DIGITAL TRANSFORMATIONS FOR HEALTH LAB

GOVERNING HEALTH FUTURES 2030

KNOWLEDGE SUMMARY

Digital determinants and adolescent well-being

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KEY MESSAGES

- Digital determinants influence adolescent well-being in both positive and negative ways.
- The majority of research on the relationships between digital determinants and adolescent well-being has been conducted in the Global North.
- The findings of research into associations between adolescents' use of digital technologies and well-being outcomes has been contradictory and inconclusive.
- Further research is required to understand how each adolescent's unique combination of personal characteristics, vulnerabilities and individual protective factors contributes to different well-being outcomes in relation to different digital determinants.
- Divides in digital access and digital literacy must be closed to allow all adolescents to benefit from the positive effects of digital transformations.

Introduction

Adolescent well-being comprises five, interconnected domains: agency and resilience; community and connectedness; health and nutrition; learning and employability; and safety and supportive environment. (Ross *et al.*, 2020) During this critical stage of development, addressing determinants of adolescent health and well-being is important to enable adolescents to thrive and achieve their potential into adulthood. (Viner *et al.*, 2012)

The digital determinants of health and well-being have become increasingly significant as digital technologies and data-driven processes become embedded into adolescents' daily lives. (Kickbusch *et al.*, 2021) Digital determinants have the potential to shape each domain of adolescent well-being in both positive and negative ways. (Holly *et al.*, 2023) Digital technologies offer adolescents new ways to fulfil their growing needs for creativity, exploration, sensation seeking and social acceptance. (Giovanelli, Ozer and Dahl, 2020) However, there are rising concerns that the surge in young people's digital technology use, particularly over the past decade, is putting adolescents at risk and contributing to a high burden of adolescent mental health disorders. (Carvajal, Requejo and Irwin, 2021)

The relationship between digital transformations and adolescent well-being has sparked significant interest from academic researchers, policymakers and caregivers. This brief attempts to provide an overview of current theories and evidence on the impact of different digital determinants

on adolescent well-being. It also seeks to identify evidence gaps and recommendations for future research and policy action.

The brief is based on a review of 74 publications. The publications were initially found through searches on Google Scholar and PubMed. Additional publications and grey literature were found by following citation trails and using further internet searches. Core search concepts for the review were variations of 'adolescents', 'well-being' and 'digital'. Publications were excluded if they were published before 2010 or did not include a focus on adolescents or young people.

Dominant themes in current research

'Digital determinants' is a relatively new concept that refers to the direct and indirect ways in which digital transformations impact equity in health and well-being. (Kickbusch *et al.*, 2021) Whilst the majority of publications included in this review did not use the terminology of digital determinants, scholars have sought to understand whether digital technology use—namely in the forms of overall screen time or internet use, social media use and online gaming—is a positive or negative determinant of adolescent well-being. Different definitions of well-being were found in the reviewed publications with most authors focusing on adolescent mental health. None of the publications reviewed had adopted Ross et al's definition of adolescent well-being but each of the five domains were discussed in at least one fifth of the publications. Connectedness, health, and agency and resilience were the domains of greatest interest to researchers.1 Overall, the reviewed literature focused more on negative associations between internet or social media use and well-being with far fewer looking at positive associations. Some scholars suggest that this dominant interest in the detrimental effects of digital technology use can be explained by the moral panic that arises following the introduction of any new technology. (Orben, 2020)

Overall conclusions on the association between digital determinants and adolescent well-being

Most of the studies reviewed examined adolescents' use of digital technologies as an important potential determinant of well-being. Such studies generated contradictory findings and were unable to demonstrate any significant cause-effect relationships. Several studies showed a small negative association between internet use and well-being outcomes. (Charmaraman, Gladstone and Richer, 2018; Twenge and Campbell, 2018; Marciano *et al.*, 2022). However few longitudinal studies using representative data have been conducted to understand the causal pathways of this relationship. (Plackett, Blyth and Schartau, 2023) Conversely, other studies suggested that screen time does not lead to lower levels of well-being (Odgers and Jensen, 2020a; Boer, Stevens, *et al.*, 2022) and some even suggest that moderate amounts of screen time could even be advantageous to adolescent well-being. (Przybylski and Weinstein, 2017) Studies trying to uncover whether different types of digital technology use lead to different well-being outcomes have been similarly inconclusive. Findings have revealed no clear distinction, for example, between active and passive forms of technology use. (Beyens *et al.*, 2021; Meier and Krause, 2022) The effects of different types of internet use can be negative,

