

## **The Response To The Covid-19 Pandemic: With Hindsight What Lessons Can We Learn?**

By: Mark Faghy, Ross Arena, Andrew P. Hills, James Yates, [Amber L. Vermeesch](#), Barry A. Franklin, Dejana Popovic, Lindsay Strieter, Carl J. Lavie, Andy Smith

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### **Abstract:**

The purpose of this paper is to put forward some evidence-based lessons that can be learned from how to respond to a Pandemic that relate to healthy living behaviours (HLB). A 4-step methodology was followed to conduct a narrative review of the literature and to present a professional practice vignette. The narrative review identified 8 lessons: 1) peer review; 2) historical perspectives; 3) investing in resilience and protection; 4) unintended consequences; 5) protecting physical activity; 6) school closures; 7) mental health; and 8) obesity. As in all probability there will be another Pandemic, it is important that the lessons learned over the last three years in relation to HLB are acted upon. Whilst there will not always be a consensus on what to emphasise, it is important that many evidence-based positions are presented. The authors of this paper recognise that this work is a starting point and that the lessons presented here will need to be revisited as new evidence becomes available.

**Keywords:** physical activity | unhealthy lifestyle | social distancing | school-based interventions | obesity | wellbeing

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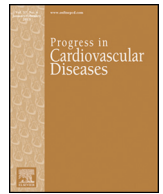
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## The response to the COVID-19 pandemic: With hindsight what lessons can we learn?

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### ABSTRACT

The purpose of this paper is to put forward some evidence-based lessons that can be learned from how to respond to a Pandemic that relate to healthy living behaviours (HLB). A 4-step methodology was followed to conduct a narrative review of the literature and to present a professional practice vignette. The narrative review identified 8 lessons: 1) peer review; 2) historical perspectives; 3) investing in resilience and protection; 4) unintended consequences; 5) protecting physical activity; 6) school closures; 7) mental health; and 8) obesity. As in all probability there will be another Pandemic, it is important that the lessons learned over the last three years in relation to HLB are acted upon. Whilst there will not always be a consensus on what to emphasise, it is important that many evidence-based positions are presented. The authors of this paper recognise that this work is a starting point and that the lessons presented here will need to be revisited as new evidence becomes available.

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Abbreviations: CRF, Cardiorespiratory fitness; COVID-19, Coronavirus disease 2019; HL, Healthy living; HLB, Healthy living behaviours; METs, Metabolic equivalents; NR, Narrative Review; PA, Physical activity; QoL, Quality of life; VO<sub>2</sub>, Oxygen consumption; UK, United Kingdom; US, United States.

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## Introduction

The purpose of this paper is to add to the emerging literature<sup>1</sup> that reflects on what, with hindsight, healthcare professionals, policy makers, and researchers could have done better in response to the coronavirus disease 2019 (COVID-19) pandemic. This paper does not seek to apportion blame to those, who with the benefit of hindsight, could have done things differently. Rather, this work seeks to help learn lessons from the Pandemic in the hope that next time things will be done better and adds to the work of others who are attempting to do the same.<sup>2</sup>

There are many different types of lessons that could be learned from the Pandemic. They include lessons related to medicine, economics, sociology, politics, and international relations. Here our focus is on the lessons that can be learned that relate to healthy living (HL) behaviours (HLB), quality of life (QoL), wellbeing, and non-communicable diseases as studied and promoted through the Healthy Living for Pandemic Event Protection (HL- PIVOT) network.

## Methods

As described in detail below, a 4-step methodology was followed to ensure the quality of the work and to triangulate the conclusions.

**Step 1:** An international and interdisciplinary authorship Team was recruited through the HL- PIVOT network.<sup>3</sup> The overarching goal of this network is to promote human resilience and quality of life by increasing HLB. This step helped ensure the quality of the work as it brought together an interdisciplinary Team of authors with a range of experiences and professional insights. The international dimension of the Team helped triangulate the perspective reported here as each of the countries 'represented' had different responses to the Pandemic.

