Health Impact of Excessive Screen Time

A Smoldering Crisis for Organizations

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Purpose: *This paper is a review of research pointing to a smoldering crisis – the negative effects of computers and screen time among organizations employees.*

Approach: *The approach is a review of screen time studies. Since limited research has specifically addressed impact on workers, research on other populations will be shown with implications to workers. We conclude by discussing recommendations to reduce hazardous impact and their controversies.*

Findings: *The paper addresses research on health issues of excessive use of screen time:*
1. Vision problems
2. Musculoskeletal problems
3. Sleep problems
4. Increased stress
5. Undesirable eating habits
6. Shortened life expectancy
7. Cardiovascular health problems and diabetes
8. Cognitive problems from atrophy of brain areas and functions negatively impacting: a) executive functions such as planning, prioritizing, organizing; b) our capacity to develop empathy and compassion for others and ability to integrate physical signals with emotion; c) the suppression of socially unacceptable impulses; d) the loss of communication within the brain; e) functions of movement, memory, pleasurable reward, attention, sleep, mood, and learning.

Research implications: *This review of previous research and the framework can be used for primary research on excessive screen time impact in organizations.*

Practical implications: *Health impact of excessive screen time is a serious business problem for organizations -- it is not generally recognized but which may generate negative news coverage if or when it goes 'public' and could result in reputational loss and other costs.*

Keywords: *Screen time; health impact; smoldering crisis*

Paper type: *General review*

Smoldering Crisis – Negative Effects of Computers and Screen Time among Employees

A smoldering crisis is defined as a serious business problem that is not generally recognized but which may generate negative news coverage if or when it goes 'public' and could result in fines, penalties, legal damage awards, unbudgeted expenses, and other costs (Encyclopedia for Small

Business, 2016). Many smoldering crises have emerged in the past, including asbestos in the workplace (Goguen, 2016). Other categories include government regulatory actions, litigation, product recalls, and investor or consumer activism.

This paper is an initial exploration of a smoldering crisis rarely talked about – the negative effects of computers and screen time among organization employees.

We spend a great deal of our time connected to a screen – including computers, mobile devices and televisions. How much time do you spend in front of a screen? It is more than you think. When you review your day, taking into account that you watch the weather channel when you wake up, then check your email, then surf Facebook on your smart phone on the bus to work, then work 8 hours on a computer and checking Twitter on your smartphone, come home and put the TV news on over dinner, then tune into your favorite prime time shows while periodically checking in with Facebook, you realize that nearly all of your waking hours are spent in front of a screen.

In 2014, average time spent per day for US adults in front of a screen with major media is 10 hours and 18 minutes. They are in front their televisions for an average of 4 hours 28 minutes per day. Online and mobile devices combined add 5 hours 46 minutes. Again, total is 10:18 minutes average per person (eMarketer, 2014). The trend toward more screen time is increasing and is about 1 ½ hours more per day than in 2010. Mobile (nonvoice) is the primary driver of the increased screen time. 64% of American adults now own a smartphone of some kind, up from 35% in the spring of 2011 (Smith, 2015). Industry analysts argue that it is "increasingly clear that consumers see no significant divide between digital and traditional media: what they want is more flexibility, freedom and convenience in when and how they consume any kind of content. Instead of a divided landscape, what we have is a fluid and multifaceted ecosystem – one where new digital offerings have created a bigger, more diverse content universe, and where digital has accelerated delivery across platforms" (PwC, 2016). Industry will continue to supply more of what the consumer wants, and consumer time spent with media will likely continue to increase.

The work environment is also contributing. For many of the approximately 40 percent of American workers considered to be white-collar workers, work means staring at a computer for the better part of eight hours a day (Rickert, 2013).

A large block of that time is spent in the workplace or work-related outside the office. Computers and mobile devices have transformed the workplace and society as a whole, providing countless tools for business and easier access to information. However, there are negative effects. Some are on processes, but the potential flashpoints are the health effects on workers.

Clearly, we spend a great deal of our time connected to a screen – including work, television, Internet browsing and mobile phones. It is a fair question to ask. What is the harm in using screens all the time if they increase productivity and keep you connected to the world and to each other? This review of recent research on the hazards of excessive screen time indicates major impact – and it is not good.

Process Problems with Excessive Screen Time for Employees

Three process problems with excessive screen time are highlighted: 1. Communication breakdowns, 2. Distractions; 3. Disconnectedness

Communication breakdowns

Due to the prevalence of computers and smartphones in the workplace, email, texting and messaging are now common modes of professional communication – with many miscommunication issues. Many employees struggle with successfully communicating messages because of writing skills. Even the most-skilled writer, however, can fail in the tone in electronic messages. Messages meant as neutral can be interpreted as critical (Markovich, 2016).

