

Key challenges in cardiovascular disease prevention in the digital era

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Introduction

In the last decades, cardiovascular (CV) mortality has declined in Western countries, but CV disease remains a leading cause of mortality, morbidity, and disability worldwide [1,2]. Recent studies have reported a yearly cardiovascular disease (CVD) mortality in Europe of more than 4 million people, representing 45% of all deaths. Of them, 1.4 million people died before reaching the age of 75 years. Moreover, the increased hospitalization rates have highlighted the burden on European health systems due to CVD [3].

CVD prevention

The enormous efforts over decades have led to substantial progress in CVD knowledge and care; since CVD risk factors have been demonstrated to be modifiable [4], the contribution of CVD prevention accounts for about half of the whole reduction of mortality [5]. Primary prevention is based on changing lifestyle and modifiable risk factors: low physical activity, unbalanced diet, high cholesterol level, uncontrolled blood sugar, unhealthy blood pressure, high alcohol consumption, and smoking [6, 7]; this is of particular concern and interest for younger subjects [8]. Nevertheless, the full implementation of preventive interventions is still incomplete and unsatisfactory, also in the secondary prevention setting, where the absolute benefit is higher. The findings of the EUROASPIRE studies in patients with known CVD show that the control of the risk factors in general practice is

poor [9] as well as adherence to prescriptions [10].

CVD mortality—especially premature—proves to be higher in women than in men [3], and risk factors specific for women, including preeclampsia, hypertension in pregnancy and menopause, deserve particular attention. Therefore, collecting and analysing women's data in the studies regarding CVD prevention can be opportune [7,11]. Moreover, several other diseases prove to increase the atherosclerotic burden: chronic kidney disease, cancer and cancer treatments can provoke CV toxicity, chronic obstructive pulmonary disease, chronic inflammatory conditions, and mental disorders (anxiety and depression) [7]. CVD prevention strategies should also consider the ageing of the CVD population as it increases the probability of multimorbidity and frailty. Indeed, two-thirds of the 70-year-old subjects with known CVD show non-CVD comorbidities. This pattern of multimorbidity represents a management challenge in daily clinical practice [7].

According to recent trends, CV events seem to be more postponed than completely prevented, suggesting the need for early CVD prevention, starting from childhood. The development of genomics can allow a more effective personalisation of strategies and therapies, and when combined with essential determinants of risk, such as organ function, biomedical features, and behaviours, genomic data may potentially favour CVD prevention [5, 7].

Finally, dedicated sub-specialty training for cardiologists and general practitioners on the primary and secondary prevention of CVD can play an essential role in the development of preventive cardiology [2]. Given the multifactorial nature of CVD, the prevention strategies should

Received: Mar.24,2022; Revised: Jul.23,2022; Accepted: Jul.26,2022; Published: Jul.27,2022

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DOI: <https://doi.org/10.55976/cds.1202216225-28>

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be similarly multifactorial [12]: CVD prevention programs must be based on a multidisciplinary approach with the involvement of several health care professionals (i.e. cardiologist, nurse, physiotherapist, dietician, and psychologist) with a tight interaction with rehabilitation facilities, other specialists and social services, particularly in elderly and frail patients [2].

Digital technology for CVD prevention

Digital technologies for CVD prevention are based on several tools such as mobile phones, the Internet, software applications, wearables, emailing, and text messaging. Digital health-based care has recently been acknowledged as a new strategy for delivering care in different care settings from diagnosis to treatment. The European Society of Cardiology (ESC) e-Cardiology Working Group has underpinned the development of dedicated digital technologies for the primary and secondary prevention of ischemic heart disease, chronic heart failure, and atrial fibrillation [13].

