



IMPROVING CARDIOVASCULAR DISEASE OUTCOMES WITH DIGITAL HEALTH PLATFORMS

Abstract

The economic burden of chronic diseases is increasing and presents a significant challenge to governments worldwide. With cardiovascular diseases at the top of the list, health care systems are aiming to shift from reactive treatments to preventive models. However, improving health outcomes for patients with cardiovascular diseases is complex and requires a combination of medication, diet, exercise, and other lifestyle adjustments.

Here, we examine the challenges of health care systems in managing cardiovascular diseases and evaluate how digital health platforms can augment current treatment plans to deliver better patient outcomes.

Introduction

Cardiovascular diseases (CVDs) are the leading cause of death worldwide, accounting for 17.9 million deaths in 2019 (1). In the coming years, the burden of CVDs is expected to increase, imposing greater strain on the health expenditure of governments globally. It is estimated that CVDs will affect more than 40% of Americans by 2030. The associated cost of diagnosis and treatment is projected to reach US \$622 billion by 2025 (2).

Approximately 50% of CVD risk can be attributed to physical inactivity, smoking, and comorbidities such as diabetes and obesity (3). While the development of CVDs can be influenced by unmodifiable risk factors such as age, ethnicity, and family history (4), the good news is that there are many modifiable risk factors that can be controlled through lifestyle adjustments and timely interventions.

Challenges Associated with the Self-management of CVDs

Though governments, health care payers, and providers are grappling with the burden of CVDs, the strong influence of modifiable risk factors that contribute to the development of CVDs can be leveraged to inhibit disease onset. A substantial body of research has demonstrated the importance of a healthy diet and regular exercise to reduce the risk of CVDs (5, 6, 7). An unhealthy diet is strongly associated with the development of coronary heart disease, characterized by plaque deposition in the vital blood vessels that supply the heart with oxygen (5). Among high-risk adults, dietary interventions have improved CVD risk factors (8). Similarly, physical activity is associated with improvements in CVD risk factors such as hypertension, insulin resistance, and elevated blood lipid levels (5).

Medication is integral to effectively manage CVDs. However, the complexity

of medication regimens poses challenges to a patient's ability to adhere to their prescriptions (9). A study of 56 patients with uncontrolled hypertension found that 50% of individuals had hypertension that is truly unresponsive to treatment. Clinically-significant reductions in blood pressure were observed among the remaining 50% of these patients when administered their prescribed medications regularly by clinical staff (10).

Apart from regular medication, maintaining a healthy diet and exercise regimen is critical for self-managing CVDs. However, a study found that among 759 US adults with self-reported coronary heart disease, only 17% achieved the recommended exercise levels and 7% adhered to the recommended dietary salt intake (11).

These results highlight that steps must be implemented to assist patients in maintaining healthy lifestyle habits.



The Role of Digital Tools in CVD Care

Given the significant burden of CVDs, there is growing interest in implementing digital solutions that assist patients in self-managing their conditions. Digital tools can help patients track their adherence to medication, nutrition, and exercise regimens. Additionally, medical device companies are also coupling their products with digital companions for a more personalized user experience.

Digital health platforms can integrate data from regulated Class I, II and III medical devices, wearables, and mobile apps and are key to the digital transformation of the life sciences industry. They help achieve benefits such as:

- **Improved patient adherence and CVD risk factors** – Digital health solutions have demonstrated encouraging efficacy in improving CVD risk factors and promoting better lifestyle management among cohorts with low to moderate CVD risk (3). A meta-analysis of 9 studies

demonstrated that the risk of adverse CVD outcomes was reduced by 39% in the digital health intervention group compared to patients receiving normal care (12). Research has also shown the effectiveness of digital interventions in improving physical activity, diet, and medication adherence (3).

