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INTRODUCTION: RECOGNITION OF A SOCIETAL ISSUE

The increased dependence of college students on digital electronic media, primarily smartphones and laptop computers, is raising concerns among researchers in mental health, education, sociology, and computer science. The number of published studies on the adverse impact of excessive use of digital devices on learning, attention span, relationships, civility, and health is increasing.

Greenfield^{1, 2} and Orzack,^{3, 4, 5} who each studied and treated Internet and computer addiction, were among the earliest to write about the issue in the 1990s.⁶

In order to summarize the research findings on the impact of digital media use on the health and well-being of college students, we searched the following databases for articles published between 1995 and 2017: PubMed, Science Direct, PsycINFO, PsycARTICLES, and Education Full Text.



We are calling the constant attachment to technology *digital media addiction*, which is used interchangeably with *social media addiction* or *technology addiction*. Other terms that have been used to describe this phenomenon include *problematic computer use*⁷ and an *inability to remove oneself from the Internet*.⁸

A TIMELINE OF MODERN COMMUNICATION

- **Early 1800s**- The telegraph, a device that uses electric signals to send simple messages, is invented.⁹
- **1837**- Samuel Morse creates the first practical telegraphic code.⁹
- **1876**- Alexander Graham Bell invents the telephone.¹⁰
- **1885**- Heinrich Hertz shows that electricity can be transmitted over electromagnetic waves, building the foundation for radio.¹¹
- **1902**- Guglielmo Marconi transmits the first wireless radio message across the Atlantic Ocean.¹¹
- **1925**- John Logie Baird transmits the first television image.¹²
- **1940**- The Complex Number Calculator, the predecessor to computers, is demonstrated at a conference.¹³
- **1941**- The touch tone phone, with a numerical keypad, is created.¹⁰
- **1951**- The Ferranti Mark I becomes the first commercially available general-purpose computer.¹³
- **1962**- ARPAnet, the earliest version of the Internet, debuts.¹⁷
- **1964**- The first transcontinental video call is made on an AT&T Picturephone.¹⁴
- **1973**- Motorola releases the first cellphone (DynaTAC 8000X).¹⁵
- **1973**- Talkomatic is invented, and is widely credited as the first online chat room.¹⁶
- **1984**- The Apple Macintosh becomes a popular consumer computer.¹³
- **1991**- The World Wide Web is developed.¹⁷
- **2003**- Skype, a service that enables long-distance video chat, is introduced.⁶⁶
- **2004**- Facebook is created at Harvard University.¹⁸
- **2007**- Apple releases the first iteration of the iPhone.¹⁹
- **2008**- There are 100 million active users on Facebook (today there are 2 billion Facebook users, or approximately 1 in 4 people on Earth).^{20, 21}
- **2013**- Internet Gaming Addiction disorder is included in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition.²²
- **2017**- 95% of Americans own a cellphone.²³

BENEFITS OF DIGITAL MEDIA

- Instant access to information
- Long-distance communication (both cellphone and video calls)
- Global Positioning System access
- Electronic payments
- Online viewing of film, art, opera, ballet, and other entertainment
- Instant messaging
- Calling 911
- Device portability
- Social networking
- Online education
- Online shopping

ADVERSE EFFECTS OF DIGITAL MEDIA

- Exposure to and reinforcement of false information
- Privacy concerns
- Expectation of constant contact
- Less exercise
- Corporations dictate content
- Hate speech promoting violence
- Ubiquity of pornography
- Reduced relaxation
- Fear of missing out
- Decrease in job productivity
- Accidents caused by texting and driving
- Cyberbullying and incivility
- Decline in reading
- Environmental pollution

DECLINE IN SCHOOL PERFORMANCE

- Technology use in the classroom has an *adverse effect on information retention and overall school performance*.^{24, 25, 26, 27, 28}
- The majority of college students use or have used laptops during lectures.^{24, 26, 28}
- Students who use laptops in class have *lower grade point averages* than those who do not by a magnitude of 0.14 to 0.25 grade points per class.^{24, 25}



DIMINISHED ATTENTIVENESS

- Cellphone use leads to *the inability to focus on the task at hand*, not just for academic assignments.^{29, 30, 31}
- Even the presence of a cellphone may *decrease attentiveness*.³²
- When crossing the street or driving, *cellphone use compromises safety* because users pay less attention to traffic.^{33, 34, 35}

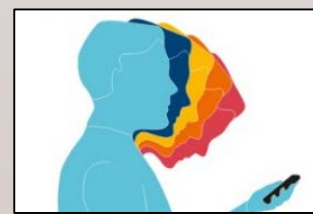
The New York Times



An October 2017 bill in Honolulu has banned texting while crossing the street.⁵⁷

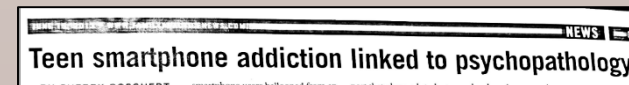
PHYSICAL HEALTH PROBLEMS

- Text messaging can lead to *text neck*, which is the unnatural curving of the upper spine due to constantly looking down at one's cellphone.^{36, 37, 38}
- Digital media use can cause *computer vision syndrome*, a term for various forms of eye strain or damage.^{39, 40, 41}
- Technology overuse can result in *poor sleep quality* and decreased sleep time when used immediately before going to sleep.^{42, 43}