1 Number of papers discussing the positive or negative aspects of a domain of adolescent well-being: Community and connectedness = 38; Health and nutrition n=36; Agency and resilience = 22; Safety and supportive environment = 19; Education and employability = 15.

positive, or null, depending on the person and the situation. (Marciano *et al.*, 2022)

Many studies have explored the relationship between digital technology use and specific negative outcomes such as insufficient sleep, cyber bullying, lack of energy, decreased physical activity and weight changes, ADHD, anxiety, headaches and pain from the ergonomics of device use. (Twenge and Campbell, 2018; Dienlin and Johannes, 2020; Fairclough, 2021; Bozzola *et al.*, 2022; Mehtälä *et al.*, 2022; Thomas *et al.*, 2022) Several scholars have proposed that rather than internet use itself, it is the negative effects of internet use—in particular on adolescents' sleep, physical activity and quality time spent with family—that can result in lower levels of well-being. (Hökby *et al.*, 2016; Marciano and Viswanath, 2023) Again, effects were not found to be uniform for all adolescents. (Viner *et al.*, 2019)

Many studies and systematic reviews have concluded that the effects of digital technology use on adolescent well-being are inherently complex. Whilst risks to adolescent well-being exist online, they do not necessarily result in harm. (Livingstone, 2012) Time spent on the internet is not an independent risk factor (Hökby *et al.*, 2016) and there is no uniform effect of social media use. (Marciano and Viswanath, 2023) In recent years, researchers have therefore sought to better understand what factors shape adolescent well-being in relation to digital technologies. Possible explanations have been offered including adolescents' different motivations for using digital technologies; levels of digital literacy; the nature of the content that adolescents are exposed to; and individual personality traits, vulnerabilities and resilience. (Beyens *et al.*, 2021; Vissenberg, D'Haenens and Livingstone, 2022; American Psychological Association, 2023). Young people's online experiences, and well-being as a result of these experiences, cannot be isolated from their individual, social, and country-level contexts. Offline vulnerabilities tend to mirror adolescents' online vulnerabilities and that what young people bring to their digital experiences can help explain the positive or negative experiences they have online. (Odgers and Jensen, 2020b)

Digital determinants

The *Lancet* and *Financial Times* Commission on Governing Health Futures 2030 characterized the digital determinants at three levels. Firstly, the direct application of digital technologies and data in healthcare; secondly, the influence of the wider digital ecosystem; and thirdly, the indirect impact of digitalization on other determinants e.g. social and commercial determinants. (Governing Health Futures 2030 Commission, 2021c) When analysing the literature in this review, this broad framework was used to explore how different aspects of digital determinants influence adolescent well-being.

a) Digital health technologies

A global survey of over 23,000 digitally connected adolescents and youth revealed that 88 per cent use digital technologies to support their health and well-being. (Governing Health Futures 2030 Commission, 2021b) Whilst young people's health priorities remain largely unchanged in the digital age, technologies offer opportunities to answer health questions in new, compelling and interactive ways (Colditz, Woods and Primack, 2018) and for health professionals to reach adolescents in remote and underserved communities. (Champion *et al.*, 2023; Holly *et al.*, 2023) Young people tend to rely on technologies such as websites, search engines and smartphone apps for health information and health promotion tools. (Lupton, 2021; Sewak *et al.*, 2023) At the same time, a growing number of adolescents are taking advantage of wearable sensors and advances in genomic sequencing to understand and address health risks. (Sabatello and Appelbaum, 2016; Xiao and Wang, 2023)

Several articles in the review assessed the use of digital tools for health promotion and chronic disease management among adolescents with mixed results reported. (Champion *et al.*, 2023; Schaafsma *et al.*, 2023) A larger number of studies looked at the impact of digital tools to support adolescent mental health, also finding varying levels of effectiveness. (Doryab, 2018; Giovanelli, Ozer and Dahl, 2020; Ådnanes *et al.*, 2022; Boer, van den Eijnden, *et al.*, 2022; Xiao and Wang, 2023)

b) Digital reach and connectivity

Few of the studies in the review reported on levels of digital connectivity within the study cohorts. This is likely to be because the majority of studies were conducted in the Global North among communities with consistent levels of connectivity. Only one paper identified access to particular pieces of equipment such as webcams and internet connectivity as barriers for remote mental health consultations. (Ådnanes *et al.*, 2022) One paper concentrating on adolescents in the Global South highlighted disparities in digital connectivity, stating that up to two-thirds of children in this region are under-connected and depend on mobile phones for internet access. (Ghai *et al.*, 2022) Mobile phone ownership varies considerably among adolescents, for example in sub-Saharan Africa, ranging from 3% in Tanzania to 40% in Burkina Faso and with higher mobile phone ownership among boys compared to girls. (Wang *et al.*, 2023)

c) Digital adoption

The majority of papers reviewed start with the premise that adolescents are rapid adopters and enthusiastic consumers of digital devices and platforms. It is noted by several authors that, in many parts of the world, the COVID-19 pandemic required adolescents to adopt or significantly increase their usage of digital technologies in order to continue education, for entertainment and to maintain social connections. (Buchholz, DeHart and Moorman, 2020; Xiao and Wang, 2023)

