Heart, Lung and Circulation (2022) **31**, 905–909
1443-9506/22/$36.00
https://doi.org/10.1016/j.hlc.2022.05.004

EDITORIAL

COVID-19: Lessons Learned and a Need for Data Driven Decision Making

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Keywords COVID-19 • SARS-CoV-2 • pandemic • COVID-19 Vaccines • health equity

Coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has propelled the world into a global pandemic. In addition to causing death and disability, COVID-19 has contributed to significant individual, economic, social, and political disruption [1]. The current co-occurring global geopolitical instability is fuelled by nationalism, populism, and disrupted global supply chains [2]. Throughout history, we look for critical junctures to help us make sense of changing and evolving circumstances. The United States is a stark exemplar of the devastating impact of the pandemic [3]. Though one of the wealthiest countries in the world, there have been 80 million cases and a million deaths from COVID-19 [3]. Other countries, including Australia, have fared better due to geographical isolation, lockdowns, and greater potential to coordinate public health services [4]. But no country or region of the world has been spared from the devastating and disruptive impacts of the COVID-19 pandemic.

In addition to challenges in health care delivery and global health, there have also been challenges to how we view and describe health care models. In this issue, of *Heart, Lung and Circulation*, Holland and colleagues [5] synthesise a range of approaches to guide clinical decision making. "Myocarditis and Cardiac Complications Associated with COVID-19 and mRNA Vaccination: A Pragmatic Narrative Review to Guide Clinical Practice" provides a synthesis of available evidence, a guideline on maximising cardiac resources in light of COVID-19, and a summary of cardiac investigations and associated risks among persons who have tested positive for COVID-19. Holland and colleagues review provides synthesized evidence for considering cardiac involvement particularly as we approach the endemic phase of COVID-19. We propose that the COVID-19 pandemic has changed not only the way health professionals interact but also our worldview, invariably impacting on our view of clinical practice and management.

The Intersection of Non-Communicable and Communicable Diseases

Traditionally, we have compartmentalised knowledge and management of communicable and non-communicable diseases (NCDs). As a consequence, this has influenced the professional training of clinicians, as well as access to health care and health care utilisation. Moreover, the intersection of biomedical, social, and political factors that impact on COVID-19 infection has been observed. This has led to greater appreciation of "intersectionality" in efforts to pro-

DOI of original article: https://doi.org/10.1016/j.hlc.2022.03.003
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mote equity in COVID-19 outcomes. Furthermore, people with existing chronic conditions such as cardiovascular risk factors and diseases, lung disease, and cancer are more likely to experience severe COVID-19 [6]. Simultaneously, there is a substantially increased multi-organ risk, including cardiac risk and events in people with or without previous cardiac conditions. There are also indirect impacts through disruption of services for people with NCDs who need regular care and are experiencing significant disruptions in their care, screening, and diagnosis. Advocating for robust evidence-based testing procedures, continued cardiovascular care in persons with pre-existing cardiovascular risk factors and conditions, continued evidence based NCD prevention programs, and increasing support for health systems and health care providers is critical.

There is a strong association between elevated biomarkers of cardiac injury, including elevations in cardiac troponin (cTn), N-terminal pro-B type-natriuretic peptide (NT-proBNP), and d-dimer which predict poor clinical outcomes, and worse COVID-19 outcomes [7]. The prevalence of elevated high sensitive tropnonin T (hs-TnT) has been reported to range from 20–30% among patients hospitalised for COVID-19, and acute myocardial injury has been reported to range from 8–62% [6]. In the context of insufficient evidence on the management of COVID-19 related myocarditis, Holland and colleagues [5] summarised available clinical evidence and guidelines on clinical examinations suggested for persons with COVID-19. Clinical evaluations in persons with COVID-19 have shown elevations in multiple measures of inflammation—interleukin-6 (IL-6), lactate dehydrogenase (LDH), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) [8], and biomarkers of myocardial injury and heart failure—high-sensitive cardiac troponin I (hs-cTnINT-proBNP [9,10]. Studies addressing the cardiovascular implications of COVID-19 have focussed on hospitalised patients with severe COVID-19 cases [11]. According to Holland and colleagues [5], available evidence suggests that the risks of myocardial involvement and cardiac complications in COVID-19 are low, with an estimated incidence rate of 11 myocarditis cases per 100,000 COVID-19 infections [5]. However, the importance of cardiac biomarker measurements as an initial triage investigation tool in suspected COVID-19 associated myocardial involvement is underscored, while highly sensitive imaging techniques such as cardiac magnetic resonance (CMR) imaging may be reserved for diagnostic confirmatory purposes.