**Step 2:** A narrative review (NR) of the emerging literature, which is challenging and contesting the response to the Pandemic, was conducted by following authors: DP, LS, AH, RA and AS. A NR was used rather than a systematic review and/or meta-analysis because: i) the literature in this area has yet to mature; ii) we wanted to purposefully select from a range of qualitative and quantitative sources; and iii) this approach better suited our aim to present a short historical overview. By conducting this review, the authors were able to compare their own thinking with that of other scholars past and present.

**Step 3:** One of the authors (BF) drafted a reflective practice vignette based on his reading of the literature and experiences during the Pandemic.

**Step 4:** Through the project, drafts of the paper were circulated to all members of the Authorship Team for comment and to identify: i) points of consensus; and ii) any differences of emphases. AV, RA, MF, AS and JY contributed to the manuscript as a whole and had a particular responsibility for taking this step. This was done largely through emails and the use of a shared drive but culminated in all Authors reviewing and revising the final draft.

It is important to note that this methodology was designed to allow many evidence-based views to be heard rather than to reach a consensus on every point. That is why we have been clear about which authors drafted which section.

## The narrative review

The method used to construct the NR created a bibliography that we considered relevant. Work was considered relevant if it addressed: i) lessons that could be learned from the Pandemic; and ii) was directly or indirectly linked to healthy living behaviours.

To ensure that a broad range of sources were reviewed, and whilst giving precedence to peer-reviewed journal papers, books were also included.

The literature was read, and selected papers are reported in three clusters. Cluster A addresses four 'higher order lessons' that are applicable to a range of settings and professions. Cluster B relates directly to lessons that can be learned about HLB [e.g., physical activity (PA), sedentary behaviour]. Cluster C relates to lessons that can be learned that relate to possible outcomes (e.g., obesity, depressive symptoms) that may have resulted from changes in HLB. These clusters are not discrete, and the lessons identified in each are interlinked. A theme that links many of them is the potential for damage to mental and physical health, education and general wellbeing by the measures put in place to control the Pandemic.

The strengths of the literature reviewed here are that they are international and multidisciplinary. Additionally, the literature is contemporaneous with the Pandemic and therefore, has an immediacy and sense of urgency.

The weaknesses of the existing literature reviewed here include a lack of interdisciplinary perspectives. Whilst the literature includes work from multiple disciplines, individual papers lack true interdisciplinary thinking and authorship teams, methodologies, and analysis. In addition, the work is by its very nature, post-hoc, as it reviews what happened after the event rather than being established at the start of the Pandemic with evaluation in mind. More contentiously, within the work, there is little evidence of authors reflecting on how the Pandemic changed their thinking or discussion about what they themselves might have done differently. Closely related to these observations, there is a danger that within the health-related professions, 'group think' may be occurring.

## NR Cluster A: higher order lessons

**NR Lesson 1 – Peer Review, Publish Quickly but with rigorous vetting of data and viewpoints and Provide Open Access:** The Pandemic had an impact on the publication of scientific and medical papers. Three Pandemic impacts can be identified. First the sheer number of papers and books on COVID-19 published since January 2020 is staggering and at this point defies simple characterisation and summary. Secondly, the speed at which both empirical data was collected and published, and opinions formed and shared, was at an unprecedented pace. On the positive side, this speed enabled the rapid development of, for example, vaccines, and is to be commended. However, moving forward, care needs to be taken to ensure that haste does not undermine the opportunity for high-quality peer review and resulting literature. The substantial immediate benefit of disseminating results quickly does not have to be at the cost of long-term damage to the peer review process - if the risk is identified and mitigated appropriately. The importance of peer review is emphasised when it is reported, for example, that President Lukashenko of Belarus informed his population that COVID-19

could be defeated by ‘drinking vodka’.<sup>4</sup> Suggestions such as this are alarming given the propensity of individuals with irrational beliefs to engage in pseudoscience practices, and have reduced vaccination intention and adherence to follow official COVID-19 guidelines.<sup>5</sup> Thirdly, many Journals made all papers related to the Pandemic open access for which they should be applauded. This precedence should become a standard practice for global health crises in the future.

