

# WORLD HEART FEDERATION ROADMAP FOR DIGITAL HEALTH IN CARDIOLOGY

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**Informing health systems approaches to CVD by  
prioritizing practical, proven, cost-effective action**



# DIGITAL HEALTH IN CARDIOLOGY

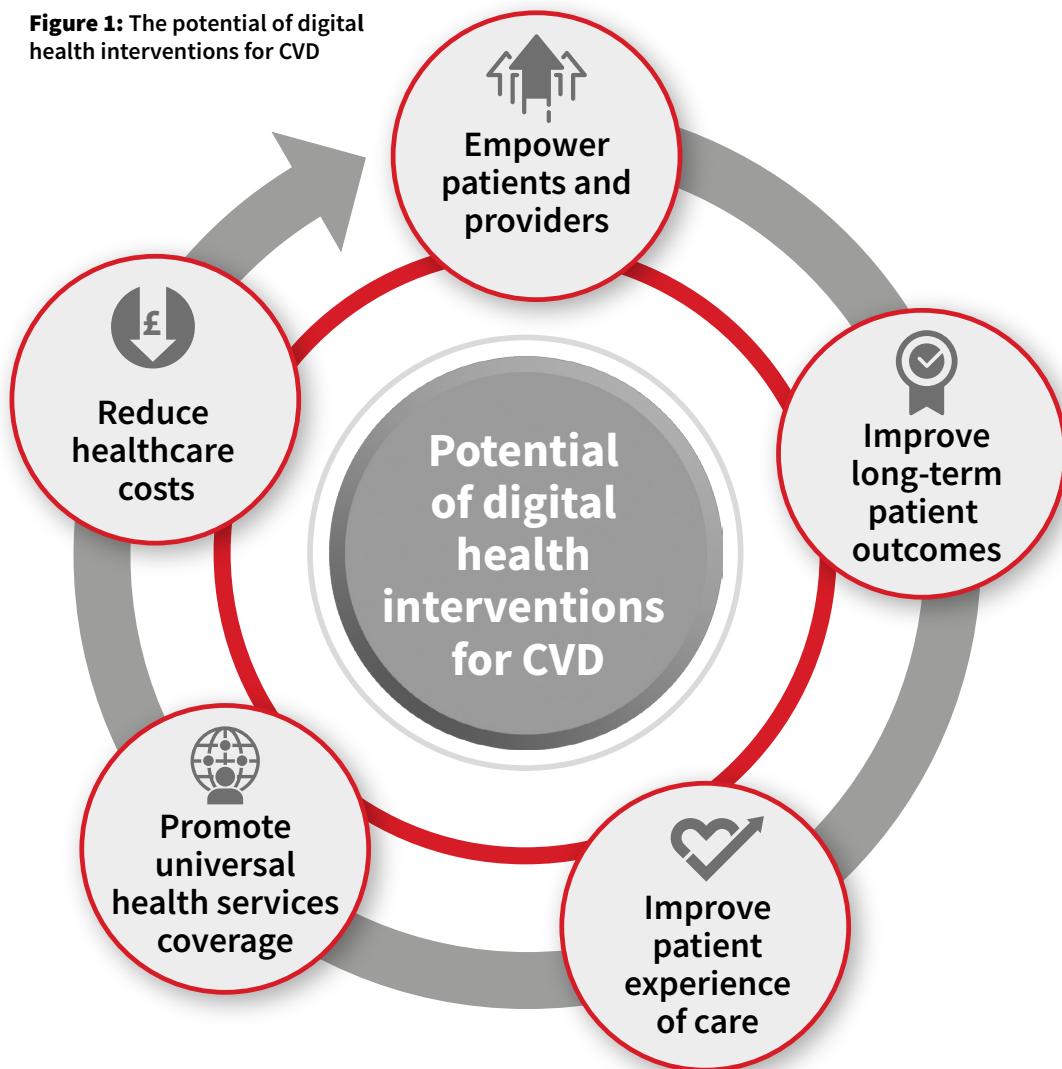
**Health systems face fundamental challenges in delivering optimal care due to ageing populations, constraints in their healthcare workforce, financing, availability and affordability of cardiovascular disease (CVD) medicine, and service delivery. Therefore, patient self-care and empowerment are becoming increasingly important.**

Digitalization has revolutionised the way we communicate, inform ourselves, shop, and, to some extent, interact with the healthcare system. Despite a good understanding of the potential of

digital technology for health, various societal and professional constraints have delayed uptake in both high- and low- and middle-income countries (LMICs). Digital health interventions (DHI), which include text message programmes, mobile (mHealth) apps, telehealth consultations, wearable devices, and electronic decision support tools, have the potential to help improve this.