Distractions

According to CNET News, office workers are interrupted approximately every three minutes by emails, instant messages, phone calls or other distractions. This decreases productivity as it takes eight minutes for the brain to achieve a creative state (Fried, 2005).
In addition to legitimate work-based interruptions, technology-driven distractions such as social media, online games and news feeds distract employees.

Disconnectedness

A sense of disconnectedness can stem from a various areas. According to Communications Workers of America, "many jobs have become more fragmented and job tasks have been narrowed, leaving workers more disconnected from the final product." This disconnectedness can lead to less workplace satisfaction and more workplace boredom. In addition, collaborating and communicating via computers instead of in person can leave employees feeling disconnected from their peers and superiors (Markovich, 2016).

Health Hazards of Excessive Screen Time

Computer-induced health problems can be an umbrella term for the various problems a computer user can develop from prolonged or incorrect computer use.

It is the potential health hazards that create the smoldering crisis for organizations. There are eight categories: 1. Vision problems; 2. Musculoskeletal problems. 3. Sleep problems; 4. Increased stress; 5. Undesirable eating habits; 6. Shortened life expectancy; 7. Cardiovascular health problems and diabetes; 8. Cognitive problems

Vision problems

Eye strain from hours of screen time can result in eye irritation, dryness, fatigue, blurred vision, and near sightedness are increasingly common. Staring at a computer monitor for hours on end has also become a part of the modern workday. Inevitably, all of that staring can put a real strain on your eyes (Krivich, 2013).

The name for eye problems caused by computer use is computer vision syndrome (CVS). CVS is not one specific eye problem. Instead, the term encompasses a whole range of eye strain and pain experienced by computer users.

Research shows computer eye problems are common. Somewhere between 50% and 90% of people who work at a computer screen have at least some symptoms of eye trouble (WebMD, 2015).

Most digital screens are backlit and emit blue light, or high-energy visible (HEV) light wavelengths, which can cause irritation and possibly long-term damage to the retina. Blue light is also known to suppress the sleep hormone melatonin, causing an artificial feeling of wakefulness and disrupting sleep patterns, which can add to eye strain (Seidman, 2015).

Dryness, caused by reduced blinking while staring at screens, is also a common factor in digital eye strain. A person's blink rate -- normally about 15-20 times per minute -- can decrease by up to half when people are fixated on what they're viewing on a screen.

Just like other muscles in the body, the eyes need a varied "workout" and some respite from prolonged strain (Seidman, 2015).

Findings, originally published in the *American Journal of Human Genetics*, point to lifestyle factors rather than genetics. In Sweden, 50% of 12-year-old children are shortsighted. That is expected to be 70% by the time they are 18. More than 34 million Americans have myopia, projected to reach 40 million by 2030 (Seidman, 2015).

Musculoskeletal problems

Another medical issue caused by the use of computers is back and posture problems. These problems relate to musculoskeletal disorders caused by the need for the user to be crouched and hunched. Wahistrom (2005) found that women are at a greater risk than men to suffer from musculoskeletal problems than men. Women may assume more taxing positions while working than men do due to differences in anthropometrics. Anthropometrics (human measurement) is concerned with the physical sizes and shapes of humans.

Traditionally the medical problem associated with computer-related work is carpal tunnel syndrome (CTS). CTS is a stress-related injury caused by repetitive movement of joints, especially the wrist, and can lead to numerous musculoskeletal problems. It has become very common among computer professionals due to poorly placed computer components and extensive typing over a long period (Ali and Sathiyasekaran, 2006).

Studies conducted show that one in eight computer professionals suffer from CTS(Anderson *et.al*., 2003). This study was conducted over 21 companies and the majority of sufferers said that they experienced acute and in some cases severe pain due to CTS. The main cause of CTS seems to be debatable, however, with some saying that the syndrome is predominantly caused by the acute positioning of the wrist while typing and this problem is exacerbated by the need for the user to be crouching towards the screen while typing. Others cite the mouse as being the main cause of CTS (Anderson *et.al*, 2003).

Employers in major companies are also taking measures to ameliorate CTS by implementing frequent work breaks and work rotation procedures to ensure that employees are not working on a single computer for hours on end. A higher level of intensity of computer work results in higher risk for CTS.

