Review

Please Stop Sacrificing Our Children for Profit: The Critical Need to Mitigate Commercial Technology Threats to Child and Youth Wellbeing

Tanya Halsall *, Alexis Holmgren, Zac Arseneau, Misha Jan, Nishad Khanna, Nicole Obeid, Ingibjorg E. Thorisdottir, Marco Zenone, Amanda Bellefeuille

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Please Stop Sacrificing Our Children for Profit: The Critical Need to Mitigate Commercial Technology Threats to Child and Youth Wellbeing

"We must hold social media platforms accountable for the national experiment they're conducting on our children" (Biden, 2022)

Halsall, T., Holmgren, A., Arseneau, Z., Jan, M., Khanna, N., Obeid, N., Thorisdottir, I. E., Zenone, M. Cheng, M., Bellefeuille, A.

Abstract: Youth mental health is in crisis. Although the influence of social media on youth mental health has been under debate in the scientific community over the last several years, there is now a growing consensus that it is causing significant harms to many children and youth, demanding immediate action to address these effects. We outline the complex pathways of influence and how they are increasing health inequities in children and young people. We apply the commercial determinants of health (CDoH) framework to highlight the mechanisms of influence driving the crisis and offer solutions to address it. This approach places the focus on the business practices of critical actors in the tech industry that create health inequities while accumulating power and wealth. These business practices will have an impact on us all. Young people are the canary in the coal mine.

Keywords: social media; child and youth health; commercial determinants of health; health equity; policy

Introduction

The deterioration of youth mental health over the last 10-15 years has become a global public health crisis (Madigan, Korczak, et al., 2023; Madigan, Racine, et al., 2023; McGorry & Mei, 2023; Sutcliffe et al., 2023; US Surgeon General, 2021; Wiens et al., 2020). Within the scientific community, there has been on-going debate regarding whether social media is a contributing factor (Haidt, 2024; Odgers, 2024; Orben & Przybylski, 2019; Twenge et al., 2020; Weigle & Shafi, 2024). Using the concept of the commercial determinants of health (CDoH), this paper provides an overview of the key issues related to social media and the pathways of influence on child and youth wellbeing. The CDoH have been defined as "the systems, practices, and pathways through which commercial actors drive health and equity" (Gilmore et al., 2023). We argue that there are clear pathways whereby the activities of tech commercial actors influence population-level health and well-being of young people, with implications for the broader population. These mechanisms can only be identified and addressed through approaches that take complexity into account, such as CDoH frameworks.

We begin with an examination of the mechanisms of influence that function to make social media an unhealthy commodity (see Gilmore et al., 2023). We describe the processes and systems relating to tech commercial actors that perpetuate these interactions. We highlight the shortcomings of traditional scientific paradigms and how they are prolonging the youth mental health crisis. Finally, we offer recommendations for how to protect our children and young people through collaborative research and policy. This paper responds to several calls to explore the mechanisms of influence implicated in social media's impact on youth mental health (Valkenburg et al., 2022) and the involvement of the tech industry (Lacy-Nichols et al., 2023; Zenone et al., 2021a, 2023).

Social media as a commercial determinant of health

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Our focus is on 'social media' as online media that is implicated in the attention economy, whereby we consider commerce that is driven through the commodification of human attention to drive profit often through user-generated content (see Crogan & Kinsley, 2012; Santos, 2022). In this definition, we include online games that may not always fall under the umbrella of traditional social media apps, such as TikTok or Instagram, but often integrate online social forums, user-generated content, algorithms to drive engagement and are associated with similar harms (see BBC, 2022b; Bowles, 2019; Boniel-Nissim et al., 2024; Amato, 2023). In particular, we examine the practices of powerful multi-national corporations that are implicated in these harms, sometimes described as Big Tech (see Abdalla & Abdalla, 2021; Costello et al., 2023; Crofts, 2024; Zenone et al., 2023). While some of these companies, such as Apple and Amazon, may not be directly involved in the management of social media platforms, they are closely implicated in related profit generation and health harms (see Crofts, 2024; Haidt, 2024; Stempel, 2025).

Researchers have highlighted that the impacts of social media are complex and have bidirectional effects with variable influence on diverse young people (Crone & Konijn, 2018; Fitzpatrick et al., 2024; Konok et al., 2024; Orben et al., 2022; Valkenburg et al., 2022; Vedechkina & Borgonovi, 2021; Weigle & Shafi, 2024; Zenone et al., 2021b). Therefore, it is useful to examine these impacts as there are unique pathways through which digital technology can act as a CDoH. We highlight categories related to: 1) Influences on development and addiction, 2) Body image and eating disorders, 3) Misinformation, cyberbullying and hate, and 4) Sexual exploitation, self-harm and suicide. These platforms both act as an unhealthy commodity and exacerbate other unhealthy commodities through their advertising affordances, targeting and data capitalism (see Zenone, 2023).

Many of the above mentioned harms are exacerbated by design features that have been created to prolong user engagement to drive profit through targeted advertising (Abdalla & Abdalla, 2021; American Psychological Association [APA], 2023; Costello et al., 2023; Dyer, 2022; US Surgeon General, 2021, 2023; Zenone et al., 2021b). Montag (2019) reviews six different features in smartphone apps that leverage psychological theory and cognitive processing mechanisms to keep users engaged. These include endless scrolling, endowment effect/mere exposure effect, social pressure, catering to user interests, social comparison and reward, and the Zeigarnik/Ovsiankina Effect (a phenomenon whereby interruptions to an engaging task tend to cause strain and increases motivation to complete the task). With recent advances to machine learning, innovations that take advantage of human tendencies to become easily bored and to be attracted to social cues have increased dramatically (Smith, 2021).