The most common types of digital tools and services used by adolescents include social media, streaming on-demand content, online gaming, texting and messaging. Some studies suggest gender differences in how technology is used, for example, girls' time online is more likely to be spent using smartphones for texting and social media whereas boys' prefer to spend their time gaming. (Madden *et al.*, 2013; Twenge and Martin, 2020) Digital technologies and their uses by adolescents are not static. The ways in which they are used change as contexts change and different platforms and technologies gain and lose popularity within an adolescent's social group. (Vuorre, Orben and Przybylski, 2021) Adolescents who are well connected with their peers also spend more time online. (Marciano *et al.*, 2022)

In response to concerns about adolescents spending excessive amounts of time online, researchers have explored whether there is a 'just right' amount of screen time for adolescents (Przybylski and Weinstein, 2017) Further studies have then gone on to investigate whether different types of technology use are a factor for adolescent well-being, distinguishing particularly between active and passive uses. (Dienlin and Johannes, 2020; Beyens *et al.*, 2021; Meier and Krause, 2022) Such studies highlight that an adolescent can use digital technologies in many different ways making generalizations about their impact on well-being very difficult.

Factors that contribute to greater technology use are of interest to researchers, largely founded on the assumption that 'excessive' use will have negative impacts on well-being. Among the factors found to be associated with higher levels of mobile phone or social media use, or gaming include coming from a lower socioeconomic group, adverse childhood experiences and pre-existing depression or feelings of low life satisfaction. (Boer, Stevens, *et al.*, 2022; Bohnert and Gracia, 2022; Raney *et al.*, 2023) Studies assessing the effectiveness of digital interventions have sought to identify

features that encourage greater adoption of digital health technologies by adolescents. Good design, pleasant user experience, personalisation and interactive components were found to be important features for engagement with digital health tools. (Radovic and Badawy, 2020; Ferretti, Hubbs and Vayena, 2023) Adolescents indicated preferences for using technological tools to enhance rather than not replace conventional healthcare. (Lupton, 2021) Adolescents' concerns about data security and effectiveness of interventions were generally low but increased in relation to interventions for sensitive health topics. (Radovic and Badawy, 2020)

d) Digital literacy and skills

Digital literacy and skills are important for all domains of adolescent well-being due to the increased role of digital technologies in everyday life including learning, employment and civic life. (Haddon *et al.*, 2020) Studies have found adolescents from higher socioeconomic backgrounds, those with greater access to technologies at home and school, and with higher overall levels of academic achievement have higher digital literacy and skills than peers from lower socioeconomic backgrounds. (Haddon *et al.*, 2020; Estrela *et al.*, 2023) Ethnicity is examined by a handful of studies as a potential source of digital inequality, with mixed results. Evidence on gender disparities have shown that girls and boys have similar levels of digital skills. (Haddon *et al.*, 2020)

Contrary to popular belief, studies have shown that digitally literate young people generally encounter more—not fewer—risks online because they spend more time online than less digitally literate peers. (Vissenberg, D'Haenens and Livingstone, 2022) A weak positive association has been found between digital literacy and young people's well-being with more digitally skilled adolescents generally reporting higher levels of well-being. Adolescents with higher digital skill levels were also found to be better at coping with negative online experiences compared with young people who reported lower levels of digital literacy. (Vissenberg, D'Haenens and Livingstone, 2022) Overall, higher levels of digital literacy and skills do not necessarily make for better well-being outcomes due to a range of mediating factors such as prior mental health conditions and other offline vulnerabilities or protective factors. (Livingstone *et al.*, 2022)

e) Big data and genomic data

The increased datafication of adolescents' bodies and activities is a concern for many groups. (Kickbusch *et al.*, 2021) Data collection and analysis is a core part of the business model of the search engines, social media sites, games and other platforms used by adolescents. Large repositories of adolescent genetic data are already available in biobanks, either obtained directly or through parental consent. (Sabatello and Appelbaum, 2016) More representative data is needed to better understand the impact of digital technologies on adolescent health and well-being and assess the effectiveness of digital interventions. (The Lancet Digital Health, 2023)