The COVID-19 pandemic has sped up the use of digitalization in healthcare and the use of DHI due to a fear of contracting COVID-19 in a medical facility, or because of the facility's overload, patients have – quite effectively – had consultations via mobile phone or via internet. Similarly, doctors have equipped patients with monitoring devices and treatments for at-home use. These technologies can contribute to Universal Health Coverage (UHC) by empowering patients<sup>1</sup> and providers,<sup>2</sup> enabling universal health services coverage,<sup>3</sup> improving long-term patient outcomes and care experience, and reducing healthcare costs<sup>4</sup> (figure 1).

**Figure 1:** The potential of digital health interventions for CVD





# 6.95 billion mobile phone users worldwide

In 2020, there were an estimated **6.95 billion mobile phone and 3.5 billion smartphone users worldwide**.<sup>5</sup> These major and rapid advances in internet and mobile technology, including in LMICs, bear an enormous potential to expand the reach of healthcare and reduce the burden of CVD. DHI may be a tool to reach Sustainable Development Goal 3.4 and reduce premature mortality from NCDs by a third by 2030.<sup>6</sup>

In 2020, the World Heart Federation (WHF) published a position paper “**The Case for the Digital Transformation of Circulatory Health**”<sup>7</sup> as an outcome of the 4th Global Summit on Circulatory Health, held in Paris on 29-30 August 2019. To build on this, WHF has developed a Roadmap for digital cardiology to support WHF Members in engaging actively with national stakeholders to implement digital health at the country level to improve the prevention and management of CVD. The Roadmap sets out to identify solutions to overcome roadblocks and leverage digital tools to increase access to cardiovascular prevention, management and care.



Today, a range of factors hinder the implementation and access to digital health technologies globally. They pertain to:

- health system governance (e.g., national privacy regulations and internet access),
- health providers (e.g., digital literacy, perceived effectiveness),
- patient (e.g., age, local sex/gender norms, socioeconomic factors, digital and health literacy), and
- technology (e.g., a context-specific adaptation of technology, interoperability).

**“** Digital health interventions (DHI) are paving the way for people living with, or at risk of, CVD to be able to manage and monitor their health on a daily basis without always having to go to a hospital or clinic to get expert advice. Patient empowerment, and more rapid and accurate decision making with less burden on health systems can be achieved through use of well validated DHI. These are exciting times for both patients and healthcare professionals: the future is bright if we can co-create modern solutions to our current problems. **”**

**PROFESSOR MARTIN COWIE,**  
Consultant Cardiologist and Co-chair  
of the WHF Roadmap on Digital  
Health in Cardiology

**“** Digital health innovations such as artificial intelligence, telemonitoring, remote monitoring, or mobile health (mHealth) apps can increase access to, and the quality of, healthcare in underprivileged populations – with the ultimate aim of achieving heart health for all. **”**

**PROFESSOR CAROLYN LAM,**  
Co-chair of the WHF Roadmap for  
Digital Health in Cardiology

**“** WHF Roadmaps are scientific documents for translating science into policy. This WHF Roadmap for digital health in cardiology identifies barriers to implementing digital health technologies for CVD and provides potential solutions for overcoming them. **”**

**PROFESSOR DORAIRAJ  
PRABHAKARAN,**  
Chair of WHF Science Committee  
and Co-chair of the WHF Roadmap  
on Digital Health in Cardiology

<sup>1</sup> Battineni G, Sagaro GG, Chintalapudi N, Amenta F. The benefits of telemedicine in personalized prevention of cardiovascular diseases (CVD): A systematic review. *J Pers Med.* 2021;11.