Algorithms are technical processes that sort content to drive user engagement for profit (Kim, 2017). Recently, the New York Times obtained internal documents from TikTok that provided some insight into the design of their algorithm (Smith, 2021). TikTok's main objective is to increase active daily users measured by retention and time spent on the app. This is achieved through an algorithm that is based on likes, comments, video play verification and video playtime. These algorithms are known to elicit addictive behaviours (Costello et al., 2023; Zenone et al., 2021b, 2023,) and can be used to drive users into rabbit holes that expose them to harmful content that promotes polarization, hate and self-harm (Costello et al., 2023; Wall Street Journal, 2021; Zenone et al., 2023). Further, social media serves as a conduit for harms from other industries, such as alcohol, tobacco and sugar-sweetened drinks (Clark et al., 2020; Eckhardt, 2024; Zenone et al., 2023), despite restrictions related to targeting advertising to young people (Zenone et al., 2023).

"Children around the world are exposed to severe threats from the commercial sector, by advertising and market-ing that exploits their vulnerability" (Clark et al., 2020, p. 630; Eckhardt, 2024). These practices are exacerbated by the selling and use of personal data from children (Clark et al., 2020; Eckhardt, 2024; Zenone et al., 2023). In 2022, the annual revenue derived from advertising focused on children and youth, alone, was found to generate $11 billion across six popular social media platforms (Raffoul et al., 2023). A recent report found that 8% of Apple apps and 7% of Google apps are targeted to children, and among these apps, personal data, such as IP and GPS, was 42% more likely to be shared with advertisement companies (Pixalate, 2022). The unboxing videos that

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proliferated on YouTube (Bergen, 2022) and the more recent emergence of "kidfluencers" (Eckhardt, 2024) are perhaps some of the more perverse illustrations of exploitative digital marketing to young people.

Influences on development and digital addiction

Childhood and adolescence are periods of continued brain development, whereby executive functioning, critical thinking and the ability to self-regulate are still involved in maturation (Arain et al., 2013; Costello et al., 2023; Crone & Konijn, 2018; Patel et al., 2018). In addition, the adolescent stage of development is characterized by increased risk-taking, impulsivity, and sensitivity to peers, social rewards and media influence (Crone & Konijn, 2018; Dekkers & van Hoorn, 2022; Maza et al., 2023; Orben et al., 2022; Oswald et al., 2020; Patel et al., 2018; Patton et al., 2016). These traits predispose children and youth to greater harms from social media (Costello et al., 2023; Weigle & Shafi, 2024), including vulnerability to fake news (Crone & Konijn, 2018), and greater risk of sexual exploitation (Madigan et al., 2018).

There is a growing body of research that demonstrates longitudinal changes in the brain that are associated with online media use. There is relative consensus in the literature that media use can have a negative impact on attention (Konok et al., 2024; Oswald et al., 2020; US Surgeon General, 2023; Vedechkina & Borgonovi, 2021). Further, smart phone use has been negatively associated with educational outcomes, with likely mechanisms of influence related to distraction and screen time displacing academic pursuits (Global Education Monitoring Report Team, 2023). Studies with younger children have identified that tablet use is associated with decreased ability to regulate emotions (Fitzpatrick et al., 2024; Konok et al., 2024) and children who are more prone to anger and frustration may elicit increased parental use of screens to manage temper (Fitzpatrick et al., 2024; Konok et al., 2024). Later childhood and adolescence represent other time periods when social media can influence development (Crone & Konijn, 2018; Maza et al., 2023; Orben et al., 2022). In young people who exhibit habitual checking of social media, neural development is altered in brain regions associated with motivation, emotion and self-regulation and this may lead to later psychological consequences (Maza et al., 2023). In another longitudinal study, researchers identified that there was a substantial negative bidirectional relationship between social media use and life satisfaction that was most pronounced in adolescence (Orben et al., 2022).

In a recent meta-analysis, researchers estimated that global prevalence of digital addiction has been increasing over the last 20 years with current estimates at 26.99% for smartphones, 17.42% for social media, 6.04% for videogames and 14.22% for general internet addiction (Meng, 2022). This is corroborated by recent findings from the global Health Behaviour in School-aged Children study that show an increasing prevalence of problematic social media use in children and young people, with increases from 7% to 11% over the last four years (Boniel-Nissim et al., 2024). The highest prevalence of problematic gaming was observed in eleven-year-old boys at 14%. Problematic social media use is significantly associated with depression, anxiety and stress in young people (Shannon et al., 2022) and in a longitudinal study, problematic social media use has been found to be associated with depression and loneliness (Shannon et al., 2024).

Body image and eating disorders

Eating disorders (EDs) are a set of conditions that often have their onset during adolescence (Herpertz-Dahlmann, 2015) and are associated with high mortality (Iwajomo et al., 2021). The relationship between social media and EDs is longstanding and consistent. It dates back to pro-ana or pro-anorexia sites that began popping up in the late 1990s, that normalized ED behaviours and thoughts, encouraged dangerous weight loss, and provided a community and forum for sharing common beliefs that EDs were not serious illnesses that require treatment, but rather a choice or lifestyle worth maintaining (Christodoulou, 2012). These have proliferated across all social media platforms and have quickly expanded to include pro-mia sites for those with bulimia nervosa

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symptoms, and hashtags such as thinspo, short for thinspiration, image-based social media content that encourages an unhealthy drive for thinness (Ghaznavi & Taylor, 2015).

Other pro-ED content focuses on food intake such as 'WhatIeatinaday' that romanticizes competitively restrictive diets, amassing 2.7 billion views (NBC News, July 19, 2020) (Kaufman, 2020), to social media accounts focused on appearances and unrealistic beauty ideals, such as thigh gaps from a decade ago, which recently resurfaced as 'legging legs', amassing 33 million TikTok views, mostly among young girls (Glossop, 2024). The mechanism in which these platforms impact young people is thought to be multifold including through social comparison (Krayer et al., 2008), increased exposure to idealized images of bodies leading to internalization of unattainable ideals (Tiggemann & Zaccardo, 2015), and weight-based teasing that often occurs via these platforms (Polanin et al., 2022). The influence of this social media content is profound, prevalent, and contagious.