There is huge potential for adolescents' data to contribute to public good. For example, one study in the review demonstrated how adolescent mental health data is being used to develop warning systems for psychological crisis detection and provide timely interventions. (Xiao and Wang, 2023) A larger number of studies have highlighted risks of personal data being exploited for commercial purposes with negative consequences for adolescent well-being. Algorithms and popularity metrics used by social media, for example, lead to highly personally relevant information being ranked higher and making it hard for adolescents to avoid exposure to content that can harm their well-being. (Livingstone *et al.*, 2022; Meier and Krause, 2022) Digital marketing of unhealthy foods has been shown to challenge adolescents' autonomy

and contribute to negative health outcomes such as obesity and non-communicable diseases. (Tatlow-Golden and Garde, 2020)

f) Other determinants

The intersection between digital and other determinants on health and well-being, particularly the social and commercial determinants, are implicit in many papers in this review. Several studies highlight differences in well-being outcomes between adolescents from high and low socioeconomic backgrounds, with already disadvantaged adolescents suffering worse well-being outcomes from their experiences with digital technologies. (Haddon *et al.*, 2020; Bohnert and Gracia, 2022) The digital practices of commercial actors are shown to have consequences for adolescent health and well-being. (Tatlow-Golden and Garde, 2020) Environmental determinants such as exposure to toxic e-waste and the climate change implications of digitalization are an emerging issue in literature on adolescent well-being. (World Health Organization, 2021)

Limitations of current research

Several authors highlight limitations of existing research which make it difficult to draw clear conclusions about the impact of digital transformations on adolescent well-being. Key variables such as well-being, mental health or digital media use are not always clearly defined. (Valkenburg, Meier and Beyens, 2022) Research is often conducted with heterogeneous groups of adolescents without fully understanding the different socioeconomic factors and population characteristics that shape individual susceptibility to different well-being outcomes. Studies often rely on adolescents' self-reported information about screen time, digital media use and its perceived impact which is subjective and may not be accurate.

A major weakness of the current body of research on digital determinants and adolescent well-being is that it predominantly focuses on adolescents living in the Global North, despite the fact that most adolescents live in the Global South. (Ghai *et al.*, 2022) Furthermore, studies are often cross-sectional, i.e. focused on one point in time, which means they can help to identify characteristics but not determine cause-effect relationships. Another challenge is that the technology landscape is constantly changing making it difficult to reach conclusions that remain relevant and to compare findings from different points in time. (Orben, 2022)

There is a paucity of qualitative studies exploring the specificities of adolescents' unique experiences with digital transformations over time which would be important for understanding the individual characteristics and factors that influence well-being outcomes. (Schønning *et al.*, 2020) Another clear gap in the research literature is the lack of focus on potentially positive aspects of digital transformations and technology use. (Rosič *et al.*, 2022)

Further research priorities

To address the limitations of current research, future research on digital determinants and adolescent well-being should prioritize the Global South and studies with a longitudinal design that examine the positive and negative effects of digital determinants over extended periods of time and could help us learn about possible cause-and-effect relationships. Due to the heterogeneity of results generated from research so far, a strong recommendation from scholars is also to conduct more qualitative and quantitative research into adolescents' different protective and risk factors and individual dynamics that may affect the impact of digital determinants on well-being outcomes.

Recommendations

In addition to suggestions for future research, a number of recommendations emerged from the reviewed literature which policymakers, digital technology companies and other actors can immediately act upon:

- **Focus policy and parenting** interventions on addressing the negative consequences of technology use such as preventing cyberbullying and ensuring adequate sleep and physical activity, rather than limiting adolescents' technology use. (Hökby *et al.*, 2016; Viner *et al.*, 2019; Livingstone *et al.*, 2022)

- **Take steps to close divides** in digital access and literacy and also divides in the support and protections available to adolescents who encounter online harms. (Odgers and Jensen, 2020b)

- **Reflect the** unique developmental characteristics of adolescents in the design and governance of digital technologies and always consider adolescents as a diverse and heterogeneous group with different needs, experiences, and evolving capacities. (Giovanelli, Ozer and Dahl, 2020; Governing Health Futures 2030 Commission, 2021a)

- **Apply a holistic interpretation** of adolescent well-being to digital governance approaches and strengthen coordinated action from different sectors to improve adolescent well-being. (Holly *et al.*, 2023)

- **Involve adolescents in decisions** about their personal data and at every stage of technology design and governance to ensure adolescent well-being is at the centre of all digital tools, services and interventions. (Sabatello and Appelbaum, 2016; Wong, Gray and Holly, 2021; Haddock *et al.*, 2022)

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