<sup>2</sup> Srinivasapura Venkateshmurthy N, Ajay VS, Mohan S, Jindal D, Anand S, Kondal D, Tandon N, Rao MB, Prabhakaran D. m-Power Heart Project - a nurse care coordinator led, mHealth enabled intervention to improve the management of hypertension in India: study protocol for a cluster randomized trial. *Trials* 2018 19:1. 2018;19:1–9.

<sup>3</sup> Wilson D, Sheikh A, Gorgens M, Ward K. Technology and Universal Health Coverage: Examining the role of digital health. *J Glob Health.* 2021;11:16006.

<sup>4</sup> Li R, Liang N, Bu F, Hesketh T. The effectiveness of self-management of hypertension in adults using mobile health: Systematic review and meta-analysis. *JMIR mHealth uHealth.* 2020;8:e17776.

<sup>5</sup> Statista. Forecast number of mobile users worldwide from 2020 to 2024. Available from: <https://www.statista.com/statistics/218984/number-of-global-mobile-users-since-2010/#:~:text=In%202020%2C%20the%20number%20of,projected%20to%20reach%207.41%20billion.> (accessed December 17, 2020)

<sup>6</sup> Countdown N. NCD Countdown 2030: efficient pathways and strategic investments to accelerate progress towards the Sustainable Development Goal target 3.4 in low-income and middle-income countries. *Lancet.* 2022;399:1266–1278.

<sup>7</sup> WHF, The Case for the Digital Transformation of Circulatory Health. Geneva, Switzerland. World Heart Federation. 2020.

# THE ROLE DIGITAL HEALTH CAN PLAY IN PREVENTING AND MANAGING CARDIOVASCULAR DISEASE



Several DHIs have shown potential for managing CVD, including text message programmes, mobile (mHealth) apps, telehealth consultations, wearable devices, and electronic decision support tools.<sup>8</sup>

## MOBILE HEALTH INTERVENTIONS

Personalised messages to patients can assist management of CVD risk factors such as tobacco smoking,<sup>9</sup> high blood pressure,<sup>10</sup> physical activity,<sup>11</sup> weight management,<sup>12</sup> and medication adherence.<sup>13,14</sup> The success of the messaging is often because of the co-design of text content with patients and clinicians, using techniques from behavioural psychology.<sup>15</sup> Similarly, mobile (mhealth) apps can reduce rehospitalisations, improve patient knowledge, quality of life, and psychosocial well-being, and help manage CVD risk factors.

## TELEHEALTH

The use of telehealth improves access to CVD treatment by ensuring constant communication between patients and their health providers, and ensuring timely monitoring and remote counselling that support CVD management.

## WEARABLE DEVICES

Wearable technology accessibility has improved, and so have its capabilities to enhance CVD management and prevention. Wearable devices are known to increase daily steps and energy expenditure compared to people not using wearable devices.<sup>16</sup> Wearable devices can go beyond counting calories to measuring one's blood pressure and heart rate by transmitting biophysical measurements and patient-generated data to physicians. Potential detection of hypertension and atrial fibrillation through wearable devices has the potential to prevent or better manage CVD.<sup>17</sup>



## ELECTRONIC DECISION SUPPORT TOOLS

Clinicians use various clinical electronic decision support tools to manage CVD conditions. Promising results from a recent heart failure trial showed an alerting system using electronic health records (EHR) could improve the use of medication to treat heart failure.<sup>18</sup> Clinicians can also use artificial intelligence (AI) to aid in interpreting medical images.

<sup>8</sup> WHF Roadmap on Digital Health in Cardiology.

<sup>9</sup> Whittaker R, McRobbie H, Bullen C, Rodgers A, Gu Y. Mobile phone-based interventions for smoking cessation. Cochrane Database Syst Rev. 2016;2016.

<sup>10</sup> Shariful Islam SM, Farmer AJ, Bobrow K, Maddison R, Whittaker R, Pfaeffli Dale LA, Lechner A, Lear S, Eapen Z, Niessen LW, Santo K, Stepien S, Redfern J, Rodgers A, Chow CK. Mobile phone text-messaging interventions aimed to prevent cardiovascular diseases (Text2PreventCVD): Systematic review and individual patient data meta-analysis. Open Hear. 2019;6.

