THEMED REVIEW

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A Review of Small Screen and Internet Technology–Induced Pathology as a Lifestyle Determinant of Health and Illness

Abstract: *Most advances in humanity have been related to the discovery or introduction of new innovations and/or technology. There should be no suggestion that all technology is pathological or that major advances in health, science, and well-being have not come from industrial and technological advances. However, just like the invention of the wheel would have no doubt caused people to be injured and modern lifesaving medicines can have side effects, modern technology can have a downside, which needs to be recognized. This article explores some of the pathologies linked to small screen and internet technologies (personal computers, communication devices, and the internet). The uptake and impact of this set of technologies is pivotal in redefining our lifestyle behaviors and environment: the way we work, shop, seek entertainment, communicate, socialize, reproduce, interact with the environment, and seek information.*

Keywords: technology; pathology; lifestyle medicine illness prevention; chronic disease management

Life is like riding a bicycle. To keep your balance, you have to keep moving.

—Albert Einstein

them to chronic disease under the acronym, “NASTIE MAL ODOURS” (Nutrition, Activity, Stress anxiety depression, Techno-induced pathology, Inadequate sleep, Environment,

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Introduction: The Good and the Bad of Technology

In the model of lifestyle determinants of health developed by Egger et al^{1,2} there are up to 15 determinants, generically labeled “anthropogens.” The anthropogens that have so far been identified have an evidence base linking

Meaninglessness, Alienation and Loss of culture, Occupation, Drugs smoking alcohol, Over and underexposure, Relationships, Social inequity). One anthropogen that is not often considered induces illness and disease through the very advances in technology that are recognized for improving health and living standards. It is labeled “technology-induced pathologies” (TIPs).

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Some of the effects of TIP fit into the category of an injury rather than an illness or disease. Others have more chronic effects that are also systemic. Yet despite the ill-defined nature of these effects, the category is destined to expand with further likely expansions of technology.

The Changing Nature of Health

Human health is paved with evolving challenges: nomadic existence, for example, predisposed humans to the elements and injury, agrarianism to zoonotic diseases, and urbanization to the spread of pestilence-related ailments. In recent times, lifestyle and modern environments have become the main drivers of lifestyles and, thus, the dominant etiology. It is not just what we eat and do, but the vagaries of modern times that pose new, albeit, less-obvious challenges.

Unquestionably, poor nutrition, inactivity, and stress can all contribute to ill-health.² But the association of disease with certain modern forms of technology is often overlooked. Problems can vary from death or chronic pain from motor vehicle or machine injuries to hearing problems from amplified music.³ At the extremes, they can range from death and disability from firearms and high-tech weapons used in warfare to apparently obscure problems such as screen dermatitis⁴ and other skin disorders.⁵ There is a body of evidence developing to show TIP related to increases in cases of impaired vision, repetitive strain injury from excessive computer and small screen use,⁶ skin damage from sun beds,⁷ cell physiology disturbances from endocrine-disrupting chemicals, such as phthalates from plastics and other industrial chemicals and processes.⁸

Other adverse health outcomes (death, injury) can occur, for example, while focusing on the new technology of social media (eg, texting, tweeting) while carrying out other activities, such as driving.^{9,10} Because of its immediacy, social media bullying and intimidation can lead to mental health issues and

even suicide among prone youth. Strange as it may seem, “Facebook depression” has already hit the medical literature.¹¹ Social contagion effects on disease are also amplified through social media, as shown in the association between social networks and disease risks such as obesity and smoking.^{12,13}

Another of the vicarious outcomes of our modern technology is that we are staying indoors more often. This has led to a growing phenomenon called nature deficit disorder.¹⁴ Especially noticeable in children, according to Louv,¹⁴ it mimics the spectrum of attention deficit disorder. The increasing use of technology can also alter other behaviors such as snacking and reduced physical activity.

Technology’s “Hormetic” Effect

Most advances in humanity have been related to the discovery or introduction of new innovations and/or technology. There should be no suggestion that all technology is bad or that major advances in health, science, and well-being have not come from industrial and technological advances. But just like the invention of the wheel would have no doubt caused people to be run over and modern lifesaving medicines can have side effects, modern technology can have a downside, which needs to be recognized.

One set of technologies that is having a big impact on the human race at the moment is the small screen and internet technologies (personal computers, communication devices, and the internet). The uptake and impact of these are pivotal in redefining the way we work, shop, seek entertainment, communicate, socialize, reproduce, interact with the environment, and seek information—that is, the way we live. As with the introduction of all new technologies, there is a corresponding adaptation of human behavior and lifestyle, with positive and negative outcomes for some, that accompanies the progress. Some potential pathological outcomes of this type of technology are described below:

1. *Adolescent obesity and physical well-being:* In general, the literature suggests that screen time for many adolescents, especially, is related to many determinants of ill health. This includes a reduction in physical activity¹⁵⁻¹⁷ and an increased intake of calorie-dense food, both of which can be determinants of obesity, metabolic disorder, and chronic disease. A World Health Organization project supported these reports and also found a decreased intake of vegetables and fruit among adolescent screen users, suggesting that they will be at an increased risk for cancer and other specific nutritional deficit disorders.¹⁸ Research also indicates that screen time can increase sleep disruption, which is also a determinant of obesity, chronic disease, and poor mental health, by (a) reducing hours available for sleep for an increasing number of adolescent late-night users¹⁹ and (b) interfering with melatonin production. Melatonin is the hormone produced in the brain that determines the quality and quantity of one’s sleep.²⁰ Decreased screen time in this same population was shown to improve melatonin production and sleep.²⁰ Bener et al²¹ also found that there is a relationship between increased screen time, obesity, and poorer vision for adolescent screen users.
2. *Mental health:* There are increasing reports of mental health issues in adolescents being associated with cyberbullying, which is being viewed as a new form of violence expressed through electronic media. A systematic review by Bottino et al²² reported that the prevalence of cyberbullying ranged from 6.5% to 35.4% of all social media users. Cyberbullying is associated with moderate to severe depressive symptoms, substance use, suicidal ideation and suicide attempts. The research found that a reduction in screen time reduces cyber bullying.^{2,23} As mentioned previously, studies identifying Facebook depression have

also reported an association between the use of social media, self-esteem, and body image, and depression and anxiety.^{23,24}

3. *Addictive characteristics:* These are conceptualized as impulse control disorders stemming from pathological internet use (PIU). Research has indicated a potential link between PIU and psychopathology, such as depression and symptoms of attention deficit/hyperactivity disorder.²³ O'Connor et al¹⁰ have shown that motor vehicle injuries are associated with heightened anticipation about incoming phone calls or messages, which they use as an example of PIU. Similarly, according to Kuss and Griffiths,²⁵ internet gaming addiction is linked to behavioral problems largely because of lack of sleep and inactivity. The tabloid literature is reporting deaths related to gaming addiction through exhaustion, dehydration, and embolism. One report is of a 17-year-old boy dying after internet gaming for 22 consecutive days without a break (<http://www.news.com.au/world/europe/russian-teenager-dies-after-playing-online-computer-game-defence-of-the-ancients-for-22-days-in-a-row/news-story/7f178341c80c5896a9c8c315b8e5c9b6>).
4. *"Phantom vibration" or "phantom ringing."* Phantom ringing or phantom vibration is described as a sense that a phone is ringing or vibrating when it is not. Men who carry mobile phones in their pockets, for example, describe a real vibration felt in their quadriceps that mimics their telephone signaling an incoming call. It is thought to be a form of involuntarily activated muscle memory related to ongoing exposure to the actual physical stimulus of the phone ringing or vibrating and potentially the electromagnetic radiation emitted by the device. In a systematic review of the field, Deb²⁶ expects phantom ringing to increase with potential implications for people with mental illness issues. Although phantom ringing may seem benign

enough in itself, it is an indicator that our small screens are having an effect on humans at a neurocellular level on a global population scale. The outcomes of phantom ringing are not as yet measured as significant in effect while using current methodologies but nor was asbestos known to be a cause of mesothelioma before the use of the X-ray and the evolution of lung biopsy.

5. *Human reproduction:* At a base level, small screen devices may also affect human reproduction. A systematic review and meta-analysis by Adams et al²⁷ concluded that pooled results from in vitro and in vivo studies suggest that the electromagnetic radiation from mobile phone exposure might negatively affect sperm motility, viability, and concentration. Further study is required to determine the full clinical implications for both subfertile men and the general population.

The Future of Researching Technopathology

Disease related to technopathology, like much modern chronic disease, is unlikely to respond to sophisticated medical intervention (except for palliation). Proper management requires vigilance and awareness, and use of the legislative/regulative arms of public health and health promotion, as has been effective in aspects of injury prevention to date (seat belt use, pool fences, bike helmets, random breath testing, etc). Avoiding allegations of promoting a "nanny state" will tend to temper these future health actions. Still, there will be a price to pay for advances in economic wealth in order to make this genuine human "wellth," if Ruskin's ideas of "illth" are to be taken seriously. Given that modern technology is mostly corporatized and the bigger corporations who develop and market the technology are politically powerful organizations, health professionals need to remain vigilant to the future veracity of research that reveals disease—or the lack

of it—related to the deployment and uptake of new technologies. Without scientific vigilance, truth itself may indeed become a TIP.

The scholarship of TIP is a green field. There is, however, already significant evidence, as shown above, to suggest that TIP is a lifestyle determinant of actual and potential disease. As with all the lifestyle determinants of disease discussed by Egger et al,² they are not inevitably linked to disease if ways can be developed and learned to manage them within our lifestyles and environment. There will undoubtedly be more to come in the future, ironically, as the evolution of technology enhances the methodologies in measuring TIPs.

Summary

It may not be unexpected that lifestyle-related problems can arise from the overuse of modern technology and that this is likely to increase with the technological revolution. Dealing with such problems may simply involve desisting in use of the offending technology; however, this may be easier in theory than in practice in a society that has become dependent on all forms of technology within employment and recreation, especially small screen and internet technologies. The success of the human race has largely been attributed to its ability to adapt to its environment, and there is no reason or evidence to suggest that this ability will be absent in the evolving technological revolution.

Authors' Note

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Ethical Approval

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