

# Health implications of new technology

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## Contents

Welcome	1
What do we mean by new technologies?	1
Biological effects on cell tissue	2
Behavioural and psychological effects	2
Gains	3
Recent reports	4
Useful reviews	5
Recent research	6
Policy and guidelines	7
Conclusion	8
Useful resources	8
References	9

## WELCOME

Health implications have been attributed to all forms of new media, yet it is hard to pin down the research evidence on whether these effects have been positive or negative. The short answer is, of course, that they have been both. What we have tried to do in this research summary is pull together some themes emerging from the literature, presenting the main messages and a selection of the resources identified.

Topics covered by earlier updates include adolescent sleep, long-term conditions, accidents and injuries, health inequalities, disability, physical activity, alcohol & substance use, teenage pregnancy & sexual health, and mental health & emotional wellbeing. You can obtain an extended version of this paper, along with copies of all our past and future updates, by joining AYPH ([www.ayph.org.uk](http://www.ayph.org.uk)).

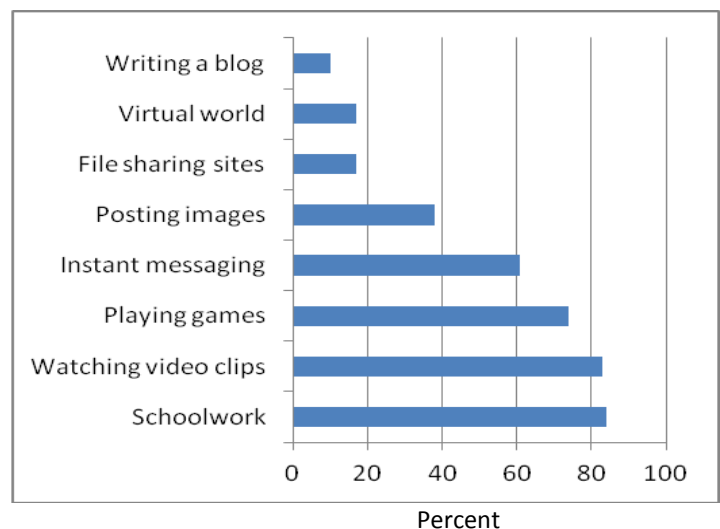
## WHAT DO WE MEAN BY NEW TECHNOLOGY?

Inevitably, the phrase 'new technologies' is used in a somewhat woolly way as a 'catch-all' for electronic aspects of modern life. At the most concrete level, it is information and communications technologies based on micro-electronics. New technologies are generally characterised by digitizing of content

into 'bits'. In this paper we are referring both to the hardware and software (I-pads, MACs, computer multimedia, computer games, CDROMs, DVDs, mobile telephones...)

and also to the new forms of communication these facilitate (instant messaging, email, text messaging, blogs, social networking, access to all the information on the web, YouTube, interactive video games, virtual reality environments..). This is an important distinction, with repercussions for

Figure 1: Young people's use of the internet in the EU



Source: EU Kids Online - Livingston et al (2010)

how we think about the health implications. It also means it is impossible to generalise across so many different aspects of new technology; there will be no clear 'overall' message about the health effects given the variety of things included in the term.

Health implications have been attributed to all these forms of new media. Links have been made to biological effects on cell tissue, to health risk behaviour, and to psychological damage from new ways of communicating. Less attention has been paid to the positive benefits. The main problem with identifying either positive or negative benefits is that the technology is in a state of constant flux. Long term outcomes from the mobile telephones of 10 years ago may have no relevance at all when we look at today's models. We thus seem to be constantly starting afresh. In addition, young people are early adaptors, exacerbating the impression that we are trying to hit a moving target.

Figure 1 summarises some of the kinds of things that adolescents are doing on line, using data from the EU Kids Online study<sup>1</sup>. This study also demonstrated that mobile telephone use is almost universal, texting is very common, and requirements to use new technologies to undertake homework at school are becoming more and more usual. Use of new technology is thus not something that can be avoided, even for those who are not particularly keen; they are being shaped into its use by the demands of the worlds in which they are living.