There is an impressive body of research that has shown the relationship with pro-ED social media content and their deleterious effects associated with worse body dissatisfaction (Harper et al., 2008; Cataldo et al., 2021; Saiphoo & Vahedi, 2019; Vandenbosch et al., 2022), greater use of disordered eating behaviours (Peebles et al., 2012; Cataldo et al., 2021; Dahlgren et al., 2024), internalization of beauty ideals (Dahlgren et al., 2024), and diminished quality of life (Peebles et al., 2012; Cataldo et al., 2021). Adolescent girls tend to be most affected by this relationship (Dahlgren et al., 2024), with the number of social media accounts associated with higher reports of ED-related symptoms (Wilksch et al., 2020). Time spent on social media use has been linked to greater odds of over-evaluation of body image, disordered eating behaviours, and related distress (Chu et al., 2024). Passive social networking sites, that enable upward social comparison, have been shown to have negative effects on disordered eating symptoms (Xiang & Kong, 2024).

There is unequivocal evidence of the alarming spike in ED prevalence and symptom severity seen during the pandemic (Devoe et al., 2023), with estimates from across Canada demonstrating a 60% increase in hospitalizations two years after the start of the pandemic, with impacts most pronounced in young people (Deloitte Access Economics, 2023). There is general consensus across experts and clinicians that the increased use of social media during the pandemic was part of what contributed to this concerning spike (Tie et al., 2023). Social media companies are fully aware of this issue, but have opted not to address it. In a highly publicized whistleblower story, an ex-employee of Facebook (now Meta) shared internal documents confirming that the company was aware that one of their platforms was exacerbating body image issues for young females, with 17% of young females reporting that social media, Instagram specifically, makes EDs worse (Pelley, 2021). In spite of this information, *they elected not to address it* (Gayle, 2021).

Misinformation, cyberbullying and hate

Misinformation refers to the spread of false information regardless of intent, whereas disinformation is the deliberate dissemination of false information (Ha et al., 2021). Social media accelerates the spread of both, making it challenging to correct inaccuracies and control harmful content. Misinformation is more likely to be shared and reposted, and the spread of misinformation has been found to be six times faster than truthful content (Vosoughi et al., 2018). With the emergence of generative AI, creating and spreading false information has become even easier (Ferrara, 2024).

Misinformation can cause severe harm related to disaster, health and politics (Muhammed T & Mathew, 2022). It can amplify the spread of propaganda campaigns to undermine democracy through the creation of false public accounts of war (Geissler et al., 2023), motivate ethnic cleansing (Stecklow, 2018; Zenone et al., 2023) and undermine democracy through the influence of voter perceptions (BBC, 2022a; Robins-Early, 2024). Health misinformation spans topics from vaccines, drugs or smoking to noncommunicable diseases, pandemics, eating disorders, medical treatments and mental health (Starvaggi et al., 2024; Suarez-Lledo & Alvarez-Galvez, 2021; Zenone et al., 2021a). During the COVID-19 pandemic, misinformation spread quickly, prompting the World Health Organization, along with partners, to issue a joint statement warning of the harms related to digital misinformation that undermined the global response to the pandemic and calling on members states

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and international organizations to take measures to mitigate negative impacts and to prevent the spread of misinformation and disinformation (World Health Organization, 2020). Notably, Facebook delayed a commitment to banning vaccine misinformation until seven months into the pandemic (Zenone et al., 2023). This contributed to the perpetuation of the pandemic within networks of the unvaccinated and substantial additional deaths (BBC, 2021; Fatima et al., 2022). Digital platforms like TikTok attempt to partner with entities like the WHO to promote health literacy and combat misinformation. However, such relationships ignore the fact that digital platforms both pose an obstacle to understanding and profit from the spread of misinformation (Zenone & Kenworthy, 2024).

In a recent poll of American young people, 77% of respondents shared that they access the news through social media, yet only 55% felt that they were able to discern whether a news story was credible (Robb, 2020). However, research on the perspectives of vaccine-hesitant young people highlights that they have challenges differentiating between accurate content and misinformation (Mckee et al., forthcoming). In addition to mis- and dis-information, social media platforms also proliferate hate speech (Carlson & Rousselle, 2020; Harrison et al., 2024; Zenone et al., 2023) leading to racism, misogyny and other forms of aggression (Harrison et al., 2024; Khaki et al., 2023; Ritchie, 2024). An examination of Facebook's 2018 policy to remove hate speech identified that only approximately half of hateful content that was reported was removed (Carlson & Rousselle, 2020) and according to internal monitoring, this percentage is much lower (Pelley, 2021). Social media platforms have exhibited a general lack of transparency (Carlson & Rousselle, 2020; Pelley, 2021) as well as active opposition to remove hateful content (Ritchie, 2024). The proliferation of hate speech on social media continues to be an ongoing issue (Spring, 2023).