In a study of the prevalence of health disorders among computer professionals and its association with working environment conditions, researchers used a sample of 200 computer professionals, from Delhi and NCR that included software developers, call center workers, and data entry workers (Talwar et. al., 2009). The prevalence of visual problems in the study group was 76% (152/200), and musculoskeletal problems were reported by 76.5% (153/200). It was found that there was a gradual increase in visual complaints as the number of hours spent for working on computers daily increased and the same relation was found to be true for musculoskeletal problems as well. Visual problems were less in persons using antiglare screen, and those with adequate lighting in the room. Musculoskeletal problems were found to be significantly lesser among those using cushioned chairs and soft keypad (Talwar et. al., 2009).

Excessive use of smartphones and other hand-held mobile devices can also cause musculoskeletal problems. Kim and Kim (2015) investigated the use of smartphones by university students in selected areas, their musculoskeletal symptoms, and the associated hazard ratio. This involved the completion of a self-administered questionnaire by dental hygiene students in Seoul, Gyeonggido, and Gyeongsangbukdo. The 292 completed copies of the questionnaire were then analyzed. The most painful body regions after the use of smartphones were found to be the shoulders and neck.

The use of hand held devices such as mobile phones, game controls, tablets, portable media players and personal digital assistants have increased dramatically in past decade.

While sending a text message or using the controls of the handheld device, the users need to use their thumb and other palm muscles extensively. Deepak *et.al*. (2014) concluded that mobile phones and devices that promoted the predominant usage of thumb or only one finger while texting or using the controls were associated with a higher prevalence of musculoskeletal problems. Treatment using a sequenced rehabilitation protocol was found to be effective.

Sleep problems

An additional hazard of screen time is its effect on sleep for adults and children. Getting engrossed in a TV show, video game or Internet social media often delays bedtime and stimulates the brain, further delaying sleep (Cain and Gradisar, 2010). Exposure to the bright light radiating from a TV or computer screen close to bedtime inhibits the body's melatonin production, making it more difficult to fall asleep (Van den Buick, 2010).

Both evening and daytime screen time can adversely affect nighttime sleep for children. A study of 3 to 5 year olds found that sleep problems were more likely with exposure to violent content during the day and any screen time after 7:00 p.m. (Garrison *et.al*, 2011).

Increased stress

Learning new computer skills and programs can put stress on workers, especially older or less-educated workers. In addition to this, employees are constantly connected to co-workers, clients,

vendors and business networks throughout the workday. Because interactions can happen instantaneously, often with a desire for instant responses, this can cause additional stress in the workplace (Markovich, 2016). Orman (2010) discussed 10 causes for computer related stress for employees. Most are employee failings, such as failing to anticipate problems.

Undesirable eating habits

The classic "coach potato" image -- becoming fat and unhealthy from watching too much TV – is well grounded in scientific research. In a study of 11,658 children aged 5-19, researchers collected information on height, weight and time spent watching television after school. They found that for every 30 minutes of average daily viewing of television, a child is 21 percent more likely to be obese (Tudor-Locke *et.al*, 2011).

Food advertisements, in addition to lack of physical activity, often are blamed for childhood obesity. Fast food commercials are twice as common and candy commercials three times as likely during children's programs compared with adult programs (Neville and Bauman, 2005). Another investigation found that ads for unhealthy foods are rampant during children's TV shows around the world (Kelly *et al*., 2010).

Do these commercials make a difference in how kids eat? Research suggests that they do. A study of fifth and sixth grade students revealed that those who watch more television have for positive attitudes toward junk food (Dixon *et. al*., 2007). Furthermore, teenagers surveyed in another study reported more consumption of heavy sugar beverages and foods, if they watched more than two hours of TV daily (Rey-Lopez et. al., 2011). An earlier study found for every two hours of daily TV viewing increases obesity risk by 23 percent and diabetes risk by 14 percent (Hu et. al., 2003).

Commercials are not the only reason screen time is associated with poor eating habits. Distractions while eating seem to dull the sensory experience, resulting in less satisfaction and more likelihood of overeating later to compensate. College students who ate lunch while watching TV were less able to recall what they ate and consumed more snack food later compared with students who ate identical lunches without the TV on (Higgs and Woodward, 2009). Similar results were found when participants played video games while eating (Oldham-Cooper et. al., 2011).

A 2012 U.S. Department of Agriculture publication (USDA 2012) noted, "strong and consistent evidence in both children and adults ... that screen time is directly associated with increased overweight and obesity."

Shortened life expectancy

In one study, people who watch an average of six hours of TV daily have a life expectancy of nearly five years less than those who watch no TV (Beckford, 2011). Another shocking statistic from the study is that, on average, for adults over age 25, each hour of TV time takes 21.8 minutes off life expectancy (Veerman et al., 2012). Research also associates screen time with higher mortality from all causes (Dunstan *et. al*., 2010).