There are significant disparities across countries in access to advanced and comprehensive cardiac diagnostic tests and interventional procedures. Biomarker measurements, characteristic electrocardiographic changes, or new imaging features of impaired cardiac function are important diagnostic and risk stratification approaches to characterising and defining myocardial injury, myocarditis, and other cardiac complications. With COVID-19, various guidelines and statements have recommended a multiparametric approach to cardiac diagnostic tests that involves expensive cardiac biomarker measurements and imaging [12,13]. A recent expert consensus document from the American College of Cardiology [12] recommends an initial triad of testing, involving electrocardiography, cardiac troponin measurements and echocardiogram, for suspected myocardial involvement evaluation in COVID-19. The implications of these pose major challenges to several resource constrained settings in low- and middle-income countries (LMICs), where the capacity to perform advanced diagnostic tests and treatments are unavailable. Consequently, there are stark inequities in acute cardiac care delivery resulting in high rates of missed diagnosis, misdiagnosis, inappropriate and futile treatments and worsening health outcomes. This situation is further worsened with COVID-19 associated myocardial injury. The substantial epidemiological double burden of communicable diseases and NCDs in many resource-constrained countries [14], and limited guidelines on resource-efficient approaches to cardiac evaluations, and management of myocarditis and other cardiac complications caused by COVID-19 constitutes a dire predicament in LMICs and may exponentially increase the burden of cardiovascular conditions.

The COVID-19 pandemic draws attention to the intersection between non-communicable and communicable diseases, highlighting the opportunity this moment offers for a collaborative and global response to mitigate the severe impact of COVID-19, strengthen resilience, enhance the detection and response for future pandemics, and the need for re-imagining approaches to health care delivery [15]. For complications like cardiac involvement in COVID-19, patient-centred care models with integrated transdisciplinary approaches towards diagnoses, management, rehabilitation, and care coordination are critically important. During pandemics such as COVID-19, it is vital to safeguard and support persons with NCDs, provide continuity of care, promote self-management, strengthen health systems, and avoid gaps in care.

Fear and Scepticism of Vaccinations

Factors influencing COVID-19 vaccine scepticism and uptake include falsehoods spread through conspiracy theories such as beliefs that COVID-19 vaccines and other pandemic measures are for economic benefits, the deliberate politicisation of the pandemic for political gain, a lack of trust in the government and stakeholders due to various ambiguities in public health messaging, and other unsubstantiated safety concerns [16]. In addition, mistrust of science due to examples of unethical research practices in the past, especially among historically marginalised populations, has led to scepticism regarding safety and efficacy, with perceived rapid development, testing, and emergency approval of COVID-19 vaccines. The impact of misinformation and mistrust affects the acceptance and uptake of vaccines and must be considered in ensuring universal vaccination coverage. This presence of many sources of misinformation enabled the proliferation of dangerous falsehoods which

propagated fear and scepticisms, hindering public health responses [17]. Baseless concerns about COVID-19 vaccines included their safety, efficacy, and short- and long-term side effects. These generated and propagated fear and vaccine hesitation [16]. Holland and colleagues [5] highlighted the importance of temporal considerations for distinguishing between viral or vaccine induced myocarditis, and investigative approaches that include chest X-ray, 12-lead electrocardiograph (ECG), and high-sensitivity troponin measurements. In addition, further doses of mRNA vaccines in myocarditis cases following mRNA vaccinations are not recommended, while myocarditis of other origins is not a contraindication to receiving vaccinations.

Information and Disinformation

The World Health Organization dubbed the overwhelming volume of disinformation on COVID-19 an "infodemic," describing it as "an overabundance of information and rapid spread of misleading and fabricated news, images, and videos, which, like the virus, is highly contagious, grows exponentially, and undermines public health measures and leads to unnecessary loss of life" [17,18]. The unprecedented high volume and rapid evolution of both genuine and fraudulent information contributed to widespread public confusion and made it impossible to sort through and recognise factual material backed up by expert evidence. Thus, as shown during the course of the pandemic, proliferation of misinformation and disinformation can have severe and lethal health and social consequences and further erodes trust in science. Misinformation differs from disinformation in terms of intent, with the former being more subtle. The former refers to the unintended distribution of incorrect information with no purpose to deceive; the later refers to inaccurate and erroneous material that is intentionally designed, curated, and shared with the intent to deceive. These can be found as a mix of opinions, unfounded falsehoods, half-truths and mis-represented truths, which can sometimes come from trusted individuals [17]. Vaccine acceptance, in particular, has been threatened by a plethora of disinformation including erroneous extrapolation of adverse effects like mRNA vaccine–induced myocarditis, the risk of which, according to Holland and colleagues is about 2.7 cases per 100,000 persons and often mild and self-limited.