Cyberbullying is "any behaviour performed through electronic or social media by individuals or groups that repeatedly communicates hostile or aggressive messages intended to inflict harm or discomfort to others" (Tokunaga, 2010). It relates to willful and repeated harm (Patchin & Hinduja, 2015; Peter & Petermann, 2018). Cyberbullying behaviours can take many forms (e.g., harassment, cyberstalking, outing/doxing, trolling, exclusion, fake profiles, etc.) and is facilitated by anonymity, greater social dissemination, lack of supervision, and greater accessibility than other types of bullying. For example, social networking sites provide perpetrators easy access to a large audience anytime (Kowalski et al., 2012). Furthermore, anonymity enables perpetrators to escape accountability. For example, researchers identified that perpetrators use fake accounts on Facebook, Twitter, and Instagram to perpetrate cyberbullying (Mkhize & Gopal, 2021). More time on social media is associated with higher risk of victimization and perpetration (Camerini et al., 2020; Villanueva-Moya et al., Craig 2023). The Health Behaviour in School-aged Children survey, conducted in 47 countries and regions, revealed that intense and problematic social media use are related to cyberbullying perpetration and victimization with modest to strong effect sizes (Craig et al., 2020).

Cyberbullying victimization and perpetration are associated with health, behavioral and psychological problems among youth (Kowalski et al., 2014). These include concurrent and long-term psychological distress (Cénat et al., 2018; Kim et al., 2019; Luk et al., 2018; Mereish et al., 2019; Parris et al., 2022; Sampasa-Kanyinga & Hamilton, 2015), concurrent and long-term suicidal ideation and attempts (Humphries et al., 2021; Jackson et al., 2009; Kim et al., 2019; Mereish et al., 2019; Romero et al., 2018; Sampasa-Kanyinga & Hamilton, 2015), lower self-esteem and more depression (Berne et al., 2014; Kim et al., 2019; Luk et al., 2018; Romero et al., 2018; Tynes et al., 2012); substance use (Kim et al., 2019; Li et al., 2019; Mereish et al., 2019; G. Phillips et al., 2017; Trujillo et al., 2020); delinquency and violent behaviors (Alhajji et al., 2019; Kim et al., 2019; Mehari et al., 2020).

Sexual exploitation, self-harm and suicide

73% of adolescents between the age of 13-17 report having viewed online pornography, with 15% reporting that they were age ten or younger when they were first exposed (Robb & Mann, 2023). Of those who had seen pornography, 58% reported that they had viewed this content by accident. Pornography consumption in young people has been associated with stereotypical attitudes related

 doi:10.20944/preprints202502.0334.v1

to gender, permissive sexual attitudes, risky sexual behaviour and sexual aggression (Paulus et al., 2024). A recent systematic review identified that exposure to sexual content was associated with an increased probability of engaging in problematic sexual behaviour, such as developmentally inappropriate behaviour, coercive or aggressive behaviour, engagement in sexual behaviour among children or youth from different age groups, or sexual behaviour that causes harm (Mori et al., 2023).

Online child sexual exploitation involves a range of online abuses, including luring or grooming, sexual solicitation, sextortion, and unwanted sexual exposure (Finkelhor et al., 2022; Ibrahim, 2022; Madigan et al., 2022; Salter & Wong, 2021). Rates of online child sexual exploitation are very high with studies reporting rates of up to 30% (Finkelhor et al., 2022; Madigan et al., 2018; Shiau et al., 2024). With the increase of screentime during the pandemic, there was also a significant increase in posts on known child exploitation forums and reports of online sexual abuse of children across the world (Salter & Wong, 2021). Canada's reporting line for online sexual abuse received 37% more reports of overall abuse in 2021, including an 83% increase of reports of luring and 74% in reports of sextortion (Ibrahim, 2022). Many young people do not report their experience of online sexual exploitation for a variety of reasons, including feeling responsible, shame and guilt as well as not recognizing the severity of the offense (Shiau et al., 2024). Therefore, actual prevalence of online child sexual exploitation is likely higher than studies report (Madigan et al., 2018; Shiau et al., 2024).

Self-harm has been defined as "intentional self-poisoning or injury, irrespective of apparent purpose, and can take many forms, including overdoses of medication, ingestion of harmful substances, cutting, burning, or punching" (Moran et al., 2024, p. 1445). Self-harm is a behaviour that is more common with young people and is a risk factor for suicide (Moran et al., 2024). Further, rates of self-harm have been increasing and experts argue that exposure to self-harm through online media may normalize the behaviour as a coping strategy (Moran et al., 2024; US Surgeon General, 2023). Online risk factors such as exposure to cyberbullying, violence, hate speech, sexual content, depression, and self-harm have been demonstrated to increase suicide-related behaviour in young people, with risk increasing exponentially with the presence of 5 or more risk factors (Sumner et al., 2021). With respect to contagion in young people, researchers have identified that seeing and posting social media content related to suicide clusters was significantly associated with suicidal ideation and posting related content was also associated with suicide attempts (Swedo et al., 2021). Online exposures to content about self-harm and other harmful content have led to many young people taking their own life (CBC, 2013; Chiu, 2018; Costello et al., 2023; Dyer, 2022; Moran et al., 2024).

Regardless of whether there is exposure to harmful materials online, it is important to consider the amount of time spent on a screen and the other healthy activities that can be displaced (Bell et al., 2015; Canadian Paediatric Society, 2022; Oswald et al., 2020; Weigle & Shafi, 2024). This could apply to socializing with loved ones, managing household responsibilities, extracurricular activities, studying or learning new skills, working at a job, volunteering, and performing health hygiene behaviours, such as sleeping or being physically active, among others (ParticipACTION, 2015; US Surgeon General, 2023). This, by itself, is cause for concern if young people are spending upwards of 5-7 hours of their recreation time on screens (Moore et al., 2020; Rideout et al., 2022; Seguin et al., 2021).