<sup>11</sup> Smith DM, Duque L, Huffman JC, Healy BC, Celano CM. Text Message Interventions for Physical Activity: A Systematic Review and Meta-Analysis. Am J Prev Med. 2020;58:142–151.

<sup>12</sup> Skinner R, Gonet V, Curri S, Hoddinott P, Dombrowski SU. A systematic review with meta-analyses of text message-delivered behaviour change interventions for weight loss and weight loss maintenance. Obes Rev. 2020;21:e12999.

<sup>13</sup> Adler AJ, Martin N, Mariani J, Tajer CD, Owolabi OO, Free C, Serrano NC, Casas JP, Perel P. Mobile phone text messaging to improve medication adherence in secondary prevention of cardiovascular disease. Cochrane Database Syst Rev. 2017;2017.

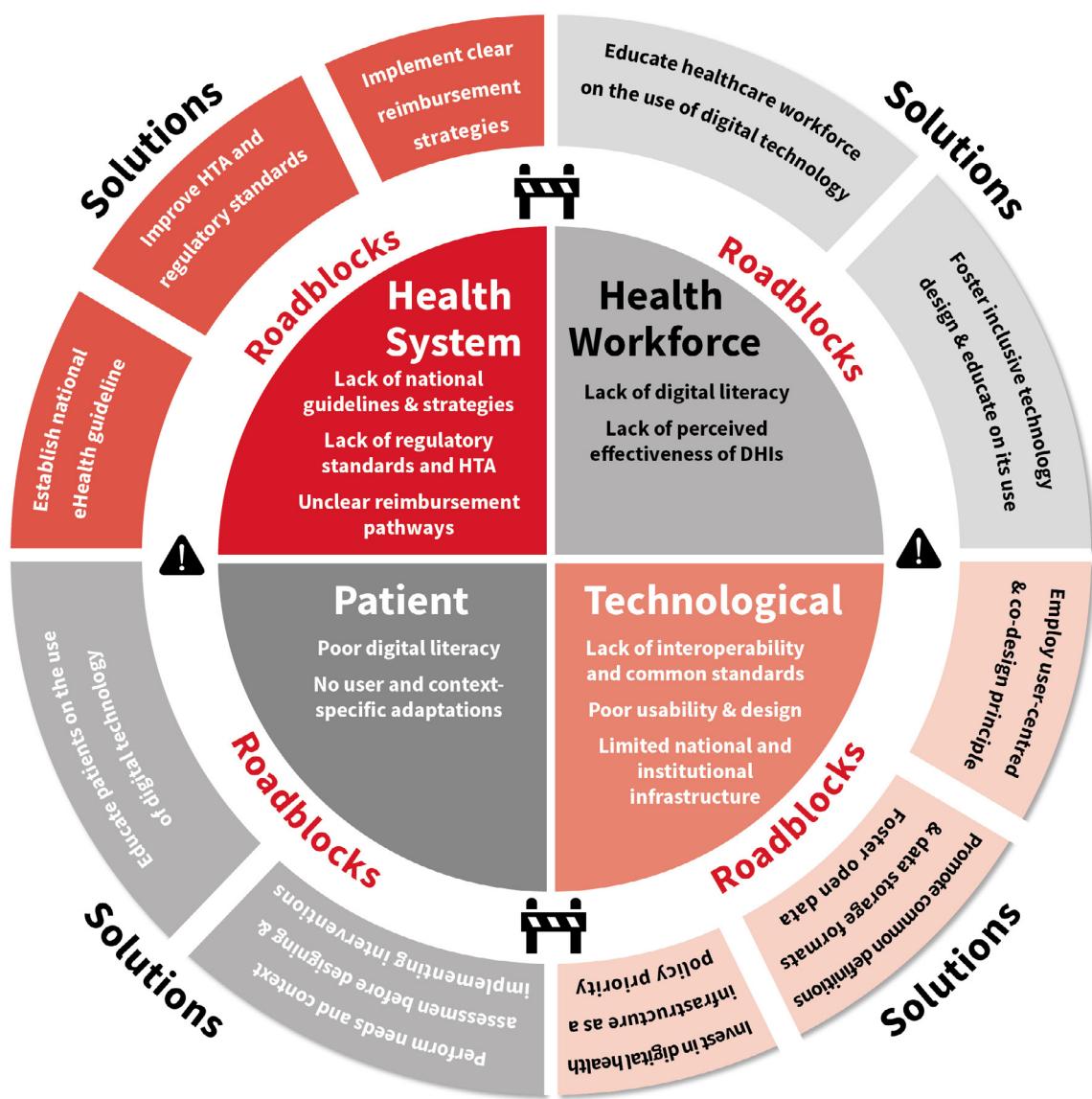
<sup>14</sup> Thakkar J, Kurup R, Laba TL, Santo K, Thiagalingam A, Rodgers A, Woodward M, Redfern J, Chow CK. Mobile telephone text messaging for medication adherence in chronic disease a meta-analysis. JAMA Intern Med. 2016;176:340–349.

