



Health innovation in cardiovascular diseases

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REVIEW

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Abstract

Cardiovascular disease (CVD) remains the leading cause of morbidity and mortality worldwide. Despite efforts to tackle CVD, its prevalence continues to escalate in almost every country. The problem requires an exploration of novel ways to uncover solutions. Health innovations that embrace new knowledge and technology possess the potential to revolutionize the management of CVD. Using findings from published studies on CVD, researchers generated innovations in the areas of global risk assessment, home and remote monitoring and bedside testing. The use of pharmacogenetics and methods to support lifestyle changes represent other potential topics for innovations. Gaps in existing knowledge and practice of CVD provide opportunities for the development of new ideas, practices and technology. However, healthcare professionals need to be cognisant of the limitations of health innovations and advocate for safeguarding patients' wellbeing.

Key Words

Health innovations, cardiovascular diseases

Introduction

Cardiovascular disease (CVD) remains the leading cause of morbidity and mortality, not only in developed countries, but also in third world countries.¹ CVD encompasses coronary artery disease, stroke and heart failure and results from a

combination of risk factors - some cannot be modified e.g. age, genetics and gender, whereas others are amenable to change e.g. diabetes mellitus, hypertension, obesity, dyslipidaemia and smoking. The lifetime risk of developing CVD considerably surpasses the lifetime risk of developing all cancers combined.^{2,3} CVD imposes an enormous burden on patients, their families and healthcare providers not only in terms of economic cost but also in terms of the social and psychological impact.

Health innovation refers to the intentional introduction and application within a role, group, or organisation, of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, group, or wider society.⁴ Innovation's three salient characteristics encompass novelty, an application component and a projected benefit. Despite ongoing efforts to halt CVD, the prevalence continues to rise in almost every country.⁵ Innovative ways need to be explored to confront this problem. Health advancements that embrace new knowledge and technology can potentially modernize the management of CVD.

In Malaysia, the prevalence of coronary heart disease increased three fold in the past 40 years.⁶ Hypertension reached a staggering prevalence of 42.6% in 2006- and diabetes increased from a prevalence of 14.9% in 2006 to 20.6% in 2011. This rising trend in CVD and the major risk factors creates concern and emphasises the need for novel interventions to counter the problem.

Literature review

Contemporary medicine initially focused on the treatment of symptoms of cardiovascular disease. After the identification of the multifaceted basis of the disease by the seminal Framingham study, the focus gradually shifted towards a prevention focus. Initially, efforts targeted single risk factors such as hypertension, hyperlipidemia and diabetes. Subsequently, medicine adopted the global risk factor approach. Research now advocates novel approaches such as combination pills and



the lifetime risk calculators. Technological advances in monitoring invaded the market place with home monitoring devices such as glucometers and blood pressure devices. Such devices immediately altered the way that doctors practice and manage patients. Innovations occurred in diagnostic testing and consisted of point of care tests such as the Troponin T/I test for the evaluation of acute chest pain. Many technological advances in medicine transpired in cardiology to improve mortality and morbidity from coronary artery disease.

Potential areas for developing health innovation in CVD

Several potential areas for health innovations development exists in CVD. The ensuing sections discuss projected spheres of advancement to transform healthcare in CVD.

a) Pharmacogenetics

A genetic family history of cardiovascular disease represents one of the major risk factors for developing the condition and illustrates the interaction between genes and the environment in the pathophysiology of the disease. In pharmacogenetics in oncology, doctors can already differentiate likely responders to a particular drug from non-responders. The pharmacogenetics potential remains immense in terms of drug selection based on the genetic profile to control risk factors in patients with CVD.

b) CVD Secondary Prevention (Screening and identification)