Although there continues to be a substantial collective scientific voice arguing that there is not sufficient evidence demonstrating social media harms (Orben & Przybylski, 2019; Vuorre et al., 2021; Vuorre & Przybylski, 2023, 2024a), there are growing calls to recognize the gravity of potential harms and to apply a precautionary approach (Clark et al., 2020; Harrison et al., 2024; Hartwell et al., 2024; US Surgeon General, 2023) "the current body of evidence indicates that while social media may have benefits for some children and adolescents, *there are ample indicators that social media can also have a profound risk of harm to the mental health and well-being of children and adolescents*. At this time, we do not yet have enough evidence to determine if social media is sufficiently safe for children and adolescents." (US Surgeon General, 2023) This is substantiated by the recent release of multiple advisories and position statements highlighting an increasing recognition of the urgent need to

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mitigate this crisis (APA, 2023; Canadian Paediatric Society, 2022; US Surgeon General, 2021, 2023, 2024).

The role of commercial actors in social media

It is of critical importance to recognize social media within the frame of the commercial determinants of health (Friel et al., 2023; Gilmore et al., 2023; Hartwell et al., 2024; Lacy-Nichols et al., 2023; Zenone et al., 2021a, 2021b, 2023). A recent Lancet series offers a valuable overview of key concepts, mechanisms and recommendations related to the commercial determinants of health (Friel et al., 2023; Gilmore et al., 2023; Lacy-Nichols et al., 2023). These relate to all commercial actors that contribute both positively, negatively or with neutral impact on health. They highlight seven key areas of commercial sector practice that are implicated, including reputation management, political, scientific, marketing, supply chain and waste, labour and employment, and financial practices. Commercial entities differ in how they engage in each of these practices and this mediates their impact on health.

Over the last decades, power imbalances have been created by wealthy individuals and large corporations promoting a movement to prioritize free market competition and economic growth (Gilmore et al., 2023). This has allowed industry (and in particular transnational corporations) to cause harm and then externalize health costs to governments, further increasing power imbalances and health inequities. Corporations from Big Tech have been identified as harmful commercial actors as these multi-national companies avoid regulation by targeting jurisdictions with fewer protections (Crofts, 2024; Zenone et al., 2023) while accumulating massive amounts of wealth and power (Costello et al., 2023; Crofts, 2024; Raffoul et al., 2023; Zenone et al., 2021b) and externalizing costs by leaving governments to manage harms (Crofts, 2024). Relatedly, Canada is investing 500 million dollars into youth mental health care in the hopes of limiting the crisis (Canada, 2024).

Lacy-Nicholls and colleagues (2023) offer a framework that is designed to analyze commercial entity practice to better understand corporate influence on health. The framework is based on the model presented by Gilmore (2023) and includes the main industry practices along with guiding questions to identify relevant data sources (see Table 1). Although the framework was created to examine individual entities, we have applied it to capture information from the main actors involved in social media impacting young people. Our findings are based on recent literature related to social media and youth wellbeing, however, these sources contained sufficient information to highlight the majority of implicated practices.

[Insert Table 1]

Inequities created by social media

Online harms serve to increase health inequities, whereby negative impacts are experienced more intensely by young people who are already marginalized (APA, 2023; Crone & Konijn, 2018; Dekkers & van Hoorn, 2022; Fitzpatrick et al., 2024; Konok et al., 2024; Oswald et al., 2020; Vedechkina & Borgonovi, 2021; Zenone et al., 2021b). For example, cyberbullying has disproportionate impacts on minoritized youth (Ash-Houchen & Lo, 2018; Barboza, 2015; Cantu & Charak, 2022; Cheah et al., 2020; Faucher et al., 2014; Garnett & Brion-Meisels, 2017; Goebert et al., 2011; Kahle, 2020; Myers et al., 2017; Przybylski, 2019; Weinstein et al., 2021; Ybarra et al., 2015). Even when it is not directly targeted, minoritized youth experience extensive vicarious cybervictimization — online victimization directed at a young person's community (e.g., ethno-racial group) or at others with whom they share an identity and/or experience (Cheah et al., 2020; Tynes et al., 2008). This targeted violence reinforces existing power hierarchies and systemic racism, sexism/cissexism, and heteronormativity. Not only is it more frequent, it is also often more severe (Garaigordobil & Larrain, 2020) and leads to greater harm for minoritized youth than their more socially privileged counterparts (e.g., Broll et al., 2018; Hinduja & Patchin, 2010; Kim et al., 2019; Luk et al., 2018; Mereish et al., 2019; Parris et al., 2022; Romero et al., 2018). For example, use of information and

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communication technologies for leisure increases the harms of cybervictimization for minoritized immigrant youth, but not for non-immigrant youth (Kim & Faith, 2020).

Gendered cybervictimization (e.g., Faucher et al., 2014) disproportionately targets girls, who are more likely than boys to experience "sextortion" online (e.g., humiliation or blackmail using sexualized images; Casado et al., 2019), unwelcome sexualized images or comments (Hazeltine & Hernandez, 2015; Jackson et al., 2009; Mishna et al., 2020), sexual solicitation (Wells & Mitchell, 2014); cyberstalking (Reyns et al., 2012), appearance-related comments (Berne et al., 2014; Jackson et al., 2009), and negative messages about their gender (Jackson et al., 2009). Sexist narratives are being promoted by misogynist influencers that promote radical views among male students and perpetration of harassment (Khaki et al., 2023; Wescott et al., 2024). These attitudes are not restricted to online behaviours, they permeate into social norms within classrooms and other environments (Wescott et al., 2024).