### **Biological effects on cell tissue**

Determining the biological effects of new technology use is very challenging, because of the constantly changing technology and long latency period for brain tumours, which is the most feared consequence. Research has attempted to look at:

- **Mobile telephone handset use.** These do not emit ionising radiation, so there are unlikely to be any implications for DNA disturbance (related to cancer). Questions remain about whether there are thermal radiation risks, but so far very little evidence exists, and what does exist is hotly debated.<sup>2,3</sup>
- **Mobile telephone masts.** Again, no concrete evidence for an association between childhood cancers and mobile phone base stations.<sup>4</sup>
- **Other kinds of wireless technology** (home and school wi-fi) Again, no evidence<sup>3</sup>
- **Vision and repetitive strain injury.** No evidence for vision effects, but there are emerging reports of musculoskeletal symptoms with prolonged use.<sup>5,6</sup>

### **Behavioural and psychological effects**

Links have been suggested with:

- **Obesity, poor eating habits, and physical inactivity.** There is an intuitive association between activity levels and use of new technology, but in fact the data are not conclusive and it is difficult to detect the direction of effect.<sup>7</sup>
- **Health risk behaviour** – Although there has been a long standing research interest establishing whether television viewing, movies and video game playing are linked to health behaviours such as smoking, drinking and violent behaviour, it is much less meaningful to try to look for these kinds of associations with, for example, internet use, which covers such a wide variety of behaviours and resources. Concern over exposure of young people to

inappropriate alcohol marketing on on-line sites have not yet led to rigorous research studies. Research on the impact of violent computer & video games suggests they may result in increases of aggression.<sup>8</sup>

- **Cyber safety, peer dynamics and bullying** The EU Kids Online survey reported that while 19% of 9-16 year olds report that someone has acted in a hurtful or nasty way to them in the last month, the majority of this was face-to-face, with 5% relating to forms of cyberbullying.<sup>1</sup> The general conclusion is that a small group of young people *are* distressed by cyber bullying, but that this remains a small and perhaps overlapping part of the larger bullying story. The EU Kids Online survey also concluded that while communication with people they had not met was not uncommon among children, it was very rare for them to meet new contacts offline, despite this being a major concern among parents. They estimated that around 3% of 11-16 year olds had been fairly or very upset by sexual messaging. Sexual exploitation through new technologies is a concern for a very small, vulnerable group who are likely to be at risk for a range of reasons, and the UK has specific legislation to protect children from online grooming by sex offenders.<sup>9</sup>
- **Cyber addiction issues.** Aspects of new media use provide continuous rewards and some have argued that this leads to addictive behaviour if it meets certain criteria (such as mood modification, tolerance and conflict) and interferes with daily life.<sup>10</sup>
- **Hyperactivity and concentration.** Excessive television viewing and video game playing have been linked to Attention Deficit Hyperactivity Disorder, although the meaning of the link is unclear.<sup>7</sup>
- **Sleep disruption.** Delayed bedtime and shorter total sleep have been shown to be related to higher levels of use of new technologies.<sup>11</sup>
- **Accidents.** Evidence is beginning to accumulate that young people's pedestrian safety is compromised by mobile telephone use.<sup>12</sup> Adolescent drivers are also at risk, and use of mobile telephones while driving can significantly increase risk of road traffic accidents.<sup>13</sup>

## Gains

There are many ways in which new technologies can contribute to the wellbeing and participation of young people, including:

- **Information gains:** Clearly the internet results in access to a wider range of material on health, faster, and evidence suggests that the privacy offered by internet sources of information particularly appeals to young people and may overcome social and economic barriers. Challenges exist in helping young people find the right kind of reliable information.<sup>14, 15, 16</sup> Home internet use has been linked to academic success among low-income children.<sup>7</sup>
- **Participation.** New forms of media offer new opportunities for all young people to make their views known about health needs and provision, but the opportunities may be particularly salient for youth with disabilities. New technologies may break down barriers, increase a sense of belonging and facilitate interaction with peers. More research is needed here.
- **New methods for health promotion.** Mass media health improvement campaigns using new media have been evaluated as useful<sup>7</sup> and may be particularly appropriate for reaching young people. Mobile telephones and instant messaging offer health promoters new

opportunities to tackle sexual health, immunization reminders, weight loss advice, and diabetes management, for example.

