co-presence'—regular eye-to-eye contact for optimal physical and mental health.^[53] Moreover, the fundamental ability to relate to others is dependent on social and emotional skills that are learnt through regular social interaction. Face-to-face conversations confer linguistic skills, along with the ability to have conversations—to know when and how to listen and contribute. This learning process is highly technical and time consuming.^[54] For example, during face-to-face interaction, in addition to hearing a voice and accompanying facial expressions of the speaker's face, the speech sounds produce tiny bursts of aspiration—air pressure which hit the child's skin—tactile information contributing to auditory perception.^[55]

Neurobiology of Socialisation

The development of empathy and compassion requiring subtle skills of reading the nonverbal nuances of others' emotions involve similar learning processes which appear to have a neural basis. For example, the insular cortex has been identified as a key brain mechanism involved in experiencing the emotional states of others and is thought to underlie egalitarian behaviour in humans.^[56] Feeling empathy for a friend's emotional suffering activates affective pain regions (dorsal anterior cingulate cortex (dACC) and insula) associated with having firsthand experience of the same suffering.^[57] The learning effects of

routinely experiencing such social emotions are reflected neurologically. The 'deliberate cultivation of compassion' through 'compassion training' for empathic responses are associated with changes in functional neuroplasticity.^[58]

At the same time, researchers conducting functional magnetic resonance imaging (fMRI) research have expressed concern that when using the internet, for example, the areas of the brain associated with empathy showed virtually no increase in stimulation, concluding 'Young people are growing up immersed in this technology and their brains are more malleable, more plastic and changing than with older brains ... As the brain evolves and shifts its focus towards new technological skills, it drifts away from fundamental social skills.'^[59 60]

Mirror Neurons

A child's brain is also believed to have multiple mirror neuron systems that specialise in carrying out and understanding not just the actions of others, but their intentions—the social meaning of their behaviour and their emotions.

People who rank high on a scale measuring empathy have particularly active mirror neuron systems. A study of the brain activity of 10-year-olds who observed and imitated emotional expressions and social skills found a direct relationship between the level of activity in the children's mirror neuron systems and 'two distinct indicators of social functioning in typically developing children': empathy and social skills. The authors concluded that the importance of observing and copying everyday social behaviours and the mirror neuron system 'may indeed be relevant to social functioning in everyday life during typical human development'.^[61]

It may be that children must exercise specific brain areas and systems regularly and extensively in situ, in order to develop crucial social and emotional skills or deficits will emerge later.

A meta-analysis of 72 studies on empathy conducted between 1979 and 2009 among almost 14 000 university students 'found the biggest drop in empathy after the year 2000. College kids today are about 40 per cent lower in empathy than their counterparts of 20 or thirty years ago, as measured by standard tests of this personality trait.' The authors believe that the sheer increase in child and adolescent ST during this time could be one very important factor, and concluded that the rise of social media may also play a role in the decline in empathy: 'The ease of having 'friends' online might make people more likely to just tune out when they don't feel like responding to others' problems, a behaviour that could carry over offline.' They also believe electronic media has contributed to a social environment that works against slowing down and listening to someone who requires sympathy.^[62]

Returning to the potential role of ST in psychosocial learning, it is known that younger children experience considerable difficulty when translating to real life what they see on a screen. Children learn tasks better from a live demonstration than from an equivalent televised demonstration, a problem referred to as the *video deficit*.^[63] This effect becomes more pronounced and may persist at older ages as the task complexity increases—and psychosocial tasks, such as perceiving and interpreting other's actions, emotions and intentions are highly complex.

Regarding the daily time available for children to learn psychosocial skills through face-to-face interactions, studies at Stanford University have led to a 'displacement' theory of internet use:

In short, no matter how time online is measured and no matter which type of social activity is considered, time spent on the Internet reduces time spent in face-to-face relationships... an hour on the Internet reduces face-to-face time with family by close to twenty-four minutes.^[64]

Sigman reported that between 1987 and 2007 the number of hours per day of face-to-face social interaction declined markedly as the use of electronic media has increased.^[65]

Interventions

There is good evidence that children's ST can be reduced through simple measures, mainly raising parental awareness. A systematic review by researchers at Harvard Medical School recently reported that 29 studies 'achieved significant reductions in TV viewing or screen-media use'.^[66] Research by the Centers for Disease Control and Prevention (CDC), along with other studies, has found parental rules and limits on ST effectively reduce ST, as does not having screens in bedrooms.^[67 68] The CDC study also found a negative dose-response relationship between weekly physical activity and the risk of exceeding recommended ST limits, recommending the promotion of physical activity as an additional means of reducing ST.