Youth who are trans/gender-expansive and sexual minority youth experience more cybervictimization than their peers (Eisenberg et al., 2017; Garthe et al., 2021; GLSEN et al., 2013; Myers et al., 2017; Shiau et al., 2024; Skierkowski-Foster, 2021; Suto et al., 2021; Ybarra et al., 2015). One American study found that transgender youth reported, 2.96 and 1.34 times more cyber victimization than cisgendered boys and girls, respectively (Garthe et al., 2021). Trans and gender expansive youth describe cybervictimization related to their gender expression, including inappropriate questions about their genitalia, misgendering, and dehumanizing and transphobic comments (Price et al., 2023). 2SLGBQ+ youth are often targeted by cyberbullying related to their sexual orientation, including being outed, which can expose young people to material danger. They are also more likely to experience sexual harassment online than their heterosexual peers (Kahle, 2020; Ybarra et al., 2015). 2SLGBQ+ youth are also at higher risk of online harassment from strangers (Finn, 2004) and through significantly more electronic sources (Myers et al., 2017). Gendered and sexualized cyberbullying are part of a broader socialization process wherein gender minorities come to expect gender-based violence and inequity, while perpetrators are frequently made invisible. These experiences become normalized and linked to ubiquitous gender stereotypes (Mishna et al., 2020) and decrease young people's perception of safety, connection and equity (Garnett & Brion-Meisels, 2017).

Digital colonialism, whereby multinational tech companies take advantage of jurisdictions with less established worker protections and industry standards, establish monopolies across the global south to support resource extraction, targeted surveillance, dominate political views and social norms, and create cultural hegemony (Crofts, 2024; Kwet, 2019; Zenone et al., 2023). Human rights abuses are also perpetuated through the more recent content moderation departments that subject workers to traumatizing content, sometimes described as the "keepers of souls" as a result of the numbers of deaths they witness in their work (Crofts, 2024; Kleinman, 2024).

Shortcomings of the scientific evidence related to digital harms

One of the major challenges that is slowing progress in policy to mitigate online harms is the over-reliance on more traditional scientific approaches "the global health community concerned with health and health equity must move beyond observation to action. This requires breaking from the hegemony of a biomedical model of health and acting on the influence of the CDOH" (Friel et al., 2023). New technology and the use of screens can be productive and beneficial (APA, 2023; Canadian Paediatric Society, 2022; Harrison et al., 2024; US Surgeon General, 2021, 2023; Weigle & Shafi, 2024; Zenone et al., 2021b), where for example, digital technology is used to overcome isolation and socialize with friends or loved ones that are far away, to read a digital novel, learn a new mindfulness technique using a videogame, complete a homework assignment using software designed to support accessibility, or meet with a therapist for a virtual session. These are not examples that would be implicated in the attention economy, yet, there are many examples in the literature that would include these aggregate findings in analyses. Further, it is often access to or the necessity of these tools that also increases exposure to harms on their devices.

 doi:10.20944/preprints202502.0334.v1

Aggregate analyses cannot take account of differential impacts that vary based on individual characteristics (Valkenburg et al., 2022; Weigle & Shafi, 2024) and mechanisms of influence are complex (Sumner et al., 2021). Harmful norms can reach beyond the screen and impact young people regardless of their usage patterns (see Dekkers & van Hoorn, 2022; Harrison et al., 2024; Wescott et al., 2024). Another challenge is that the variable of interest is constantly evolving. The emergence of machine learning has accelerated this evolution and it is not clear whether there will ever be the perfect data that is typically expected within the scientific community to make definitive conclusions. When considering complex public health issues, there is a critical need to move "away from simple, linear, causal models, to consideration of the ways in which processes and outcomes at all points within a system drive change" (Rutter et al., 2017).

Finally, similar to the tobacco industry, Big Tech has been heavily influencing scientific practice and again action is being delayed in anticipation of stronger evidence (Abdalla & Abdalla, 2021; Oswald et al., 2020). Some of the major criticisms of the existing evidence regarding social media harms are that studies are primarily cross-sectional (Odgers, 2024; Valkenburg et al., 2022; Weigle & Shafi, 2024) and many studies rely on self-report (Bradley & Howard, 2023; Orben & Przybylski, 2019; Vuorre et al., 2021; Vuorre & Przybylski, 2023). There is broad recognition that investigations are hindered because tech companies do not share data transparently (Costello et al., 2023; Raffoul et al., 2023; US Surgeon General, 2021) and are known to resist sharing data, including through litigation (Costello et al., 2023; Dyer, 2022; Orben & Blakemore, 2023; Raffoul et al., 2023; Zenone et al., 2023). Tech companies, such as Meta, enforce strict regulation of access to their data, including control of who is given permission to access the data as well as what content is available to them, which creates difficulties to capture trends and likely impacts on the resulting findings (Zenone et al., 2023). Further, they do not permit scraping outside of their own tools and have removed researcher accounts to limit attempts to examine content related to misinformation.

Big Tech also influences scientific practice by funding research and shaping research directions (Abdalla & Abdalla, 2021; Meta Research, 2024; Zenone et al., 2023). It is concerning that it is not yet widely known that industry can influence the resulting evidence through these partnerships (see Abdalla & Abdalla, 2021) and partnership with industry continues to be offered as promising solutions (Vuorre et al., 2021; Vuorre & Przybylski, 2023). This is concerning as the World Health Organization has recently announced a collaboration with TikTok (World Health Organization, 2024). It is unclear how substantially industry has influenced the overall research findings related to child and youth mental health, however, we identified several published studies that present positive or neutral findings related to the association between social media and mental health (as well as recommendations to partner with, and not to impose regulations on industry) with co-authors who report conflicts of interest and/or consultation roles related to tech industry (see Orben & Przybylski, 2019; Vuorre et al., 2021; Vuorre & Przybylski, 2024a, 2024b).