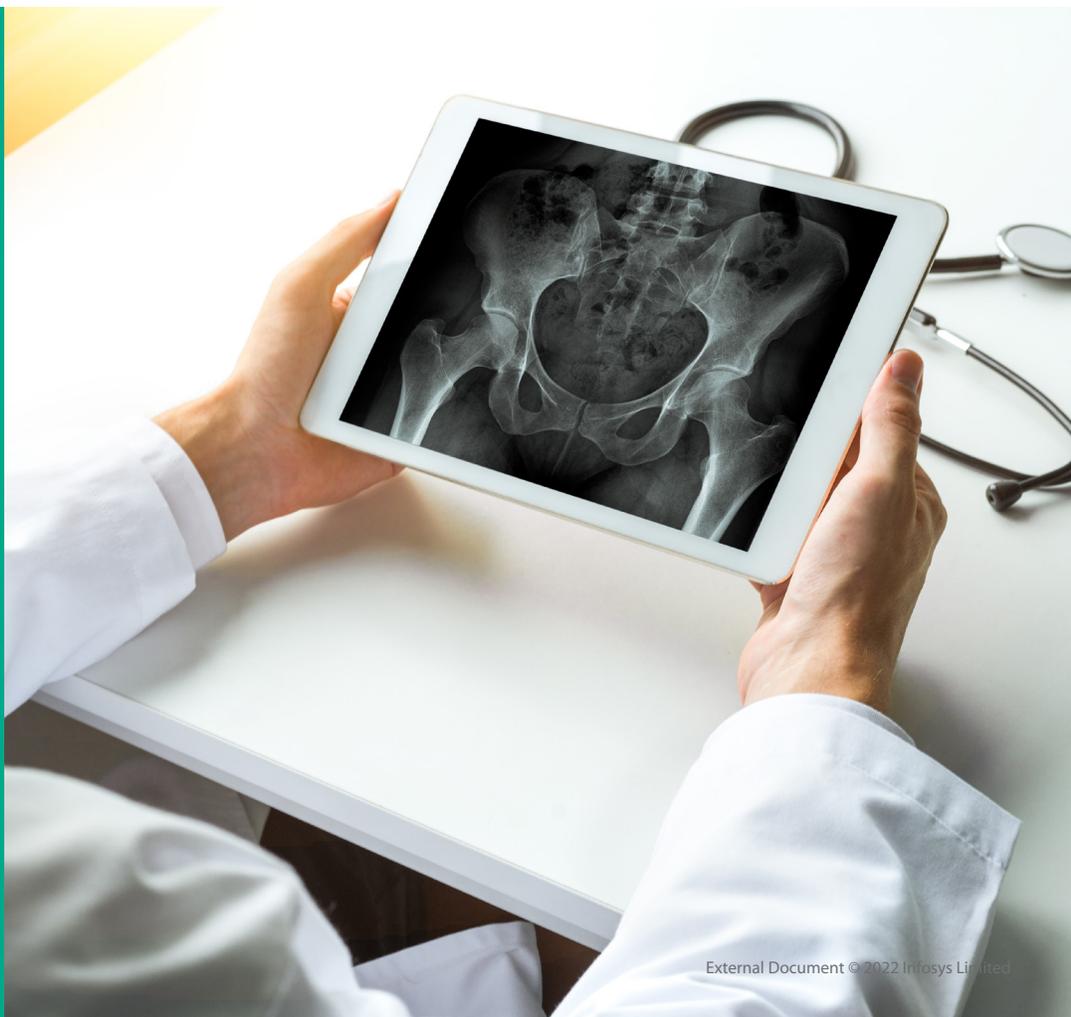
- **Enhanced tracking in real-time** – Bluetooth technology is now enabling data generated from pacemakers (CRT, CRT-D, ICD) to be viewed on a patient's smartphone (13). This data can be easily transmitted from smartphones to a secure network without the need for traditional bedside monitors as transmitters. Patients using Bluetooth-enabled pacemakers coupled with a mobile app recorded a success rate of 94.6% for scheduled transmissions. This was significantly higher than the 56.3% and 77% success rates among patients using manual or wireless transmission methods via a bedside monitor (13).
- **Increased patient engagement** – Trials have investigated whether digital

health interventions for hypertension management improve patient engagement (14). Patients assigned to the digital medicine group were asked to purchase a wireless blood pressure unit and encouraged to take frequent readings to submit to their clinical team. In contrast, those in the normal care group continued to visit their physician. Over a period of 90 days, the digital medicine group recorded an average of 55 blood pressure readings compared to an average of 0.8 readings in the normal care group, demonstrating higher patient engagement (14).

When considering digital health platforms or digital tools, it is important to ensure that all devices comply with the requisite norms and health care standards. Further, the use of patient data for artificial intelligence and machine learning-based predictions and analytics must be governed by strong security protocols. With this approach, digital health platforms can greatly assist health care systems in delivering better quality of life outcomes for CVD patients.