Role modelling is another important factor. Parent and child levels of screen viewing are strongly related: children who live in a household that promotes TV-watching (TV is on when the child comes home from school, and meals are eaten in front of the TV) are more likely to watch excessive amounts of television themselves. If parents watch television for more than 4 h/day, their son and daughter, respectively, will be 10.5 and three times more likely to watch it for more than 4 h/day too.^[69]

Recommendations

The associations between ST and health risks are reported to occur generally beyond exposure of 2 h/day. Yet the average child is exposed to three times this amount. Therefore, reducing total daily ST for children, and delaying the age at which they start, could provide significant advantages for their health and well-being. Although popular phrases such as 'striking a balance' or 'everything in moderation' may sound reassuringly sensible, one of the main obstacles in encouraging parents to reduce their children's ST is the vagueness of the terms 'moderation' and 'excessive'. Paediatricians must now define these terms by first considering ST as simply another form of consumption measured in units of hours/minutes consumed per day: a simple public health concept to grasp and act upon. Considering the existing empirical research and position of medical bodies and governments in other countries, the following guidance on recreational ST (eg, 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.

- Eighty per cent of adult brain size growth occurs during a child's first 3 years, when they may be most vulnerable to the effects of screen media. There should be a buffer zone in the early years, whereby this stage of child development is 'cordoned off' from premature exposure to screen media. Screen viewing should be delayed, or minimised, until age 3 years.
- Encourage no screens in children's bedrooms.
- Parents of younger children should be advised to choose screen material with a slower pace, less novelty and more of a single narrative quality.
- Parents should be encouraged to monitor and control the time their children spend on hand-held computer games/media.
- Ideal discretionary ST limits are:

- 3–7 years: 0.5–1 h/day
- 7–12 years: 1 h
- 12–15 years: 1.5 h
- 16+ years: 2 h

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 along with the potential influence of background or 'passive' media.
- Information about infants and toddlers watching screens should be included within maternity ward 'birth packs' given to mothers.
- Health visitors should be aware of medical evidence and advise new parents.
- Nurseries and day care centres should make parents aware of this issue, as is the case in Belgium and France.
- Schools should adopt a position on the amount of time children spend in front of a screen in and out of school and communicate this to pupils and parents.

Discussion

The study of ST as a public health subject is relatively new, and the associations between ST and health risk cited in the observational studies above do not prove direct causation. While it is not possible within the confines of this paper to describe and compare the design and independent variables, including the demographic profile of each study, others are beginning to do so. For example, a meta-analysis of relevant studies, including some of the above, involving European, US and Australian populations on ST and risk of Type 2 Diabetes, CVD and all-cause mortality carried out at the Harvard School of Public Health, included large sample sizes, long durations of follow-up, and well established prospective studies. In addition, their pooled estimates were based on prospective analyses with detailed adjustment for a wide range of confounding variables. After adjusting for BMI or other obesity measures and dietary variables, the associations with health risk still remained highly significant.^[15]

The various studies finding associations between ST and subsequent attention problems were predominantly prospective and controlled for relevant confounding variables including pre-existing attention problems.^[38–41] Several of the above studies on ST and psychosocial well-being used cross-sectional designs, making it more difficult to determine whether higher levels of ST were associated with the development of negative well-being, or negative well-being preceded higher levels of ST.^[47–50] For example, whether children with psychological difficulties, such as extreme shyness, are more likely to gravitate towards ST over more sociable activities.