Blaming the victim

The biomedical model has been blamed for drawing efforts downstream toward interventions that cannot address population-level issues (Godziewski, 2021; Green et al., 2022; Halsall et al., 2024; Hunter et al., 2009; C. Phillips et al., 2016; Roesler et al., 2022). Also informed by the biomedical paradigm, there is a prevalent narrative within the scientific literature that argues for recommendations to mitigate harms uniquely through educational interventions that place the responsibility on marginalized individuals (youth and families) (APA, 2023; Canadian Paediatric Society, 2022; Finkelhor et al., 2022; Valkenburg et al., 2022; Weigle & Shafi, 2024) rather than policy action that can prevent harms and reduce health inequities. Shifting responsibility from themselves and onto the consumer is a known strategy employed by health-harming industries (Allen, 2020; Kirkland & Raphael, 2018; Raphael et al., 2019), including social media corporations (Crofts, 2024; Hartwell et al., 2024; Zenone et al., 2023). One example is the recent campaign launched by Google advising parents that "sometimes the best YouTube is less YouTube" and "choose what tweens can see on YouTube" (see for example, Google, 2023; Zub, 2024). These advertisements began to make

 doi:10.20944/preprints202502.0334.v1

regular appearances across Ontario, concurrent with the launch of multiple school board law suits against tech giants (CBC, 2024). It is recognized that Big Tech participates in questionable corporate social responsibility (Crofts, 2024; Zenone et al., 2023).

With children and younger adolescents, the responsibility often falls on parents and caregivers. Guidelines recommend that children under the age of two should not access screens except to chat with other supportive adults, children 2-5 should be limited to one-hour or less (Canadian Paediatric Society, 2022) and no more than 2-hours of recreational time for children age 5-17 (Tremblay et al., 2016). Knowing about these recommendations and strategies to limit screen time is not sufficient to support parents in mitigating their children's exposure. Social platforms are attractive to young people because their peers are there and many feel pressured to be responsive to their online networks (Weigle & Shafi, 2024). Absence from these spaces can lead to peer pressure and bullying (Costello et al., 2023). This creates conflict when parents attempt to limit use of devices. A recent survey of Canadian families identified that 85% of parents are in conflict with their teens with respect to their technology use and that this conflict impacts their whole family negatively (Ellis & Hutchinson, 2024).

With the closure of schools and daycares, the pandemic placed a significant care burden on mothers and families (Power, 2020), and many were forced to cope by increasing screen time "letting them have more screen time was the only way to survive" (Kallitsoglou & Topalli, 2021). Correspondingly, child and youth screen time increased dramatically with averages between five and over seven hours/day (Moore et al., 2020; Rideout et al., 2022; Seguin et al., 2021). Despite the easing of restrictions, many of these habits have continued, indicating that norms related to screen use are persisting (Resende et al., 2023; Ten Velde et al., 2021). These screen-based devices are inside each family household and require constant management. Children are driven to use screens and identify ways to access them despite parental restriction (Costello et al., 2023; Reddit Post, 2024; Taylor-Klaus & Dempster, 2020).

Technology to support parental controls exist (see Qustudio, 2024), however, these become obsolete when software updates and can be hacked. Further, they are not accessible strategies for all parents as they require a fairly high level of skill and time management and subscription costs increase if parents would like to disable certain apps, like YouTube, completely. Many children are now assigned Chromebooks through the Canadian public school system. These come with YouTube, and it is not possible for parents to uninstall this function. Google Classroom only functions when a child is online, therefore, they cannot complete their schoolwork without having this constant distraction, along with the rest of the internet. YouTube currently garners the vast majority of the youngest audience (Anderson et al., 2023; Rideout et al., 2022) and the YouTube shorts algorithm functions similarly to the ones driving Instagram and TikTok. Parental concerns are widespread as expressed in a post on the YouTube for Families help page "As a parent I'm begging for the option to disable shorts on my kids phone" (YouTube For Families Help, 2024). This post received over 2000 responses asking the same question.

It is nearly impossible to limit the addictive behavior when the source of the addiction is integrated into every space where children spend time, at home, at school and with peers. Further, even if a parent is successful in setting limitations, their child will still be exposed to harms from negative digital trends through indirect exposure from the social norms among their peers (Harrison et al., 2024; Wescott et al., 2024). This has been demonstrated in research with vaccine hesitant youth (Mckee et al., forthcoming). A recent U.S. Surgeon General's Advisory report was released calling attention to the increased levels of stress being experienced by parents (US Surgeon General, 2024). The report states that 70% of parents feel that parenting has become more difficult over the last 20 years, with a majority stating that they worry about their child's exposure to social media. Similarly in Mott Children's Hospital National Poll, the top two parental concerns were overuse of digital devices or screen time (67%) and social media (66%). These are not findings that support future directions focused on educating parents. It appears that the majority of parents have a profound awareness of the risks related to social media and they are crying out for help. "The entire burden of

 doi:10.20944/preprints202502.0334.v1

mitigating the risk of harm of social media cannot be placed on the shoulders of children and parents" (Eckhardt, 2024; US Surgeon General, 2023).

Solutions and recommendations

Recognizing the critical importance of protecting child and youth wellbeing, Kickbush (2021) argues, "there is an urgent need to orient digital health priorities towards the establishment of strong health and wellbeing foundations early in life… The governance of digital technologies in health and health care must be driven by public purpose, not private profit" (p. 1727-1728). In terms of addressing the CDoH more broadly, Friel and colleagues (2023) offer compelling recommendations that support: 1) a movement toward economic models that prioritize health and public interest, 2) the development of international policy frameworks, 3) the regulation of industry and development of alternative business practice, and 4) social mobilization through advocacy from across stakeholders, including health and civil organizations, journalists, academics and the public. They also highlight that "health actors must understand the language of, and engage with, influential government and business actors such as finance and trade ministers and financial investors" (p. 1237). Collaborative partnerships are essential as these issues cannot be addressed by working in disciplinary silos (US Surgeon General, 2021; Zenone et al., 2021b).