Cardiovascular health problems and diabetes

Excessive screen time links with several health risks beyond obesity. Research connected watching over two hours of TV daily to increased risk of type 2 diabetes and cardiovascular disease, blaming both unhealthy food choices and replacement of physical activity with TV. The study found that every two hours of daily TV viewing increases obesity risk by 23 percent and diabetes risk by 14 percent (Grontved and Hu, 2011).

Even among younger people, cardiovascular risk is connected to screen time. A study of seventh grade students in Australia found significant increases in blood pressure for every hour spent in front of the TV or computer (Tohidi et. al., 2012).

Cognitive problems

A variety of screen time –brain linkages have been identified in the research literature. Lin and Zhou *et. al.* (2012) concluded about brain scan studies on Internet and gaming addiction: "Taken together, internet addiction is associated with structural and functional changes in brain regions involving emotional processing, executive attention, decision making, and cognitive control."

Studies indicating atrophy of gray matter areas where processing occurs in internet/gaming addicted subjects include Zhou *et al* (2011), Yuan *et al* (2011), and Weng *et al* (2013). Areas affected included the frontal lobe, which governs executive functions, such as planning, planning, prioritizing, organizing, and impulse control. Volume loss was also seen in the striatum, which is involved in reward pathways and the suppression of socially unacceptable impulses. Additionally, there is gray matter reduction in an area known is the insula, which is involved in our capacity to develop empathy and compassion for others and our ability to integrate physical signals with emotion.

Studies indicating increased problems with white matter integrity include Lin *et al (*2012), Yuan *et al* (2011), Hong *et al* (2013) and Weng *et al* (2013). Reduced white matter integrity translates into loss of communication within the brain, including connections to and from various lobes of the same hemisphere, links between the right and left hemispheres, and paths between higher (cognitive) and lower (emotional and survival) brain centers. White matter also connects networks from the brain to the body and vice versa. Interrupted connections may cause signals to slow down, short-circuit or misfire.

Several studies link cognitive impairment and screen time. Hong *et al* (2013), and Yuan *et al* (2011) found reduced cortical thickness (the outermost part of the brain) in the frontal lobe of online gaming addicts (late adolescent males and females) correlated with impairment of a cognitive task.

Other studies have found less efficient information processing and reduced impulse inhibition (Dong *et al*, 2012), increased sensitivity to rewards and insensitivity to loss (Dong *et al*, 2013, and abnormal spontaneous brain activity associated with poor task performance (Yuan *et. al*., 2011). Uhls *et al* (2014) found that sixth-graders who went five days without even glancing at a smartphone, television or other digital screen did substantially better at reading human emotions than sixth-graders from the same school who continued to spend hours each day looking at their electronic devices.

Other findings in internet addiction include reduced numbers of dopamine receptors and transporters (Kim, 2011) and (Hou, 2012). Some notable functions of dopamine are movement, memory, pleasurable reward, attention, sleep, mood, and learning.

Controversy about Recommendations for Screen Time Reduction

For decades, the American Academy of Pediatrics (AAP, 2015) has warned that children need to cut back on their screen time. The group's latest prescription: Entertainment "screen time" should be limited to two hours a day for children ages 3-18. For 2-year-olds and younger, none at all. The Centers for Disease Control and Prevention (CDC) reinforced the same time limit recommendations (CDC, 2002).

Of course, there is some controversy. Even the AAP debates modifications (AAP, 2014) Zero to Three, a nonprofit research organization focused on infants, toddlers and their families, published "Screen Sense: Setting the Record Straight" (Zero to Three, 2015). The report summarized existing research and encouraged child-adult interactions. It concluded that screen time is most effective when adults and children use electronic devices together.

As media multiplies, it is increasingly difficult to manage screen time. Decades ago, television and radio were the only tech distraction. Now have smartphones, tablets and laptops — not to mention electronic games.

A recommendation from Summers (2014) is to media a part of our lives, but in a planned, sensible way. Families should encourage a "healthy media diet" for their children. Parents and kids should work together to decide how much time to spend with media every day, and to make sure good choices are being made about what media to take in.