However, the prospective longitudinal Canadian study controlling for pre-existing psychosocial problems found significant associations with ST.^[52]

There are additional concerns not addressed above, regarding safeguarding children from online exploitation and exposure to inappropriate material. There are also emerging concerns about the potential effect of 3D screens on the development of the child's stereoscopic vision and depth perception through possible alterations in the development of the 'fusion center' of the brain. Interestingly, in their 'Nintendo 3DS—Parents' Information, 3D Concerns', Nintendo of America states, 'children 6 and under should not use the 3D feature of the Nintendo 3DS system.'^[70]

The simple arithmetic of hours of eye-to-screen contact versus eye-to-eye contact are making clear the profound implications of such extensive ST for family and social relationships. In 2007, when children had access to far fewer screens, a large-scale study by Britain's Children's Society found that television alone was already displacing the parental role, eclipsing 'by a factor of five or ten the time parents spend actively engaging with children'.

An ongoing study of families in situ by the University of California—Los Angeles has found that social disengagement is rapidly increasing, as side-by-side and eye-to-eye human interactions in the home are being displaced by the eye-to-screen relationship. It was reported that 'family members seldom came together as a group.' The number of parents who were ignored or unacknowledged on their return home because children were 'otherwise engaged in [screen] activity... comprised a substantial percentage of observed behavior'. The high level of being unacknowledged 'encountered by fathers when they reunited with their children was particularly striking... These latter results are particularly noteworthy. Social scientists have long documented the near universality of positive behavior in the form of greetings when two or more people reunite after being apart for a period of time. Greetings recognize a person's arrival, status and display positive intentions that universally facilitate the transition into social interaction with another.' ST has changed this.'^[71]

Although this paper is concerned with ST, when one includes screen content—which may be very much at odds with the values and desires of parents, but which children may be absorbing for many hours a day, the distorting effect on the parental role in imparting their own values and providing boundaries for adolescence could be considerable. A decade ago, in their 'Analysis of Children's Programming Provision', the British Government's Broadcasting Standards Commission concluded 'The television is almost like a member of the family in its own right'. With subsequent birth of multiple screens, today extensive ST appears to have created the three-parent family.

Both within and outside the family, children learn the rules of relationships through extensive routine face-to-face experience. Yet, as social media consumes a larger portion of a child's daily life, this is likely to create difficulties in extrapolating on-line 'un-boundaried' relationships to those of the 'real' world, thereby affecting those relationships.

The family environment has been described as an ecosystem of interruption technologies. Background media that is not being actively viewed by the child is increasingly associated with developmental risks. A study of 5–6-year-olds found that both active TV viewing and background 'passive' TV exposure was related to shorter sleep duration, sleeping disorders and overall sleep disturbances. Moreover, passive exposure to TV of more than 3 h/day was strongly related to sleep disturbances, therefore, 'parents should control the quantity of TV viewing and ... limit children's exposure to passive TV.'^[72] A study of 1–3-year-olds found that background TV significantly reduced the amount of time they played with their toys, and the amount of time they spent in focused attention during play. Researchers concluded, 'These findings have implications for subsequent cognitive development.'^[73] Researchers have also found both the quantity and the quality of interactions between parents and children decline markedly when background TV is on, which 'may have a negative impact on development'.^[74] Current US estimates for children 8 months to 8 years of age are 3.9 h of background TV per day.^[75] The report by AAP 'recommends that parents and caregivers ... recognize that their own [background] media use can have a negative effect on children'. The AAP considers claims by media industry executives that educational media programmes are meant to be watched by both the parent and the child to facilitate social interactions and the learning process as having quite the opposite effect.^[12]

There are limitations in simply advising parents to reduce children's ST. As with many preventative health initiatives, such advice may be least effective in families where it matters most. However, it is wrong to assume that it is simply the underprivileged families being referred to. The AAP recently reported 'Parents who believe that educational television is "very important for healthy development" are twice as likely to keep the television on all or most of the time.'^[12] Most parents want to reduce health risks for their children, provided they understand the rationale behind the advisory, and a clear course of action is offered. For example, between 1996 and 2007, children in England, exposed to passive smoking, declined by nearly 70%. Most interestingly, declines were greatest in the 2 years immediately *preceding* legislation as the result of, it is thought, the media campaigns and greater publicity on the impacts of passive smoking during this period. Subsequent research has found that 'absolute declines in exposure were greater in those most exposed at the outset ... including those living in lower sociodemographic status households'.^[76]

At the moment, most parents and physicians are unaware of ST as a health issue, and if they do harbour concerns, they remain unaware of the rationale or a clear rule of thumb as a course of action. It is, therefore, an imperative to first redress this knowledge void. Given that many parents have grown to rely on ST as a means of occupying their children—the electronic babysitter—any guidance on ST would benefit from the inclusion of suggestions for developing constructive practical alternatives to ST.