<sup>15</sup> Redfern J, Thiagalingam A, Jan S, Whittaker R, Hackett ML, Mooney J, Keizer L De, Hillis GS, Chow CK. Development of a set of mobile phone text messages designed for prevention of recurrent cardiovascular events. Eur J Prev Cardiol. 2014;21:492–499.

# ROADBLOCKS AND SOLUTIONS TO IMPLEMENT DIGITAL HEALTH INTERVENTIONS

Ideal conditions for implementing digital health technologies are often not met. The success of a national eHealth environment relies on good leadership and governance, high-quality legislation and policies, a clear investment and reimbursement strategy, high-quality services and applications, a supporting digital health infrastructure, clear interoperability and data standards and a tech-savvy workforce as outlined in the adapted WHO/ITU framework<sup>19</sup> (figure 2), that also includes patient-level barriers.

**Figure 2:** Selected roadblocks and solutions to implement digital health interventions, based on the WHO/ITU framework



<sup>16</sup> Brickwood KJ, Watson G, O'brien J, Williams AD. Consumer-based wearable activity trackers increase physical activity participation: Systematic review and meta-analysis. JMIR mHealth uHealth. 2019;7.

<sup>17</sup> American College of Cardiology. Digital Health Solutions

<sup>18</sup> Ghazi L, Yamamoto Y, Riello RJ, et al. Electronic Alerts to Improve Heart Failure Therapy in Outpatient Practice: A Cluster Randomized Trial. J Am Coll Cardiol. 2022;