A sensible rule set for adults comes from Monahan (2013):

- Establish three ½-hour intervals a day (outside of sleeping) to not look at a screen at all.
- Never bring any device other than an electric toothbrush into the bathroom.
- Three times a week pick up the phone to talk to a friend rather than text, tweet or Facebook message them.
- Three times a week spend a whole commute (train ride) reading a book (not on phone or handheld device).
- Once a week, take photos with an actual camera.
- Once a month write three cards/letters to friends or loved ones.
- Instead of immediately tweeting something you think is interesting or pithy, share it in a verbal conversation with a friend, colleague or family member.
- Start a journal and commit to writing in it one Sunday a month. Writing does not have to be prose, could include germs of ideas, song lyrics, silly observations or drawings.

To reduce vision problems from screen time, recommendations are to follow the 20-20-20 rule. Every 20 minutes that you are on a computer or a mobile device, look away from the computer at an object at 20 feet away or further for 20 seconds or more. That will let those eye muscles relax. Just like other muscles in the body, the eyes need a varied "workout" and some relief from prolonged strain (Seidman, 2015).

As a final suggestion, which has support, but does need further research: meditation and/or yoga. Just look at three areas, musculoskeletal improvement, stress relief, and brain and cognitive function repair.

Musculoskeletal improvement and pain relief

Posture can help reduce the strain. Health.com (2016) has 10 ways to improve posture including yoga (health.com, 2016). Nassif *et al* (2014) evaluated the effectiveness of mindfulness meditation for managing chronic pain in U.S. military veterans who sustained a trauma brain injury during deployment to Afghanistan or Iraq. Musculoskeletal pain conditions were the most frequently diagnosed health condition in this military cohort, exceeding any other medical or psychological concern. Dr. Richard Miller developed iRest which promotes deep relaxation through breathing, guided imagery, and progressive relaxation techniques. Findings from this pilot study lend support for the potential effectiveness of iRest for pain.

Stress reduction

Mayo Clinic (2016) as well as many others, praise various forms of mindful meditation for stress reduction. Heading their web page, they pointedly state "Meditation can wipe away the day's stress, bringing with it inner peace."

Brain and cognitive function repair

Sara Lazar, a neuroscientist at Massachusetts General Hospital and Harvard Medical School tested the possible benefits of meditation in brain scans. What she found surprised her — that meditating can literally change your brain (Schulte, 2015). Her first study looked at long-term meditators vs a control group. She found long-term meditators have an increased amount of gray matter in the insula and sensory regions, the auditory and sensory cortex. That makes sense. When you are mindful, you are paying attention to your breathing, to sounds, to the present moment experience, and shutting cognition down. It is reasonable senses would be enhanced. She also found they had more gray matter in the frontal cortex, which is associated with working memory and executive decision-making. Our cortex shrinks as we get older – it is harder to figure things out and remember things. Nevertheless, in this one region of the prefrontal cortex, 50-year-old meditators had the same amount of gray matter as 25-year-olds Lazar et al, 2005).

Maybe the people with more gray matter in the study had more gray matter before they started meditating. It led to a second study by the team. They took people who had never meditated before, and put one group through an eight-week mindfulness-based stress reduction program. They found differences in brain volume after eight weeks in five different regions in the brains of the two groups. In the group that learned meditation, we found thickening in four regions:
1. The primary difference was found in the posterior cingulate, which is involved in mind wandering, and self-relevance.
2. The left hippocampus, which assists in learning, cognition, memory and emotional regulation.
3. The temporo parietal junction, or TPJ, which is associated with perspective taking, empathy and compassion.
4. An area of the brain stem called the Pons, where many regulatory neurotransmitters are produced.

The amygdala, the fight or flight part of the brain that is important for anxiety, fear and stress in general. That area got smaller in the group that went through the mindfulness-based stress reduction program. The change in the amygdala was also correlated to a reduction in stress levels.

This data showed changes in the brain after just eight weeks. In a mindfulness-based stress reduction program, the subjects took a weekly class. They were given a recording and told to practice 40 minutes a day at home. Some did less. The average time was 27 minutes -- about a half hour a day (Holzel et al., 2011)

Implications

In organizations programs can be developed to assist employees in countering the potential negative effects of computers and screen time. The health impact can be: 1. Vision problems; 2. Musculoskeletal problems. 3. Sleep problems; 4. Increased stress; 5. Undesirable eating habits; 6. Shortened life expectancy; 7. Cardiovascular health problems and diabetes; 8. Cognitive problems.

On a basic level, employees can be encouraged to follow the 20-20-20 and physical break times. Additionally, yoga programs may reduce the musculoskeletal impact. On a higher level to counter to brain and cognitive function impact of excessive screen use, mindfulness meditation programs can be implemented.

Research needs to be conducted within organizations to fine-tune the programs and test their efficacy.

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