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Editorial

The Integration of Innovative Technologies to Support Improving Adolescent and Young Adult Health

Generation Z are currently around 10–23 years of age and are noteworthy both for having grown up entirely in a digital age and for experiencing a portion of their formative years in the grip of the coronavirus disease 2019 (COVID-19) pandemic [1,2]. The pandemic has forced many countries to rapidly transition work, education, social connection, and health care onto online platforms. Although not intended, it is poignant that this supplement about integrating innovative technologies to support improvements in adolescent and young adult (AYA) health coincides with a time when the benefits of technological reforms in health systems and health care are suddenly being realized for all age groups.

Notwithstanding current circumstances, the case for integrating technology into health care has great potential for AYA. Young people are early adopters of technology. They frequently turn to digital sources for health information and advice and use technology in other aspects of their recreational, educational, and working lives [3]. Technology shows great potential to mitigate health care access barriers and to support preventive care [4]. Yet, we must also be mindful of challenges. The COVID-19 pandemic has highlighted critical issues such as inequity of access to adequate internet bandwidth or fast digital devices and difficulty finding safe or private spaces to access health care using technology. Our increasing reliance on digital health data—and the ethical and legal considerations about who accesses these data and how it will be stored and used—is another critical issue thrust forward by current circumstances [5].

This supplement brings together six articles that showcase cross-disciplinary collaborations exploring diverse aspects of technological innovation; its place developmentally; its power to facilitate youth-led participatory action research (YPAR); and its potential to improve access to preventive services, to support behavior change, and to assist health care delivery. Specific solutions include artificial intelligence (AI) and personalized preventive AYA health care.

In addition to the empirical articles, Thadaney Israni et al. [6] write a provocative commentary on the perils of applying AI to AYA health care, juxtaposing these with the promise of technology implemented through a lens of "human rights values" and balanced with equity and inclusivity for those experiencing vulnerability. The authors discuss three perils most relevant to AYA—data bias, surveillance capitalism, and sharenting—and acknowledge that although AI is a game-changing technology, it needs to be thoughtfully integrated with health care to avoid societal harm.

The article by Giovanelli et al. [7] explores the nature of adolescent biopsychosocial development and its occurrence within a "context of digital platforms". Specifically, this article considers what types or foci of digital technology are likely to have the most impact at different stages of a young persons' cognitive, physical, and psychosocial development. The authors argue that adolescent health clinicians and researchers can leverage developmental windows of opportunity by tailoring digital health initiatives to align with them.

Gibbs et al. [8] examine the potential for technology to engage adolescents as coresearchers in health and well-being projects relevant to their own lives. They conducted a systematic review of published evidence on the use of technology to increase the reach and impact of YPAR. The authors identified five unique projects—four in the U.S. and one in Portugal—that used a range of platforms (e.g., Facebook, Twitter, and Instagram) primarily to gather data from adolescent participants. This article articulates multiple challenges to realizing the potential of using technology to scale up YPAR and identifies a need for revised frameworks to inform the management of these complex, collaborative relationships.

Wong et al. [9] conducted a scoping review characterizing digital health tools used in clinical preventive services for AYA according to how they exemplify five key affordances, namely, social, cognitive, identity, emotional, and functional. The affordances framework considers digital design and how and for what purpose the product is intended to be used. The authors map the challenges for future work in better integrating digital tools with clinical care, addressing digital privacy and security settings, and improving identification of best-fit tools for the AYA age group.

The article by Ozer et al. [10] takes readers through the innovative journey of the codesign of a behavior change intervention, called *Inspire*, aimed at reducing alcohol use among adolescents. The intervention elements are underpinned by a strong theoretical framework for behavior change (social cognitive theory) and technology advances (narrative-centered learning environments) to maximize the likelihood of significant impact when used alongside clinical preventive care. More than 200 adolescents participated in the iterative development of

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Inspire, which embeds alcohol reduction strategies into interactive story scenarios within a three-dimensional commercial game. *Inspire* is part of the emerging field known as "games for health," which allows the user to see the consequences of the different choices they make during an interactive game to practice strategies for reducing risky behaviors.

Bickmore et al. [11] report an evaluation of *Gabby*, a novel Web-based virtual animated health counselor facilitating preconception care among young women. Preconception risks were identified via an online survey, after which participants interacted with *Gabby* over 12 months. The intervention had a high level of use and acceptability among participants. There was also a positive impact on behavior, with more than 70% of participants reporting that they had followed *Gabby's* recommendations at 1 year. Although study participants preferred to talk directly with a health provider, this study shows that digital interventions are a viable option for reducing preconception risk.

In the final article of this supplement, Rowe and Lester write on much anticipated opportunities for more tailored and effective health care created by AI applied to personalized preventive adolescent health care [12]. The authors provide a computer science perspective on how emerging AI technologies, such as intelligent learning environments, interactive narrative generation, stealth assessment, affective modeling, goal recognition, and adaptive coaching, can be used to model adolescent learning and engagement and deliver personalized support in adaptive health technologies. The article outlines key challenges, including privacy, ethics, encoded bias, and integration into clinical care workflows and the lives of young people.

The articles in this special issue advance and frame our thinking on the potential of technology to extend the scope and reach of preventive care beyond the face-to-face clinical interaction. These solutions can improve the effectiveness of care by targeting interventions to developmental stages or more personalized characteristics. Meanwhile, the themes raised in Thadaney Israni's commentary are carried through the other papers, highlighting the human rights framework necessary to mitigate against potential and unintended societal harms.

What seems clear is that policy makers, researchers, and practitioners need to work together to ensure an equitable and inclusive environment in order for real impacts of technology on public health to be realized. Alongside the researchers developing the technology, we must have researchers skilled in facilitating the implementation of the technology into current clinical practice and enabling clinicians to change workflow to embed new practices. It is surprising how rapid this adaptation can be when the community, clinicians, policy makers, and researchers are all involved in purposively generating and iteratively adapting the solutions, such as we have seen in response to COVID-19. And above all, involving AYA in technological solutions for their future preventive care will be crucial for the success of those solutions.

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