**NR Lesson 2 – Learn from the Past:** With great foresight in 2016, McMillen<sup>6</sup> wrote “very often history is forgotten or rediscovered only when we confront contemporary epidemics and pandemics, and thus patterns from the past are repeated thoughtlessly” (page 1). As Fig. 1 illustrates, COVID-19 was not the first-time humankind has encountered a Pandemic. Despite these historical Pandemics, arguably, when COVID-19 struck, it appeared to arrive as a complete surprise. Why else would so many governments, health care systems and professions appear to have been so unprepared. The delayed implementation of control measures internationally manifested despite widely observed preceding inter-country spread of the virus.<sup>7</sup> A key takeaway is in the knowledge that another Pandemic will occur, and we should urgently prepare for it by learning all possible lessons from COVID-19. This paper is part of that global endeavour which includes, for example, the Public Enquiry into the Pandemic being conducted by the United Kingdom (UK) government.

As well as learning from previous Pandemics, other historical events provide an opportunity to learn. For example, during the German bombing of London during the Second World War (‘The Blitz’), the British Government introduced a night-time blackout to prevent the Luftwaffe using the City’s lights to target the area. It is reported that this well-intentioned action led to a massive increase in road deaths with a suggestion in the British Medical Journal that it killed 600 people a month.<sup>2</sup>

**NR Lesson 3 – Invest in Resilience, Wellbeing, and Protection:** The Pandemic shone a bright and uncomfortable light on the lack of resilience, wellbeing, and unpreparedness of many countries’ health systems, and their populations. National stockpiles of personal protective equipment might be part of the solution along with ensuring that countries have the necessary infrastructure to manufacture their own basic medical and health equipment. In addition, nations need to invest in improved methods of communication between government departments and the public. To tackle future Pandemics, societies need the capacity to adopt “whole of society” approaches which mobilise the contribution of all for the benefit of all. The challenges of coping with future Pandemics necessitates parallel disruptions to prevention and management, including novel behavioural insights to address poor behaviours, including panic buying and sedentary behaviours.<sup>8</sup>

**NR Lesson 4 – Beware of Unintended Consequences:** As well as producing the intended outcomes, any action tends to result in unintended consequences. Arguably the most significant one during the Pandemic has been the politicisation of public health.<sup>9</sup> This was perhaps most evident in the United States (US) where mask wearing became, and may still be, a hotly contested political issue.

Another unintended consequence was how social distancing mandates negatively impacted initiatives to promote PA. The initial assumption being mandates that limited PA would decrease viral transmission, an assumption that following further analysis was proven to be false; “most traced contagions diagnosed after lockdown mitigation continued to happen inside closed communities [May 1–20: 49.5% nursing homes; 24.3% private houses; 7.2% hospitals—June 1–30: 35.1% nursing homes; 24.6% private houses/relatives; 6.6% hospitals (2020)]”.<sup>9</sup>

By their very nature, unintended consequences are unpredictable – the lesson here is to ensure that any action is well-thought-out and that group think is avoided. In addition, from time to time the inclination to act may need to be tempered by an acknowledgment that sometimes doing nothing may be the right course of action.



**Fig. 1.** Previous Pandemics as Identified and Ordered by McMillen (2016).  
**Legend:** HIV/AIDS, human immunodeficiency virus/acquired immunodeficiency syndrome; COVID-19, coronavirus disease 2019.

## NR Cluster B lessons directly related to HLB and lifestyle

**NR Lesson 5 – Protect PA Levels:** The evidence that physical inactivity and living a sedentary lifestyle is a major cause of disease and lower QoL is well established.<sup>10</sup> Before the Pandemic, many countries and organisations were taking steps to increase levels of PA, although many of these initiatives have not been as successful as hoped. In addition, exercise was being used in a range of clinical settings as a means of both pre-surgical preparation and rehabilitation from, for example, coronary heart disease. In many countries, sport and fitness are large parts of both the economy and cultural life of the nation. PA, exercise, sport, and fitness can, therefore, be seen as crucial elements of the health and wellbeing of a nation. Prior to early 2020, who could have imagined that across the world people would be confined to their homes, gyms and rehabilitation services would be closed, and outdoor public spaces shut? Not surprisingly, lockdowns resulted in an inevitable reduction in levels of PA and patients being unable to access clinical exercise rehabilitation programs.<sup>11</sup> Any benefits that accrued from lockdowns in terms of reducing the rate of transmission of COVID-19, need to be offset by the cost of reducing levels of PA. Such a cost-benefit analysis has yet to be conducted and will be challenging to perform because of the different timescales on which COVID-19 disease burden and physical inactivity impact the health of both individuals and populations and should recognise that the cost-benefit may differ across groups. Infection by the COVID-19 virus results in illness and sometimes death within days, or results in long-lasting, yet-to-be determined deleterious health effects, whilst the results of low levels of PA and sedentary living may take years or decades to accrue. This time difference in negative effect may account for many governments acting in ways that resulted in a relatively quick reduction in the reproduction rate of the virus whilst potentially sabotaging the long-term health of many by reducing their levels of PA.

**NR Lesson 6 – Keep Schools Open:** At the start of the Pandemic, it was understandable, and necessary to prevent viral spread, that many countries closed their schools. However, our actions to continue shutdowns and remote schooling long after it was known that infections and death rates from COVID-19 among children were low<sup>12</sup> was, with hindsight, perhaps not the ideal approach. Lewis et al<sup>13</sup> stated “Children have least to gain and most to lose from school closures. This Pandemic has seen unprecedented intergenerational transfer of harm and costs from elderly socioeconomically privileged people to disadvantaged children”.

During the Pandemic in the US, overall leading causes of death for children ages 0–14 remained consistent (i.e., unintentional injury and cancers).<sup>14</sup> Concurrently, the number of suicides and hospitalizations due to mental health issues increased. In 2020, the second leading cause of death, behind unintentional injury, for ages 5–9 and 10–18 was suicide.<sup>15</sup> More and more, children are being hospitalized for mental health issues including depression and anxiety.<sup>16</sup>

In addition to the mental health effects, children’s nutrition has suffered. In many countries, schools provide nutritious food to low-income families through various government initiatives. When schools shut down, so does access to these programs. In the US, food insecurity increased by 4% from March 2020 to July 2020.<sup>17</sup> Most likely from fear of contracting COVID-19 from grocery stores, more and more families resorted to ordering food, resulting in an increase in the purchasing of packaged foods and consumption of less fresh fruits and vegetables.<sup>18</sup>

Remote schooling, remote programming, and shut-downs of after-school activities also contributed to a reduction in children’s PA and fitness.<sup>19</sup> With an increase in screen time came a decrease in PA. Other children lost access to physical education altogether. Sports and physical extracurriculars were also put on hold.

Goldfeld et al<sup>20</sup> made an important contribution to the issues explored here through their narrative review on the impact of the Pandemic on children’s health. Taking Australia as its starting point, a country that had some of the strictest restrictions in place, they identified 11 potential negative impacts of these restrictions on young people. Negative impacts were grouped in the following clusters: i) child-level

factors; ii) family-level factors; and iii) service-level factors. In stating that “these restrictions are having immediate and likely longer term adverse consequences on children’s developmental potential” (page 364), Goldfeld et al. adds to the commentary of many researchers globally from different disciplines who have expressed concerns about the adverse impact the Pandemic is having on children and adolescents.<sup>21–23</sup>

Individually, the impacts of the Pandemic and school closures on healthy living behaviours is a major cause for concern, when combined with childhood obesity, the full scale of the problem becomes worryingly apparent.<sup>24</sup> To address the damage that has been done to children by the Pandemic and lockdowns calls have begun for recovery plans for children, see for example Gauvin et al.<sup>25</sup> Of course, not just children have suffered from the closure of schools but parents, and particularly mothers, had to take on the responsibility of teachers which many found had a negative impact on their mental health.<sup>26</sup> It would be remiss of researchers to not continue to monitor and assess the long term effects of this period on young people and their families following such an unprecedented compromise of public health.

## NR Cluster C lessons that can be learned that relate to health outcomes

**NR Lesson 7 – Protect Mental Health:** Whilst the evidence on the impact of the Pandemic on mental health is still emerging, a negative impact is clearly apparent.<sup>27,28</sup> Many people went through illness and spent days in lockdown feeling anxious and fearing for their own health and for that of loved ones. A meta-analysis showed that COVID-19 quarantine had varying impacts on psychological stress, regardless of country of origin.<sup>29</sup> Every age category was hit: i) children sharply changed their environment, some were separated from their families, isolated and demonstrated increased mental health disruption<sup>30</sup>; ii) adolescents had a higher frequency of using alcohol and cannabis and particularly negative mental health impact was prominent among adolescents in one-parent, one-child, and low-income households; and iii) adults exhibited diverse mental health problems and the elderly were particularly under the risk due to self-integration, self-efficacy, and resilience issues.<sup>31</sup> The Pandemic poisonous polypill included not only illness and fatigue, but physical inactivity, mental stress, loss of family members, financial and food insecurities, isolation, loneliness, reduced or no access to social networks, travel restrictions, lockdowns, work from home, and general uncertainty leading to diverse stress-related conditions.<sup>32</sup> Limited or no access to mental health services further worsened the situation. There were no organized and planned healthy living programs to combat Pandemic related physical and mental health issues. Some countries recognized the problem and attempted to intervene to combat mental health issues, however it was often sporadic and insufficient.<sup>33</sup> Many vulnerable population groups were forgotten including those with pre-existing mental health conditions and those with learning difficulties.<sup>34</sup> If in response to future Pandemics lockdowns are imposed, it is important that compensatory measures are put in place to protect the mental health of the population. Besides psychosocial support, implementation of training programs, guidelines and system level protocols, the measures should include the implementation of pre-planned healthy living programs designed to protect mental health which include exercise interventions that have been shown to reduce psychosocial stress.

**NR Lesson 8 – Factor in Obesity:** Well before the COVID-19 Pandemic, obesity was, and will continue to be, a major global health crisis; it should be considered a Pandemic in its own right.<sup>35</sup> Very early in the COVID – 19 Pandemic, the risk that lockdowns would make an already major health crisis such as obesity worse, was identified.<sup>36</sup> Such a risk should not have been a surprise to anyone given the already well understood multi-factorial nature of obesity. As the prevalence of overweight and obesity continues to rise and impact individuals of all ages, this points to the fact that, as a global community, we have been summarily unsuccessful in preventing unhealthy weight gain. Prior to the



COVID-19 pandemic, we had certainly failed to address the broader biosocial nature of obesity, so with the overlay of an additional Pandemic, many individuals are further compromised, even if we simply consider primary drivers including reduced levels of PA, increases in sedentary behaviour and food insecurity. Evidence is now emerging that these fears were justified, and that obesity, and a range of other health indicators, have worsened over the COVID-19 period.<sup>37</sup> For example, there is considerable evidence that in countries with higher levels of obesity, the impact of COVID – 19 has been associated with higher death rates and health complications.<sup>38–44</sup> Unfortunately, COVID-19 has exposed and amplified existing inequalities in society. Marmot and Allen<sup>45</sup> framed this notion in relation to the UK as “inequalities in COVID-19 and inequalities in the social conditions that lead to inequalities more generally”. An ongoing issue for societies will be to address inequalities in health and effectively respond to additional impacts; otherwise, we risk greater challenges over time for a larger proportion of the global population.

### NR Conclusion

Of the lessons learned through this NR, the one we attach the most weight to is the need in future Pandemics (and other global emergencies), to keep schools open (i.e., lesson 6). Evidently, we cannot say based on the arguments reviewed here what would have happened if we had kept schools open. In forming our view that schools should be kept open, we were of the view that policy makers and others reduced the function of schools to teaching and learning – activities that arguably can be conducted online. This view disregards the essential role schools play in socialisation, cultural transition, and integration. Also, it ignores the importance of ‘hands on learning’ that is required in a range of subjects including physical education, music, and the arts, and underestimates the important role schools play in ensuring some of our most vulnerable children have access to food, psychological support, and safeguarding services.

