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COVID-19 shapes the future for management of patients with chronic cardiac conditions

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The impact of the current COVID-19 pandemic has raised awareness of the importance of finding urgent and innovative solutions to the organization and delivery of health care, particularly for those people with long-term and chronic conditions living in the community. This editorial highlights the potential value of eHealth and the importance of creativity using an advanced AI (artificial intelligence) solution, the Patient Self-care uSing eHealth In chrONic Heart Failure (PASSION-HF), as a case study in heart failure. A significant group affected by COVID-19 is those people with heart conditions, with early evidence indicating that 1 in 5 COVID-19 patients have signs of heart disfunction.[1] In the UK, for example, chronic cardiac diseases are the most common COVID-19 comorbidity (29%)[2] and in the US and Europe cardiovascular disease is one of the strongest predictors for ICU admissions in patients with COVID-19.[3] Not only is cardiac disease, especially heart failure with its symptoms such as breathlessness and fatigue, a prominent risk factor for COVID-19, but those at high risk of COVID-19 are far more likely to suffer serious cardiac damage.[4,5]

Prior to COVID-19, our greatest health care challenge was finding solutions to overloaded healthcare systems. The pandemic and ensuing worldwide lockdown has brought this challenge into sharper focus. With human-to-human hospital-associated transmission suspected in up to 41% of patients,[6] pressing issues to address include: physical proximity of care; increased patient volume and care complexity; limited healthcare resources; physical and mental health and wellbeing of frontline healthcare workers; and threat of further outbreaks.

With the concurrent rapid growth in non-communicable diseases such as heart failure, accelerated solutions are being urgently sought to meet this challenge. For example, heart failure patients are especially vulnerable as they require regular and ongoing disease monitoring and management to reduce the risk of deterioration. Yet, patient visits to general practitioners and specialists have reduced by almost half during COVID-19.[7]

In response to COVID-19, many countries have fast-adopted and scaled up digital transformations; primarily to 'test, track and trace'.[8] Further to this, in order to solve some of the most problematic and complex contemporary health issues, technologically advanced digital solutions are being identified to ensure that decision making is supported by high quality data, to provide safe, accessible, patient-centered, precision healthcare from a distance. PASSION-HF, a European consortium, is working toward such an advanced eHealth solution: a digital *'doctor-at-home'* system (Figure 1). Through an avatar, the *doctor-at-home* offers personalized care 24 hours a day, seven days a week. It will implement a predictive, rather than reactive, approach to HF care by using multilevel diagnostics (e.g. medical imaging, patient specific questionnaires, multilevel sensors) and treatment decisions by current HF clinical guidelines, enhanced by AI/machine-learning.[9] The integration of serious gaming motivates regular use of the application by patients and provides additional diagnostic information. Importantly, smart coaching

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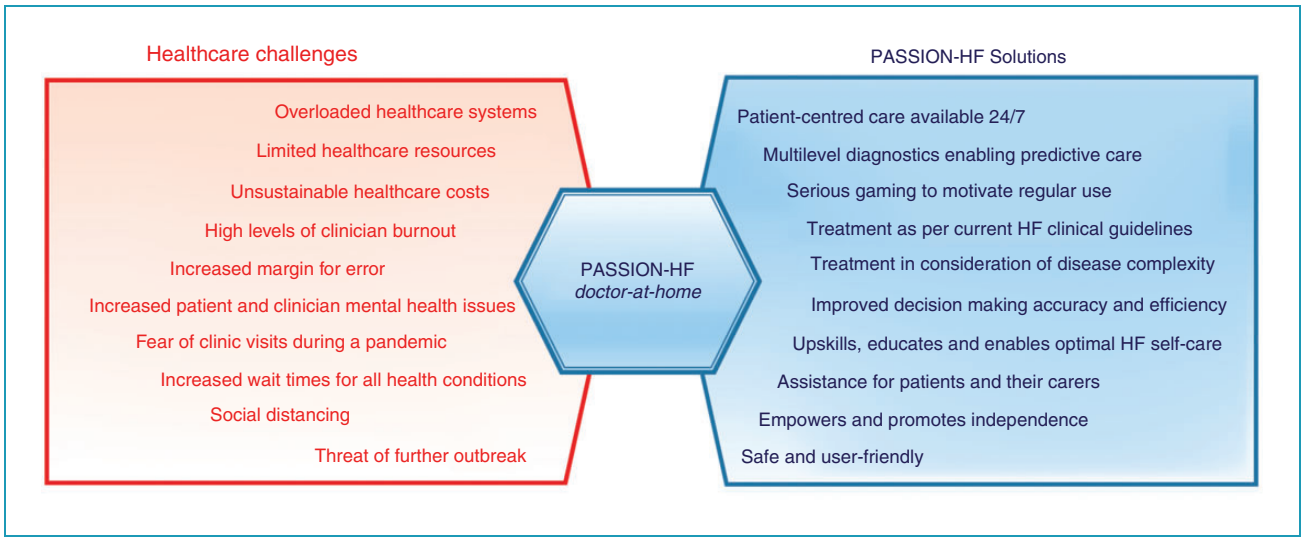

Figure 1. Healthcare challenges and PASSION-HF *doctor-at-home* solutions.

of the *doctor-at-home* educates, upskills and empowers patients to optimize effective HF self-treatment in consideration of their disease complexity. In the deployment of such cutting-edge technologies, PASSION-HF integrates robust governance to provide transparency, abide by ethical principles, ensure high-level data protection and security, and minimize risk.[10]

As we face public health crises, expectations, needs and practices of patients and healthcare providers are changing. The COVID-19 crisis shows the importance of protecting the public and healthcare workforce, working remotely and creatively and exploiting the latest technology.[11] It also illustrates that many patients are willing to embrace these new technologies. Today's new reality is, virtual care, which offers many benefits including real time assessments and advice, improved accuracy and efficiency of decision making, reduced clinician burden and enhanced patient confidence in self-treatment.

Whilst awaiting a proven vaccine, with long-term effectiveness, we must find innovative ways of adapting to our new reality – the possibility of living with COVID-19 for many years to come. The PASSION-HF *'doctor-at-home'* system proposes a personalized participatory approach to precision medicine that leads a paradigm shift in individualized heart failure care.[9] The envisaged improved efficiencies in continuous patient care through this resource will enable doctor's to spend more quality time with complex cases and patients themselves. Accompanying this are likely improvements in the transfer of care from hospital to the home, with subsequent benefits for healthcare budgets. This added value has great potential to become a blueprint for the management of various chronic diseases using eHealth solutions via intelligent algorithms.[9] A lesson learned from COVID-19 is the need to think and work in more creative ways, that will allow us to optimize care before, during and after hospital visits: eHealth solutions such as a *doctor-at-home* are case in point.

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