To address this, organisations such as the World Health Organization (WHO) have implemented social listening tactics that use artificial intelligence to continuously evaluate and analyse large amounts of data provided on social media platforms [18]. This allows for the tracking of viral public health issues, as well as associated emotions and attitudes, which are analysed to generate targeted and sensitive health messages. This method was equally effective in areas with a large digital divide and those where other popular information sources, such as radio, are widely used. Partnerships with governments, such as the UK-WHO collaboration to manage the COVID-19 infodemic [19], incorporating community voices and individual fact-checking to local contextualising of information, and advice documents to minimise ambiguity were among the other initiatives. In the US, the National Institutes of Health established the Community Engagement Alliance initiative in recognition that it is essential that communities at risk be engaged to inform and guide research to address COVID-19 misinformation and inequities. Twitter, Facebook, YouTube, Google, and other social media platforms have also implemented policies to handle disinformation including sanctions for violations, though some of these have been criticised either as inadequate or as censorship and barring divergent viewpoints. Some traditional news outlets used communication efforts like BBC World Television's "Stop the Spread" to implement methods. Intervention against false content, especially sources that propagate it; promoting and assuring the plentiful availability of transmission of true information; developing the public's resilience to misinformation and disinformation; and providing a nationally coordinated, whole-of-society reaction to widespread false and inaccurate information are among the proposals for addressing the growing danger of disinformation and misinformation [17].

Health Equity and Social Justice

The COVID-19 pandemic has exacerbated long-standing and persistent global health disparities and inequities, and the cost of inaction or reluctance to address these inequities is high and harmful to all. COVID-19's impact in the rapid reversal of advances in closing wide health racial and ethnic gaps in health outcomes is still emerging [20]. Socioeconomic disadvantages and injustices caused by class, gender, and racism, as well as global causes that promote impoverishment and instability in many poorer regions of the world, are driving these trends. The COVID-19 epidemic has shown acute inequities and stark discrepancies in socioeconomic and health hazards, despite being a collective crisis. In the United States, historically underserved populations such as African American, Hispanic, and Native American people were overrepresented in COVID-19 hospitalisations, complications, and deaths [21]; similarly, people of Black and Minority Ethnic (BAME) origins were overrepresented in the United Kingdom; and Indigenous people were overrepresented in Australia [22]. Several low-resource countries launched effective public health measures despite severe economic and health-system constraints, whereas countries with supposedly stronger health systems, but which have been plagued by decades of underinvestment and fragmentation in both medical and public-health infrastructure, have had more trouble implementing a meaningful COVID-19 response [22].

Coordinated measures geared at improving socioeconomic determinants of health, such as housing, access to food and health care, education, closing the digital gap, and policies targeted at addressing health disparities at every governmental level are among the multi-pronged approaches and

recommendations of actions crucial to resolving health inequalities [23,24]. This includes tackling the inequity and fragility of public health measures inside systems, as well as the pervasive politics of global health neglect [22], and casting a spotlight on larger political-economic systems and institutional conditions that maintain and promote imbalances in power and resource distribution. This also involves investments in increasing health care worker capacity, and comprehensive evaluation of complications such as cardiac involvement in COVID-19 as highlighted by Holland and colleagues [5] and strengthening local health care systems in various parts of the world, notably in low- and middle-income nations. Access to affordable health insurance and paid sick leave are crucial in enabling people to receive medical care and quarantine if infected. In the United States, some workers, especially the poor, who fell ill and did not have access to these social programs went to work since they could not afford to stay home. This contributed to the spread of the virus.

A Way Forward and Lessons Learned

Many new and better ways of addressing disease outbreaks have come to light during this pandemic and previous disease outbreaks such as the 2014 Ebola epidemic that began in West Africa. Evidence based solutions exist that can greatly strengthen national and international capacities to prevent, detect and respond to future disease outbreaks. Such efforts must include preventing spillovers through stopping the destruction of intact ecosystems; closing risky, unregulated wet markets; and collapsing demand for illegal wildlife products to reduce illegal wildlife trafficking. We must also capture this moment to strengthen public health systems which are not only necessary to address disease outbreaks, but are vital platforms to address the tsunami of NCDs. The multinational Global Security Agenda should be strengthened by: supporting countries to enhance their own independent data collection and management systems that can release quality data publicly free of political interference; and address the gaps identified in the Joint External Evaluations. In addition, we need to implement what works at a grassroots level to combat disinformation. In the end, it is up to us all to work with governments at all levels to implement these and other solutions, and to engage the public and civil society.

Leadership and governance have emerged as critical factors as has been the need for robust public health responses not just locally, but globally. The need for dynamic, data driven clinical decision making as well as cross sector collaboration and partnership have been emphasised in improving health outcomes. As Holland and colleagues [5] note, leveraging data sources will be critical as we live and learn with this global health challenge. In the end, what will be implemented are political choices. More than data drives those decisions. It is up to all of us to engage in these political processes to advocate for the evidence based data supported solutions that will secure a far better response to future disease outbreaks, and reduce the rise in NCDs.

Conflicts of Interest

None declared.

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