However, successful outcomes attainable with digital technologies require clearly defined objectives, measurable indicators, standardised metrics, and methods. The players of the implementation of digital technology are the digital health industry, whose commitment should aim at providing more and more patient-driven designs of digital applications, patients and healthcare professional organisations, who determine specific guidelines and scientific research [13,14]. Particular efforts should be made in standardising data and creating interoperability (aggregation of data from different sources on a unique platform for clinical and research purposes) [13].

The use of digital technologies may be involved in both primary and secondary prevention of CVD or cardiac rehabilitation and can help in some clinical conditions, in addition to the face-to-face relationship between patients and healthcare providers. The e-cardiology has been developed as a specific branch of telemedicine and telehealth dedicated to changing lifestyle, assessing risk factors, tele-monitoring, and continuous data transmission of blood pressure, ECG, physical activity and exercise, treatment adherence, etc. [15-17]. According to the position paper of the ESC e-Cardiology Working Group, assessing the socioeconomic, demographic, digital, and health literacy of the patients is essential for the integration of digital tools in routine clinical practice [13]. For this integration, high-quality evidence of proven accuracy and validation of the devices are a fundamental prerequisite [18].

Digital technologies, through multichannel tools that might reach many patient subgroups, may play a specific role in the social communication aimed at the awareness of CVD risk factors. For example, adolescents are a potential target group for the early improvement of the individual CVD risk profile by interventions with electronic

health behaviour change [19]. In several circumstances, digital applications can work, yielding feedback on the effects of the communicational campaigns [5]. Research has reported encouraging findings with digital interventions for the diabetic foot [20]; others suggest the need for high-quality data for the primary prevention of CVD and type 2 diabetes [21]. Some evidence shows different influences on behavioural factors or multiple outcomes, including adherence to medications, in primary and secondary CVD prevention [22].

Overall, in-depth analyses are needed to verify the effectiveness of different digital modalities and strategies in improving the effectiveness of CVD prevention and rehabilitation.

Health policy

Health policy should comprehend action plans consistent with specialist healthcare guidelines, evidence, and interdisciplinary approaches [5]. The contribution of health policy-makers can be centred on lifelong programs of education regarding health, especially CVD risk factors [5]. Structured long-lasting information and educational campaigns can be implemented in a suitable socioeconomic environment and involve all the family components [5]. From the point of view of societies and health systems, tight monitoring by epidemiological studies based on specific research questions, including variables linked to socioeconomic changes relevant for CVD [12], is an essential approach for the implementation of more effective CVD prevention at an individual level.

An ethical (legal) framework to optimise biomedical datasets may enable an appropriate stratification of the individuals to personalise prevention activities [5]. Structured action plans of governmental or non-governmental organisations should promote and reinforce the evaluation tools for CVD risk inside and outside national health systems [23]. These plans should promote initiatives in compliance with evidence-based results, for example, interventions for reducing air pollution that is strongly associated with atherosclerotic CVD [7].

Improved platforms of data collection and statistics can enhance multinational epidemiological studies concerning CVD prevalence and incidence, hospitalisation rates, and hidden burden of CVD. These studies can then favour actionable programmes with clear implications in public health [3].

Health policy plans should involve activities to ease healthcare access and health literacy and promote data security [24]. This effort should also point to the harmonisation of the regulatory framework related to the accuracy of the devices [25], and promoting high-quality research, including cost-effectiveness evaluations, on digital technologies to manage CVD in some population subgroups to identify reliable digital platforms of e-cardiology. For example, a specific approach deserves the screening,

assessment, and appropriate interventions of frailty in populations with CVD that can include home and social support beyond the hospital [26].

Conclusion

Although lifestyle changes in the population of developed countries have led to the decline of CV events, the CVD prevention research needs further development by long-term studies at the community, epidemiological, genetic and interventional levels.

Digital technology may play a crucial role in the widespread use of digital tools in the population and increasing home-based CVD care, yet it requires a step forward in research on primary and secondary prevention in different settings. Further studies with standardised methods are required to gain insights into the optimised integration of digital technologies in routine clinical practice with paramount public health relevance.

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