Conclusion

While CVDs pose a huge strain on health care systems worldwide, lifestyle adjustments and guided medication can go a long way in managing the disease. However, treatment regimens can be complex, making it difficult for patients to follow prescribed routines unmonitored. Digital health platforms are designed to integrate medical device data as well as medication, dietary, and activity trackers to generate actionable insights in one place. These ensure that patients follow regimens to effectively self-manage their condition. It improves patient engagement, adherence to medication and lifestyles regimens, and promotes ownership of health outcomes. It also gives CVD patients the opportunity to improve their quality of life while reducing the burden on health care systems.



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References

1. World Health Organisation. Cardiovascular diseases (CVDs) [Internet]. World Health Organisation, 2021 [updated 11 June 2021; cited 8 Dec 2021]. Available from: [https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-\(cvds\)](https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds))
2. Heidenreich PA, Trogon JG, Khavjou OA, Butler J, Dracup RN, et al. Forecasting the Future of Cardiovascular Disease in the United States, *Circulation*. 2011 Jan 24; 123: 933-944.
3. Akinosun AS, Polson R, Diaz-Skeete Y, De Kock JH, Carragher L, Leslie S, et al. Digital Technology Interventions for Risk Factor Modification in Patients With Cardiovascular Disease: Systematic Review and Meta-analysis. *JMIR Mhealth Uhealth*. 2021 Mar 3;9(3): Article no.: e21061.
4. British Heart Foundation. Session 4 – Modifiable and non-modifiable risk factors and Session 5 – Introduction to screening [Internet]. London: British Heart Foundation, n.d. [cited 6 Dec 2021]. Available from: [https://www.bhf.org.uk/~media/files/publications/healthy-hearts-and-chest-pain-kits/4-6-risk-factors-for-chd.pdf](https://www.bhf.org.uk/~/media/files/publications/healthy-hearts-and-chest-pain-kits/4-6-risk-factors-for-chd.pdf)
5. Doughty KN, Del Pilar NX, Audette A, Katz DL. Lifestyle Medicine and the Management of Cardiovascular Disease. *Curr Cardiol Rep*. 2017 Oct 4;19(11): Article no. 116.
6. Cornelissen VA, Smart NA. Exercise training for blood pressure: a systematic review and meta-analysis. *J Am Heart Assoc*. 2013 Feb 1;2(1): Article no. e004473.
7. Ford ES, Bergmann MM, Kröger J, Schienkiewitz A, Weikert C, Boeing H. Healthy living is the best revenge: findings from the European Prospective Investigation into Cancer and Nutrition-Potsdam study. *Arch Intern Med*. 2009 Aug 10;169(15):1355-1362.
8. Saneei P, Salehi-Abargouei A, Esmailzadeh A, Azadbakht L. Influence of Dietary Approaches to Stop Hypertension (DASH) diet on blood pressure: a systematic review and meta-analysis on randomized controlled trials. *Nutr Metab Cardiovasc Dis*. 2014 Dec;24(12):1253-1261.
9. Hamrahian SM. Medication Non-adherence: A Major Cause of Resistant Hypertension. *Curr Cardiol Rep*. 2020 Sep 10;22(11): Article no. 133.
10. Hameed MA, Tebbit L, Jacques N, Thomas M, Dasgupta I. Nonadherence to antihypertensive medication is very common among resistant hypertensives: results of a directly observed therapy clinic. *J Hum Hypertens*. 2015 May 7;30(2):83–89.
11. Tang L, Patao C, Chuang J, Wong ND. Cardiovascular risk factor control and adherence to recommended lifestyle and medical therapies in persons with coronary heart disease (from the National Health and Nutrition Examination Survey 2007-2010). *Am J Cardiol*. 2013 Oct 15;112(8):1126-1132.
12. Widmer RJ, Collins NM, Collins CS, West CP, Lerman LO, Lerman A. Digital health interventions for the prevention of cardiovascular disease: a systematic review and meta-analysis. *Mayo Clin Proc*. 2015 Apr;90(4):469-480.
13. Tarakji KG, Zaidi AM, Zweibel SL, Varma N, Sears SF, Allred J, et al. Performance of first pacemaker to use smart device app for remote monitoring. *Heart Rhythm O2*. 2021 Oct; 2(5): 463-471.
14. Milani RV, Lavie CJ, Bober RM, Milani AR, Ventura HO. Improving Hypertension Control and Patient Engagement Using Digital Tools. *Am J Med*. 2017 Jan; 130(1):14-20.

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