Although children may be regularly involved in various screen activities and using different screen devices, most ST is recreational, that is, discretionary, and it is this ST that should be the primary public health target for reduction. There may be scope for further reductions. Preschool and infant schools, if made aware of this issue, could easily reduce ST, as much of it is predominantly discretionary at that stage of education. Junior and secondary schools could reconsider the extent to which entertainment TV programmes and films are used as lessons and as 'golden time'. There is a concern that not to expose young children to screen technology puts them at a developmental and educational disadvantage. Furthermore, it is often assumed that if children do not 'get used to' screen technology early on, they will in some way be intimidated by it, or be less competent at using it later. However, research has found that even Rhesus monkeys are comfortable with, and capable of using, the same screen technology that children are exposed to.^[77] The charity, Orangutan Outreach, has been conducting trials gauging iPad interaction with their apes. The director has reported 'It's not really toy-like because they are engaging with them as devices ... it's definitely going in the cognitive direction'.^[78]

Political Implications

Perhaps because ST is not a dangerous substance or a visibly risky activity, it has eluded the scrutiny that other health issues attract. Additionally, there is little funding and public gratitude in looking for the negative effects of the world's favourite pastime. In 2006, American paediatric researchers writing in the American Medical Association's *Archives of Pediatric and Adolescent Medicine* asked rhetorically: 'Why is it that something that is widely recognised as being so influential and potentially dangerous has resulted in so little effective action? 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'.^[79]

A Problem of Provenance

Rather than paediatricians, it has been the academics in ICT, media literacy, education, marketing and social and cognitive psychology, whose research is often funded by TV, software and technology industries, who have dominated research, public and professional understanding of, and policy considerations on, ST and child health. Few seem to have spotted the most salient point: their focus is not on child health, but as one leading institution advising successive British governments states, 'research focuses on children's and young people's *interactions with* [author's italics] electronic media, and on media education.'

Information Hygiene

Moreover, while medical journals, such as the *BMJ* group have instituted measures to identify competing interests and sources of funding, particularly regarding the pharmaceutical industry, in order to minimise such influence within their publications, thereby maintaining a high standard of information hygiene, the culture and standard of hygiene with respect to research on screen media and children is very different in media, psychology and education journals.

As the most valid impartial arbiter of child health, British and European paediatric medicine must in future be at the centre of research, public understanding and policy formation on ST.

In other areas of child health and development, when considering the potential effects of profound new developments, the paediatric health profession instinctively adopts a principle of precaution. Yet, to date, the increasingly excessive levels of child ST have been met with relative silence. While many questions remain regarding the precise nature of the association between ST and adverse outcomes, the advice from a growing number of both researchers and other medical associations and government health departments elsewhere is becoming unequivocal: reduce ST.^[10–17 21 24 29 35 38 41 80–83] Irrespective of whether this will endear paediatricians to the public or not, Britain and Europe's medical establishments, including the RCPCH, EAP and Department of Health, should now formally express some concern over ST.

A drop in viewing figures may be bad for TV executives' blood pressure, but may prove to be very good for child health.

Conclusion

Children of all ages are spending more time than ever before, watching screen media. Viewing screen media is physiologically distinct from other forms of sedentary behaviour, with average daily ST increasingly considered an independent risk factor, often exhibiting a dose-response relationship with disease and unfavourable child development outcomes. As health risks are reported to occur beyond exposure of 2 h of ST per day, although the average child is exposed to three times this amount, a robust initiative to encourage a reduction in daily recreational ST could lead to significant improvements in child health and development. Britain and European medical establishments should consider ST as a separate entity from sedentary behaviour, and offer an advisory on the average number of hours per day young children, in particular, are viewing screen media, and the age at which they start.

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