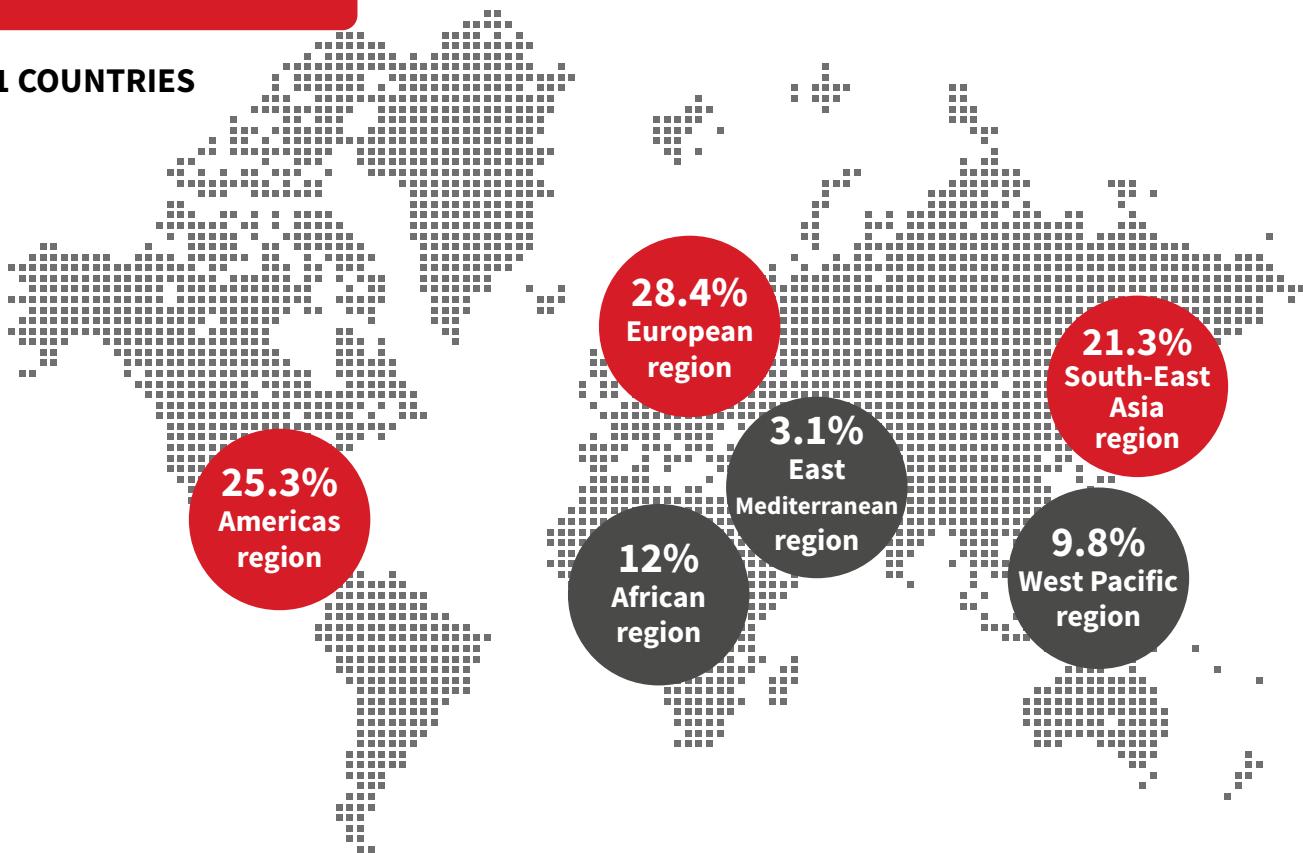
<sup>19</sup> WHO. National eHealth Strategy Toolkit Overview. World Health Organ Int Telecommun Union. 2012;9.

# ROADBLOCKS TO IMPLEMENTING DIGITAL HEALTH INTERVENTIONS

A global survey of WHF Membership organisations gathered data related to roadblocks and solutions to implementing DHIs. In total, **227 participants from 71 countries completed the survey.** The European region made up **28.4% of the responses collected;** 25.3% in the Americas, 21.3% in South-East Asia, 12% in the African Region, 9.8% in the western Pacific and 3.1% in the Eastern Mediterranean regions. Furthermore, 35% were from high-income countries, 60% from middle-income countries and 15% from low-income countries.

## GLOBAL SURVEY RESPONSES

**71 COUNTRIES**



- ⚠️ Lack of national guidelines and eHealth strategy
- ⚠️ Poor involvement of critical national stakeholders
- ⚠️ Lack of clear monitoring and evaluation standards. No repeated monitoring of effectiveness, reach and impact of interventions
- ⚠️ Lack of long-term investment strategy for sustainability of digital technologies
- ⚠️ The local infrastructure of healthcare provider systems does not allow the integration of new DHI
- ⚠️ National and international differences in data collection, storage and definitions standards
- ⚠️ Poor understanding of the health workforce needs
- ⚠️ Lack of understanding and perceived effectiveness and use of DHI



# SOME SOLUTIONS TO OVERCOME ROADBLOCKS



- Establish national or regional eHealth guidelines and strategies
- Inclusive engagement with stakeholders by policymakers, including representatives of patients, practitioners, payers, industry and civil society
- Clear national standards for monitoring and evaluation of DHIs. Long-term monitoring of effectiveness and implications of digital health interventions. ‘unexpected effects’ registry
- Explicit national guidelines on data access and security. Promote harmonisation of policies between institutions
- Clear reimbursement strategy for DHI. Include economic evaluations in the design phase
- Include long-term investment strategy as part of national guidelines
- Employ user-centred and co-design principles. Include end-users (practitioners/patients) early in the design phase

- Investing in digital health infrastructure should be included as a national policy priority
- Applications should be flexible and available in on- and offline modes
- Promote collective definitions and data storage formats with an emphasis on the implementation of open data platforms
- Include clear health system and needs assessment in the design phase of DHIs
- Provider education on the use of digital technology
- Inclusive technology design and education of use
- Patient education on the use of digital technology, context-specific adaptations of technology to match patients' physical abilities
- Inclusive technology design, education of use and user acceptance, usefulness and engagement evaluation alongside clinical trials and related research.