Several proposed solutions have been offered for the reform of corporate practice. For example, Montag (2019) offers recommendations for adapting gaming services. Currently, many apps apply freemium gaming models, whereby videogames can be downloaded for free in exchange for user data, such as attention to advertisements, or by charging for premium features. As alternatives, they recommend that users be charged a reasonable fee for access to the app and that design features be regulated so that they are less addictive. The U. S. Surgeon General (2021) recommends that corporations improve transparency by sharing data with a broad range of independent researchers, users and the public regarding user characteristics, algorithm design, to avoid conflicts of interest and not require non-disclosure agreements. They also recommended that tech companies support child and youth wellbeing, including acknowledging the harms their products are inflicting on children, build safer products, limit harmful exposure to content, create safety standards and give users better control to opt-out of harmful content. Many of these were reiterated in the 2023 report (US Surgeon General, 2023) and by other experts (see Moran et al., 2024; Salter & Wong, 2021; Swedo et al., 2021).

Given the loss of profit, it is unlikely that corporations will move in these directions, without regulation from policy (Costello et al., 2023). Researchers have proposed that there is a need for regulatory measures that restrict marketing practices to reduce harmful impacts on vulnerable groups (Clark et al., 2020; Eckhardt, 2024). For example, Clark (2020) recommends the implementation of an expanded protocol for the UNCRC focused on the regulation of commercial marketing practices that target children with harmful products.

With respect to how policy can be navigated in regulating digital algorithms, Costello and colleagues (2023) put forward a very thorough analysis of existing legislation and legal precedents to offer comprehensive and feasible recommendations. There are two considerable obstacles in American policy that have hindered progress in the regulation of social media up to this point: 1) the First Amendment and 2) Section 230 of the federal Communications Decency Act (Costello et al., 2023; Zenone et al., 2023). The First Amendment offers protection of free speech (with the exclusion of illegal acts) and based on legal precedent, may offer algorithms (as a form of computer code) these same protections, limiting the opportunities to target them with legislation (Costello et al., 2023). Section 230 protects digital industry from liability related to harmful user content (Costello et al., 2023; Zenone et al., 2023). They offer independent algorithm risk audits as a possible solution (Costello et al., 2023). This approach is based on a previous settlement related to the Fair Housing Act and discriminatory advertisements promoted by Facebook that led to the implementation of a process that involved a third-party reviewer to ensure that harms are measured, reported and mitigated. The housing settlement set is the first instance whereby Meta will be held liable for its

 doi:10.20944/preprints202502.0334.v1

marketing strategies. They argue that this process could be adapted to support risk audits of algorithms to protect child health and wellbeing. They recommend that this process should be mandated under legislation along with other promising legislation, such as the United Kingdom Age Appropriate Design Code and the California Age Appropriate Design Code Act and the Kids Online Safety Act (Costello et al., 2023). In Canada, the Online Harms Act (Bill C-63) was proposed in 2024 (Government of Canada, 2024). Recently, the Australian government passed the Online Safety Amendment (Social Media Minimum Age) Bill 2024, under which social media companies need to take 'reasonable steps' to ban children under the age of 16 from their platforms (Parliament of Australia, 2024;).

Future research and the importance of integrating youth voice

In terms of future research, integrate the concept of the CDoH (Zenone et al., 2023) and design interdisciplinary research and interventions to take account of complexity in collaboration with policymakers. For example, realist reviews may be beneficial to capture a more holistic understanding of the mechanisms of influence related to social media and youth wellbeing. We applied Lacy-Nichols (2023) framework to several major corporations that are implicated in negative digital impacts on child and youth health. The funds, employment and market concentration categories were not assessed in this analysis as we focused mainly on academic sources. This analysis was not exhaustive and future research should examine individual tech companies using the framework to explore differential contributions from each organization.

There is a critical need for more studies that examine the lived experience of parents and families attempting to mitigate exposure to screens to identify feasible interventions. In addition, children, youth and families should inform future directions in practice and policy (US Surgeon General, 2021, 2023). They will bring greater insight into their lived experience and will enhance design of research and intervention to support stronger impact. It is no surprise that it is often parents who are leading advocacy efforts; they have the most skin in the game: their children. Applying the United Convention on the Rights of the Child (1989), we recognize that tech corporations and their related harms infringe upon many of the fundamental human rights of children, including their right to privacy, access to information from the media, protection from violence and exploitation and through displacement, and their right to education and play.

Complacently scrolling through manipulative content is the antithesis of exercising free will and arguments from tech corporations about restrictions limiting freedom of speech are deceptive and misleading. *There can be no free speech without free will.* Propaganda campaigns and fake news exacerbate polarization and undermine fair election processes (Geissler et al., 2023). Meta recently announced that they will be ending their fact-checking program, an initiative that was created in response to the Cambridge Analytica election scandal (Chow, 2025) and will follow an approach similar to X (Kaplan, 2025). This accompanies an end to their equity diversity and inclusion program (CBC, 2025) and new policy to loosen restrictions on hate speech (Meta, 2025). After supporting Trump's election campaign, Elon Musk, the wealthiest man in the world, has now been named to co-lead the Department of Government Efficiency (Honderich, 2024). These recent directions will certainly exacerbate current issues related to misinformation, polarization and inequities. In his farewell address, Biden warned, "An oligarchy is taking shape in America of extreme wealth, power and influence that literally threatens our entire democracy" (The White House, 2025). There was a clear presence of tech industry at the Trump inauguration in January 2025 (Helmore, 2025). We must recognize and address this threat that will impact all of us. Children and young people are the canary in the coal mine.

Conclusion

"How a society treats its most vulnerable is always the measure of its humanity" (Rycroft, 2015). In our hesitation to address commercial technology threats, we are failing our children and young

 doi:10.20944/preprints202502.0334.v1

people. We hope this work sheds light on the complexity of the relationship between social media and health, the critical challenges related to industry and the most promising ways forward. We appeal to researchers, policy-makers, practitioners and all who hope to create a better world for young people, to take a stand *together*, for them and for our collective future.

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