## RECENT REPORTS

### ***New media, new problem: Alcohol, young people and the internet***

Alcohol Concern (2011)

This report arose from a concern about the presence of alcohol companies on Facebook, Twitter, YouTube and other social networking sites. Recommendations include restricting advertising on these sites, and developing clearer guidelines about content. Download from

<http://www.alcoholconcern.org.uk/publications/policy-reports/new-media-new-problem>

### ***Do we have safer children in a digital world? A review of progress since the 2008 Byron review***

Byron T (2010), published by the DCSF

A review on progress since Professor Tanya's Byron's review on the topic to government in 2008. Recommendations relate particularly to the work of the UK Council for Child Internet Safety (<http://www.education.gov.uk/ukccis>), a voluntary organisation chaired by Ministers from the Department for Education and the Home Office. The full review is available at:

<http://media.education.gov.uk/assets/files/pdf/d/do%20we%20have%20safer%20children%20in%20a%20digital%20world%202010%20byron%20review.pdf>. It focuses on a younger age group than

this briefing paper, but has been influential in this area and may provide ways forward for protecting older children too.

### ***Risks and safety on the internet: The perspective of European children. EU Kids Online initial findings***

Livingston S, Haddon L, Gorzig A and Olafsson K (2010), LSE: London, EU Kids Online. Reports of a survey funded by the European Commission's Safer Internet Programme, in order to strengthen the evidence base for policies on online safety. Based on a random stratified sample of 23,000 children aged 9-16, in 23 European countries. Demonstrated the range of diverse and potentially beneficial things that young people use the internet for, and the varied ways in which they do so. Concluded that use was embedded in children's lives, and brought both risks and opportunities, and that the line between them was not always clear. Raised the issue of the social exclusion among those with less access.

### ***Adolescents and Electronic Media: Growing up plugged in***

Brown B and Marin P (2009), Child Trends Research Brief, Child Trends/National Adolescent Health Information Centre

A review of research relating electronic media to the health, social development and education outcomes of young people. [http://www.childtrends.org/files/child\\_trends-](http://www.childtrends.org/files/child_trends-2009_05_26_rb_adolelecmedia.pdf)

[2009\\_05\\_26\\_rb\\_adolelecmedia.pdf](http://www.childtrends.org/files/child_trends-2009_05_26_rb_adolelecmedia.pdf)

### ***Protecting Children from Online Sexual Exploitation***

Jones V and Quale D (2005) Save the Children, Denmark

Balanced overview containing useful data, particularly relating to unintentional exposure to sexually explicit material and the risks of internet chat rooms. The authors emphasise that child protection procedures need to be constantly updated and revised in cooperation with law enforcement and

child protection services if we are going to keep pace with developments. They also stress the importance of empowering young people to protect themselves.

[www.childscope.net/2009/httpdocs/publications/cddea67ce2be65c6c725b6513e782bcf.pdf](http://www.childscope.net/2009/httpdocs/publications/cddea67ce2be65c6c725b6513e782bcf.pdf)

### **Cell phones and cancer risk**

Useful, succinct report by the National Cancer Institute at the National Institutes of Health in the USA, summarising the findings on links between phone use and cancer and concluding that there is no convincing evidence for a link.

[www.cancer.gov/cancertopics/factsheet/Risk/cellphones](http://www.cancer.gov/cancertopics/factsheet/Risk/cellphones)

### **Mobile telecommunications and health research programme, Report 2007**

Set up in response to the 2001 Stewart report, and funded by both government and industry, the MTHR supported 28 research projects up to the mid 2000s. None of the research published by the date of this report had demonstrated that biological or other adverse health effects were produced by radiofrequency exposure from mobile telephones.

[www.mthr.org.uk/documents/MTHR\\_report\\_2007.pdf](http://www.mthr.org.uk/documents/MTHR_report_2007.pdf)

## **USEFUL REVIEWS**

### **Interventions using new digital media to improve adolescent sexual health: A systematic review.**

Guse K, Levine D, Martins S et al (2012) *Journal of Adolescent Health*

Review of 942 papers resulted in 10 papers meeting the research-inclusion criteria. Eight related to web-based interventions, one used mobile phones, and one used another form of instant messaging. Interventions were directed at condom use, abstinence attitudes, knowledge of HIV and STIs, etc. Results were usually positive but sometimes went in unpredicted directions, with some interventions unexpectedly resulting in development of more potentially risky attitudes to sexual health.

[www.sciencedirect.com/science/article/pii/S1054139X12001358](http://www.sciencedirect.com/science/article/pii/S1054139X12001358)

### **The digital revolution and adolescent brain evolution**

Giedd J (2012) *Journal of Adolescent Health*, 51, 101-105

Jay Giedd is one of the leading scientists in adolescent brain development, and this is his review on the ways in which new digital technologies affect the way adolescents learn, play and interact. He reviews evidence relating to education (benefits of the ease of information access), entertainment (including the effects on the brain of playing video games, and research on sex and violence effects), and evidence relating to the social interactions in the Facebook era.

[www.ncbi.nlm.nih.gov/pubmed/22824439](http://www.ncbi.nlm.nih.gov/pubmed/22824439)

### **Electronic media use and sleep in school-aged children and adolescents: A review**

Cain N, Gradisar M (2010) *Sleep Medicine*, 11, 735-742

The first comprehensive review to address the association between new technology and sleep in this age group. Delayed bedtime and shorter total sleep time are reliably associated with media use. However, we need to know more about why there are these links; what is driving what?

[www.ncbi.nlm.nih.gov/pubmed/20673649](http://www.ncbi.nlm.nih.gov/pubmed/20673649)

**Public health implications of wireless technologies**

Sage C and Carpenter D (2009) *Pathophysiology*, 16, 233-46

Argues for new biologically based public exposure standards for chronic exposure to low-intensity wireless radiation. Existing safety standards focus on thermal effects only.

[www.ntia.doc.gov/legacy/broadbandgrants/comments/6E05.pdf](http://www.ntia.doc.gov/legacy/broadbandgrants/comments/6E05.pdf)

**Electronic media, violence and adolescents: An emerging public health problem**

David-Ferdon C and Hertz M (2007) *Journal of Adolescent Health*, 41, S1-S5

Introduction to a special issue on the topic, looking at the potential benefits and risks of use of new media technology. Draws attention to both the positive social and learning opportunities, and also a degree of risk, including risk of electronic aggression.

[www.sciencedirect.com/science/article/pii/S1054139X07003643](http://www.sciencedirect.com/science/article/pii/S1054139X07003643)

**RECENT RESEARCH**

There is a growing research literature on how to use new technology for sexual health promotion and illness management in adolescence. There is also an equivocal research literature on the physical harms from microwave radio signals emitted by mobile telephones. Other research questions have been less well addressed. Some interesting recent examples from the literature include:

**Brain tumour risk in relation to mobile telephone use: results of the INTERPHONE international case-control study**

Cardis E et al (2010), *International Journal of Epidemiology*, 39, 675-694

The Interphone study is a series of multi-national case-control studies, run by the International Agency for Cancer Research (IARC) to explore the radiation risks from mobile phones. Results were published in 2010 in the *International Journal of Epidemiology*

(<http://ije.oxfordjournals.org/content/39/3/675.full.pdf+html>), causing a flurry of media comment and debate, as the results were not clear cut (see this discussion piece in the *Journal of the National Cancer Institute* - <http://jnci.oxfordjournals.org/content/102/13/928.full.pdf+html>).

The general conclusion was that the risk had not been established, despite the huge costs and robust design of the study. The JNIC article concluded "The Interphone study has neither reassured the concerned or convinced the sceptics of a link" (p929)

**Adolescents perspectives on the use of a text messaging service for preventative sexual health promotion.**

Perry R, Kayekjian K, Braun R et al (2012) *Journal of Adolescent Health*, 51, 220-225

Teens at clinics in Los Angeles County participated in focus groups, and concluded that the use of text messaging is an innovative way to deliver messages and encourage better health protection.

They appreciated the helpfulness, convenience and relevance of the message content. Available on-line at [www.jahonline.org/article/S1054-139X\(11\)00645-8/fulltext](http://www.jahonline.org/article/S1054-139X(11)00645-8/fulltext)

**The effectiveness of SPARX, a computerised self-help intervention for adolescents seeking help for depression: randomised controlled non-inferiority trial**

Merry S, Stasiak K, Shepherd M, Frampton C, Fleming T and Lucassen M (2012) *BMJ*, 344 available online at [www.bmj.com/content/344/bmj.e2598/rr/591965](http://www.bmj.com/content/344/bmj.e2598/rr/591965)

Innovative and effective computerised cognitive behavioural therapy delivered in the form of an interactive fantasy game. The young person chooses an avatar and undertakes a series of challenges to restore the balance in a world dominated by GNATs (Gloomy Negative Automatic Thoughts). As they succeed in beating the thoughts, they move up through the game's levels. A control group was allocated to treatment as usual. Results indicated that SPARX results were similar to those in regular treatment. The authors conclude "SPARX is a potential alternative to usual care for adolescents presenting with depressive symptoms in primary care settings and could be used to address some of the unmet demand for treatment."

***MEMO – a mobile phone depression prevention intervention for adolescents: Development and postprogram findings on acceptability from a randomised controlled trial.***

Whittaker R, Merry S, Stasiak K et al (2012) *Journal of Medical Internet Research*, 14, 1, pages e-13. Similar to the SPARX project, and including some of the same team members, the study explored the novel mobile phone delivery of a depression intervention developed from 15 key messages derived from cognitive behavioural therapy. A fully automated system delivered two messages a day for nine weeks, using text, video and cartoon messages. A randomised controlled trial suggested that CBT can be successful delivered by mobile telephone and that young people welcomed the format. Effectiveness in terms of outcomes is still being assessed.

[www.ncbi.nlm.nih.gov/pubmed/22278284](http://www.ncbi.nlm.nih.gov/pubmed/22278284)

***Electronic media use and adolescent health and well-being: Cross-sectional community study.***

Mathers M, Canterford L, Olds T, Hesketh K, Ridley K, Wake M (2009) *Academic Pediatrics*, 9, 307-314 [www.sciencedirect.com/science/article/pii/S1876285909001016](http://www.sciencedirect.com/science/article/pii/S1876285909001016)

Results of a large cross-sectional survey drawing on an Australian school-based population study, including completion of computerized time-use diaries. Interestingly the direction of association (with either positive health or depression/behaviour problems) varied according to the media. Higher levels of computer use was associated with less psychological distress, whereas high video game use was associated with poorer health ratings. Television and telephone durations were not associated with health outcomes.

## **POLICY AND GUIDELINES**

- American Academy of Pediatrics (screen time, 1-2 hours, no screen media in bedrooms, co-view with adults, and discuss content).
- Department of Health/NHS guidelines on 'Mobile phones and base stations'. The UK Chief Medical Officers advise that children and young people under 16 should be encouraged to use mobile phones for essential purposes only and to keep calls short. However, the conclusion in the leaflet is that no health risks have been demonstrated.  
[www.dh.gov.uk/prod\\_consum\\_dh/groups/dh\\_digitalassets/documents/digitalasset/dh\\_124899.pdf](http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_124899.pdf)
- UK Council for Child Internet Safety (UKCCIS)
- Health Protection Agency health advice on mobile phones  
[www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/ElectromagneticFields/MobilePhones/info\\_HealthAdvice/](http://www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/ElectromagneticFields/MobilePhones/info_HealthAdvice/)
- GSMA Europe: The European mobile industry developed, with the endorsement of the European Commission, the 'European Framework for Safer Mobile Use by Younger

Teenagers and Children’. Recommendations relate to classification of content, parental control mechanisms, investment in awareness-raising and fighting illegal content:

[www.gsma.com/publicpolicy/wp-content/uploads/2012/03/GSMA\\_Exec\\_Summary\\_P011.pdf](http://www.gsma.com/publicpolicy/wp-content/uploads/2012/03/GSMA_Exec_Summary_P011.pdf)

## CONCLUSION

Many people advocate taking a precautionary approach to understanding the health implications of new technologies, given the lack of evidence and their widespread use. However, there is very little in the way of indication of long-term harm. In terms of mobile phones, for example, this results in recommendations to keep the handset a little distant from the body – some recommend wired earpieces or speakerphones – until the full risks from long-term exposure to microwave radio transmission have been established. In fact, the risks from accidents while distracted by phone and ipod use seems much more significant.

But this reflects just a concern with the actual hardware, not with the psychological impacts on how we learn and interact. In this respect, research clearly indicates new technologies as a force for good in health promotion, but also suggest some areas where there are concerns. New technologies are so embedded in young people’s lives, with their use being prescribed by, for example, school and college, that the challenge becomes maximizing the benefits and minimizing harm, rather than suggesting new technologies should somehow be avoided. Empowering young people to deal with the risks of, for example, viewing unsolicited sexually explicit material, is a part of this. We would note that there are some large research gaps in the whole area, and the fact that the technology changes all the time makes it a particular challenge to construct an evidence base. However, the opportunities for health promotion advances make it worth encouraging new and innovative ways of communicating with young people and delivering their services.

## Examples of useful resources (extended list in our full research update)

- Child Net International (<http://www.childnet.com/>)
- Beatbullying <http://www.beatbullying.org/>
- BBC <http://www.bbc.co.uk/cbbc/topics/stay-safe>
- Child Exploitation and Online Protection Centre <http://ceop.police.uk/>
- UK Council for Internet Safety <http://www.education.gov.uk/ukccis>



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