## PRACTICAL EXAMPLE 1

### CONNECT: A CONSUMER-FOCUSED, RESPONSIVE AND PRIMARY CARE-INTEGRATED WEB-APPLICATION

The Consumer Navigation of Electronic Cardiovascular Tools (CONNECT) intervention is a consumer-focused, responsive web application. It is interactive and integrated with data from the patient's primary care electronic health record. It was co-designed with consumers, clinicians and software developers.

#### CONNECT includes digital reminders and access to :

- Information about medical conditions, information on medicines and interactive absolute risk awareness (red tiles);
- goal-setting, progress tracking and virtual rewards (green tiles);
- polling for interactivity and social interaction (blue tiles).

## PRACTICAL EXAMPLE 2

### MPOWER HEALTH: A CLINICAL DECISION SUPPORT SYSTEM FOR EVIDENCE-BASED CARE

#### MPOWER HEART WORKS ON TWO CORE PRINCIPLES:

##### 1. Technology (a knowledge-based Clinical Decision Support System-CDSS)

- A mobile app for healthcare providers and a web-based dashboard/server for healthcare administration
- Clinical Decision Support System generates personalised management plans for patients with hypertension and diabetes
- Computing clinical risk scores
- Maintaining longitudinal health records of the patient
- Ability to work in offline mode (without internet connectivity)
- Real-time monitoring and profile visualiser for trending and quick decision making.

##### 2. Task-shifting

- Empowering the non-physician workforce to deliver quality care by using technology
- Generating lifestyle recommendations tailored to individual patients.

# WORLD HEART FEDERATION ROADMAPS

Already the **world's number one killer**, deaths from cardiovascular disease (CVD) are increasing globally.

CVD and related conditions can often be prevented, but if not, can be detected early

and treated cost-effectively, preventing costly hospitalizations and death. But this requires coordinated national policy and health systems responses built around evidence-based strategies. Health resources are limited and so cost-effective interventions for the prevention, detection and management of CVD must be prioritized in order to plan effective health systems responses.



## WHAT ARE ROADMAPS?

**WHF Roadmaps are a global framework that are adapted and used at national or regional level.**

### THEIR PURPOSE IS TO:

1. Summarize current recommendations to reduce the burden of CVD that are proven, practical and cost effective
2. Highlight obstacles to implementing these recommendations
3. Propose potential solutions for overcoming these obstacles
4. Provide tools and strategies to adapt solutions to local needs.



### HOW DO THEY WORK?

WHF Roadmaps offer a global framework, tools and solutions that can then be used and adapted, through stakeholder collaboration, to meet the specific needs of individual regions and nations.

#### This requires:

- A situation analysis of the current health system based on tools such as WHF CVD Scorecards
- Roundtables with multiple stakeholders to discuss obstacles, solutions and appropriate strategies

- A plan to implement and evaluate the proposed strategies

### WHO ARE THEY FOR?

WHF Roadmaps empower our Members, including CVD foundations, societies and patient associations, to lead country-specific, action-oriented initiatives, including Roundtables.

#### These involve diverse stakeholders, such as:

- Governments and policy makers
- NGOs, health activists and advocates

- Healthcare professionals
- Corporate entities
- Academic and research institutions
- Patients and patient groups

### WHY ARE THEY IMPORTANT?

To trigger effective action that can measurably reduce premature deaths and the associated global economic burden caused by CVD.

**TO DOWNLOAD THE FULL ROADMAP PLEASE VISIT – [CVDRoadmaps.org](http://CVDRoadmaps.org)**

We thank Astra Zeneca for their sponsorship of the WHF Roadmap for Digital Health in Cardiology, as well as Escope and Aktiia for their support of the initiative.