MENTAL HEALTH PROBLEMS

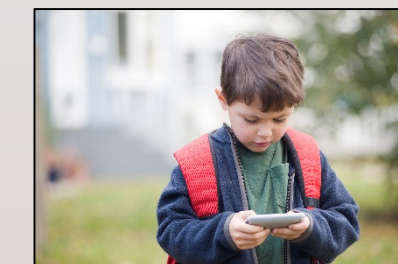
- Young adults with a higher frequency of Internet and cellphone use have *greater rates of depression and stress*.^{44, 45, 46}
- High levels of texting can result in *burnout and depression* in college students.⁴⁵
- Individuals who *experience anxiety* in social situations use electronic media, particularly texting, more than those who do not feel anxious.^{47, 48, 49}



Family Practice News. June 15, 2013.

IMPACT OF MEDIA ON CHILDREN

- Digital media devices can displace interactions between parents and children, *hindering pre-educational learning* (problem solving, empathy, social skills).^{50, 51}
- Children learn best when learning is continuous; cellphone interruptions during parent-child teaching *decrease children's abilities to learn new words*.^{52, 53, 54}
- The American Academy of Pediatrics recommends that infants under 18 months be kept away from screens, and children age 18 to 24 months be limited to 1 hour of media consumption per day.⁵⁵
- In contrast, children ages 8 to 12 spend 6 hours per day consuming media; teenagers, 9 hours per day.^{56, 57}



INCIVILITY

- Phone users are *less polite, attentive, and honest* in face-to-face conversation.^{58, 59, 60}
- *Conversation quality is perceived as lower* when one individual is using their cellphone.⁶⁰
- *Checking messages during conversations can damage the impression another person has of that individual*.⁶⁰ Men and the 18-34 year age group, as opposed to women or any older group, find texting more appropriate in any given situation.⁵⁹



LESS SATISFYING RELATIONSHIPS

- *Partner phubbing* is defined as attending to a cellphone instead of communicating with a significant other.⁶³
- Digital media use when interacting with a partner results in *decreased romantic intimacy and relationship satisfaction*.^{61, 62, 63}
- Cellphone use can *diminish autonomy*, because individuals expect their significant others to respond to calls and messages immediately. A lack of contact can result in decreased relationship satisfaction.^{64, 65}

The New York Times



EFFECTIVE MULTITASKING: AN OXYMORON

- People are *poor multitaskers*.^{66, 67, 68, 69}
- Heavy media multitaskers perform *worse at controlling their memory, paying attention, and learning*.^{67, 68, 69}
- *Multitaskers are poor at filtering out what is not relevant to their current goal* when there are multiple sources of information coming from both the screen and the real world.⁶⁷

The illusion of multitasking

By CHASE M. WALK, Ph.D.
 Have become fixtures of daily life. People walk around supermarkets and...
 under what we call "multitasking."
 I am writing for...
 Medical Economics. April 10, 2012.

CIGARETTES AND CELLPHONES

Throughout the 20th century, the harmful effects of cigarette smoking were downplayed by tobacco companies and ignored by consumers. Nor did the public have a negative view of the tobacco industry, which was a major sponsor of sports, the arts, and many of the most popular radio and TV shows. As recently as the late-1990s, the tobacco industry even denied that cigarette smoking caused lung cancer, heart disease, emphysema, and addiction. Yet the number of Americans who die each year from smoking has risen to nearly 500,000.

The modern anti-smoking movement arose in the 1960s following the publication of research studies that implicated cigarettes as the main cause of lung cancer. In contrast, despite rising digital media addiction and studies implicating this dependency in a growing number of health problems, there is no significant effort to reduce digital media use. Indeed, although media companies encourage constant use of technology (eg, BlueTooth, Google Glass), they are largely seen as beneficent. Common Sense Media, which claims to be an independent watchdog of media directed at children, is funded almost entirely by the major media corporations (eg, Google, Microsoft, Facebook Apple, Netflix) and online retailers (eg, Amazon).

Cell phones may be edging out smoking

LONDON — British teens are smoking less and talking more on cell phones. And researchers think that may not be a coincidence. The cell phone seems to compete with cigarettes as...
 15-year-olds has dropped from 30 percent in 1980 to 23 percent in 1995, cell phone ownership had risen sharply over the same period to about 70 percent today, the scientists noted. Clive Bates, director of Action on Smoking and Health in London, said many kids simply can't afford both.

In 2000 a British study attributed the decline in smoking among teenagers to their buying cellphones instead of cigarettes. Have we merely replaced one serious addiction with another?

LACK OF RECOGNITION BY UNIVERSITIES

Examples of colleges and universities that either acknowledge or address students' growing digital media dependency are few and far between. Liberty University has created a WiFi-free Center for Digital Wellness where students can meet, converse, and study together without any distractions from electronic media. The Center's founder, Dr. Sylvia Frejd, notes that "many students are immersed in their technology and are almost uncomfortable in real-life situations. The Center plays a role in awareness, education, and prevention of technology overuse."

CONCLUSIONS

A growing body of evidence suggests that digital media addiction is increasing among college students and that the problem has not been addressed by universities. As dependence on digital media grows, adverse consequences are likely to intensify.