Secondary prevention with accurate prediction of an individual's risk of developing CVD remains the holy grail of cardiovascular risk assessment. Current technology only allows individual risk prediction to be extrapolated from population studies. Novel biomarkers and new diagnostic tools (cardiac scans) only minimally assist in risk prediction and early diagnosis. Present risk scoring translation means that in a 100 patients with a similar risk profile, 20 would develop a major cardiovascular event in ten years, 80 patients out of the 100 would not. Yet, all get targeted as high risk and receive management. Health innovations capable of identifying those at risk would allow targeting resources at the true high risk individuals and reduce overtreatment of false positives.

c) Modification of risk factors in patients

Changing patient behaviour continues to be a challenging and daunting task. One study found that 62% of smokers resumed smoking within a year after a myocardial infarction.⁷ Individuals who continued smoking experience a threefold increased risk of dying compared with those who stop. Evidence supports the effectiveness of lifestyle interventions, but professionals need novel strategies and methods to intervene successfully in modifying dysfunctional lifestyle practices.⁸

d) Adherence to medication

Greater than one in five patients discontinued use of aspirin, beta-blockers, or statins, and one in eight discontinued use of all three medications within one month after a myocardial infarction.⁹ Although health professionals attempted many different methods to improve adherence, a review showed that improvements failed to produce moderate increases even with the most effective methods.¹⁰ Healthcare providers need effective health innovations in this matter of critical patient self-care.

e) Paucity of information for developing countries

Evidence and epidemiological data in the cardiovascular field comes mainly from research done in high income, developed countries. Yet, the low to middle income countries increasingly feel the overwhelming burden of CVD. The disease occurs more commonly in the poor and also contributes to poverty, creating a vicious cycle that impedes development.⁵ The developing countries urgently need cost-effective health innovations. When translating evidence-based low cost interventions to resource poor countries, research needs to show the ability to successfully implement the cost-effective innovation in the resource poor country.

f) CVD management for specific populations

Gaps exist in the knowledge and approach towards CVD management of specific populations such as women, indigenous people and the young. A perception about CVD being a disease of older white men persists despite evidence of increased prevalence in women and certain ethnic groups. Health innovations need to build in a plan for inclusion of these vulnerable populations to ensure the non-marginalization of those at risk.

Barriers, challenges and facilitators in the health innovation

Inertia to change remains a pervasive barrier to health innovation especially regarding the existing healthcare system and policy. These factors along with financial issues hinder the adoption of health innovations. For example, unhealthy lifestyle behaviour continues to be a major risk factor for CVD yet doctors and patients possess the awareness for the need to modify unhealthy behaviours. Despite comprehending these facts, doctors frequently cite health system barriers such as the lack of time or resources as the main reason for not promoting lifestyle interventions. Health innovations in the future will require the employment of complex intervention strategies to overcome multiple barriers in order to be successful.



Limitations of health innovation

By virtue of their nature, health innovations require evaluation in practice prior to implementation. Cost-effectiveness, acceptability and accessibility remain unknown until tested. Similarly, negative aspects or adverse events from health innovations may fail to be apparent in the initial stages until months or years after implementation as evidenced by drugs like thalidomide used in pregnancy for morning sickness that caused children to be born without limbs in the 1960s.¹¹ New modalities require on-going post-marketing surveillance to detect any rise in morbidity and mortality. Technological health innovation potentially can also depersonalize patient care. Unforeseen consequences can arise such as a patient adopts incorrect self-care practices by finding inaccurate information online via search engines. Clinical practice may come to over rely on technology resulting in the loss of essential skills e.g. surgical expertise. Healthcare providers need to ensure adherence to the principles of ethics such as patient confidentiality, autonomy, beneficences and non-maleficence at all times in the implementation of health technological inventions. At all costs, the professional needs to preserve patient-centered care and decision making.

Conclusions

The 21st century represents an exciting era for development of health innovations. Health innovators stay poised to confront the CVD epidemic. Gaps in existing knowledge and practice of CVD need to be viewed as opportunities for improving ideas, practices and technology. However, medical professionals must be cognisant of the limitations of new age inventions and safeguard patients' well-being.

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests