

# The Obesity Epidemic and the Potential of Augmented Reality

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Augmented reality (AR) is an emerging technology with potential to combat the obesity epidemic among younger populations in the United States and healthcare providers ought to embrace the use of this advancement in promoting a healthier society. AR involves integrating digital information with one's environment in real time. With the advent of this technology, users are empowered to interact dynamically with their surroundings in new ways all while safely partaking in physical activity. The hope is that by spurring activity we can reverse disconcerting trends related to obesity (i.e. an excess of body fat compared to one's height, and age for pediatric populations). Two-thirds of adults in the United States are considered overweight or obese and the same is true for over a third of children and adolescents [1, 2]. Furthermore, given certain overarching trends such as technological innovations, advances in transportation, and a shift toward an information-centric economy, more Americans are leading sedentary lifestyles. Obesity and sedentary behavior have both been linked to increased risks of developing cardiovascular disease and to higher rates of all-cause mortality [3]. Many expert groups, including the American Heart Association, recommend that adults pursue at least 150 minutes of moderate-intensity aerobic activity each week. Researchers estimate that inactivity costs the global economy nearly \$70 billion annually in medical expenses and productivity losses [4]. Even moderate physical activity has been estimated to prevent over a quarter of a million deaths each year [5]. One survey demonstrated that among Americans with cardiovascular disease, those who met recommended exercise guidelines had about \$2,500 lower annual healthcare costs than those who did not meet the guidelines [6].

While many healthcare delivery reform efforts are directed towards managing elderly populations with multiple chronic conditions, the disconcerting trends in obesity and inactivity particularly in younger populations also warrants attention and resources to secure the wellbeing and economic stability of future generations. One strategy to promote healthy activity and combat obesity in younger groups is to leverage emerging technologies. AR could represent an innovation with the potential to positively influence the health and wellness of young people. The popularity of and interest in AR has exploded with the release of popular entertainment titles such as Pokémon Go (a multiplayer game in which players use their smartphone camera and GPS to walk around and explore their neighborhoods to find, catch, and train fictional creatures that are overlaid onto the real world). While AR applications for wellness are relatively new in the marketplace, AR solutions have been used in healthcare for some time, for example, to enhance the phlebotomy process, to assist surgeons in the operating room, and to easily locate external defibrillator machines in cases of emergencies.

By stimulating consumers to engage with technology in novel ways, developers of consumer-directed AR solutions are poised to significantly drive physical activity in millennials and future generations to the benefit of societal health and wellbeing. Given their growing popularity, AR solutions which encourage physical activity (by incorporating geolocation technology and other solutions) promise to supplant common sedentary activities such as television watching, internet surfing, and the playing of static video games. Promisingly, there have been recent strides related to AR. In the last few years, popular video game console manufacturers have marketed motion-controlled video systems such as the Sony Move, Xbox Kinect, and the Nintendo Wii. These systems require participants to actively move around, thus promoting more physical activity than predecessor products. The downside to these systems is that they require consumers to purchase separate and often expensive equipment and may necessitate a great deal of dedicated space for optimal use. On the other hand, modern AR solutions are increasingly being adapted to technologies that are already widely adopted such as smartphones and tablets. Consequently, AR solutions require little to no additional equipment investment and enable users to engage nearly anywhere with limited space needs.

While AR solutions stand to promote healthy behaviors in younger populations where obesity is becoming commonplace, the potential benefits must be considered against the risks of excess "screen media exposure" in the pediatric group. The American Academy of Pediatrics recommends limiting total entertainment screen time in children to less than 1–2 hours a day and the group discourages any screen media exposure in those less than 2 years of age [7]. As the evidence base guiding these recommendations continue to evolve, we must acknowledge the fact that advances in our technology may outpace guidance literature. We must also rigorously investigate the impact of AR despite our intuition of their beneficial effect, especially considering recent evidence demonstrating that wearable tracking technologies may not confer a benefit to young people attempting to lose

weight [8]. There have also been reports of motion sickness associated with these types of novel technologies and a user may risk injury on account of not being aware of his or her surroundings. Furthermore, while we anticipate the cost of AR solutions (and the platforms upon which they are built) to continue to decline over time, there is still a risk that those of lower socio-economic standing will be unable to afford these technologies (and/or the associated data plans) for some time. In the same vein, wellness-focused AR solutions may be poorly suited for more destitute neighborhoods which may lack safe spaces for recreation. Given this reality, the use of AR solutions to combat obesity may potentially exacerbate healthcare disparities as they relate to inactivity and associated sequelae. Stakeholders must be vigilant in terms of identifying and promoting affordable advances for obesity management.

From a commercial standpoint, health and wellness AR developers will also be obliged to create stimulating products that capture the hearts and minds of young people while spurring them to action, lest their products be quickly discarded as fads. These products will need to be continually refreshed, updated, and reimagined if AR developers hope to win recurrent customers. We expect AR developers to rise to the challenge and the industry will benefit from continuous improvements in geolocation and accelerometer technology in mobile devices. The most successful AR developers will likely find novel ways to incorporate data from and robustly interact with other technological platforms such as various wearable solutions, other media and entertainment devices, and electronic health records. Ensuring data interoperability, privacy, security, and optimizing data usability will be key elements for the success of AR in the health and wellness space. Further, in order to achieve out-sized returns in health and wellness, AR developers should recruit employees with deep healthcare domain knowledge (particularly healthcare providers and other allied health professionals), align with influential stakeholders who envision a healthier society (e.g. working with the American Heart Association to fashion AR solutions in keeping with their recommendations of healthy activity levels, working with nutritionists and other allied health professionals to incorporate a broad set of lifestyle interventions into AR solutions, working with pediatrics groups and the research community to better elucidate risks and benefits of AR solutions aimed at wellness).

Despite the aforementioned challenges, it is clear that AR has the potential to play an important role in healthcare and it should in wellness also. Undoubtedly, ensuring adequate privacy and security of health-focused AR systems as well as clarifying data ownership rights will continue to be important issues. Innovators in this space must attract a broad swath of consumers while addressing these various issues. Many will fail to gain a lasting foothold but those who do stand to improve the health of younger populations while accruing substantial profit for themselves.

## Multiple choice question

Expert groups, including the American Heart Association, recommend that adults pursue at least how many minutes of moderate-intensity aerobic activity each week?

- A) 30 minutes
- B) 90 minutes
- C) 150 minutes [correct answer]
- D) 200 minutes

### Contributors' Statement

Dr Poku conceptualized and paper, drafted the initial manuscript, and approved the final manuscript as submitted. In addition, he had substantial contribution to conception and design of paper, contributed to the drafting the article and revising it critically for important intellectual content and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Drs Behkami and Bates reviewed and revised the manuscript, had substantial contribution to conception and design of paper, contributed to the drafting the article and revising it critically for important intellectual content and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved, approved the final manuscript as submitted.

**Financial Disclosures**

Dr. Poku and Dr. Behkami have no financial relationships relevant to this article to disclose. Dr. Bates consults for EarlySense, which makes patient safety monitoring systems. He receives equity and cash compensation from QPID, Inc, a company focused on intelligence systems for electronic health records. He receives cash compensation from CDI (Negev), Ltd, which is a not-for-profit incubator for health IT startups. He receives equity from Enelgy which makes software to support evidence-based clinical decisions. He receives equity from Ethosmart which makes software to help patients with chronic diseases. He receives equity from Intensix which makes software to support clinical decision-making in intensive care. He receives equity from MDClone which takes clinical data and produces deidentified versions of it. Dr. Bates' financial interests have been reviewed by Brigham and Women's Hospital and Partners HealthCare in accordance with their institutional policies.

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None

**Conflict of Interest**

Dr. Bates consults for EarlySense, which makes patient safety monitoring systems. He receives equity and cash compensation from QPID, Inc, a company focused on intelligence systems for electronic health records. He receives cash compensation from CDI (Negev), Ltd, which is a not-for-profit incubator for health IT startups. He receives equity from Enelgy which makes software to support evidence-based clinical decisions. He receives equity from Ethosmart which makes software to help patients with chronic diseases. He receives equity from Intensix which makes software to support clinical decision-making in intensive care. He receives equity from MDClone which takes clinical data and produces deidentified versions of it. Dr. Bates' financial interests have been reviewed by Brigham and Women's Hospital and Partners HealthCare in accordance with their institutional policies.

Dr. Poku has no conflicts to disclose.

Dr. Behkami is an employee of Merck & Co, he has no other conflicts to disclose.

**Human Subject Research Approval**

No human subjects participated in the completion of this paper. N/A

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