In concluding this section of the paper, we are conscious of the fact that it is the nature of any exercise in ‘learning lessons’ that the focus is on what went wrong and negative outcomes. However, there is a possibility that for some individuals and things that there could be post traumatic growth. People who overcome great challenges can become stronger and societies who tackle common problems can change. Regarding the latter, arguably the Pandemic has put a greater focus on the importance of health and community cohesion. Nonetheless, any positive outcomes from the Pandemic will need nurturing if they are to have a lasting impact.

### Vignette

#### *Lessons Learned from the Lingering COVID-19 Pandemic: Need for Greater Self-Responsibility*

This vignette and the lessons it contains was drafted by BF. As the Pandemic appears to have shifted into a new phase (e.g., less public lockdowns and social distancing mandates), we should reflect on what we have learned and apply those lessons should other viral mutations or an entirely new Pandemic strike in the future. Although the Pandemic has been particularly devastating in the US, not all citizens were affected equally. Without question, cultural and societal factors placed some demographic, racial, and ethnic groups at increased risk of contracting and dying from COVID-19.<sup>46</sup>

#### *Population disparities*

Hispanic, Black, and Native American Indians experienced disproportionately high rates of COVID-19 hospitalizations, with reported rate ratios of 3.0, 2.8, and 3.5, respectively, when compared with their White counterparts.<sup>47</sup> After adjusting for age, these population subsets

also experienced a much higher percentage of the COVID-19 mortality burden relative to their percent of the US population.<sup>48</sup> This may be partially attributed to the social determinants of health, income and wealth disparities, inequalities in health care access and use, occupational vulnerability (i.e., more face-to-face interactions with the general public), public transportation transmission, and living in multigenerational or multifamily housing.<sup>49</sup>

Rural Americans were more than twice as likely to die from COVID-19 infections than their urban counterparts.<sup>50</sup> This heightened mortality may be attributed to higher age, lower socioeconomic status, limited access to health care, and a higher incidence of chronic diseases such as obesity and type 2 diabetes mellitus. Further, because rural Americans tend to express less enthusiasm for vaccine safety and effectiveness, they have lower rates of vaccination against COVID-19.<sup>51</sup>

Additionally, the aforementioned demographic groups, as well as other vulnerable populations, including low-income and older Americans (i.e., ≥65 years of age), confronted the virus with a much higher prevalence of chronic diseases, such as known cardiovascular and pulmonary conditions.<sup>52</sup> These underlying risk factors, especially in combination, increased the likelihood of getting severely ill from COVID-19.

#### *Misguided governmental responses, medical misinformation and constitutional rights*

The COVID-19 Pandemic was initially exacerbated by a delayed, dampened, downplayed governmental response. It provided unprecedented challenges to the medical community, which was further compounded by antiscientific meddling and mishandling of those regulatory agencies responsible for the country's countermeasures.<sup>53</sup> To eliminate or reduce panic, Americans were irresponsibly told by some in leadership positions that the end of the virus was just around the corner or that it would magically vanish with the seasonal transition to summer.<sup>54</sup>

Uncertainty abounded. Hydroxychloroquine and Ivermectin were initially promoted as a potential treatment for COVID-19 – a claim that has been subsequently refuted.<sup>55,56</sup> According to numerous studies, in spite of reported reactions, some serious adverse events, and breakthrough cases, COVID-19 vaccines are generally safe and highly effective in preventing COVID-19-related hospitalization and death.<sup>57</sup> Despite considerable evidence that masks block virus transmission and save lives, some argued that they have a “constitutional right” not to wear them, or that wearing a mask exposes the wearer to dangerous levels of carbon dioxide; neither of these suppositions are valid.<sup>58,59</sup>

#### *Pandemic of the unvaccinated*

During a July 2021 White House briefing, Centers for Disease Control and Prevention (CDC) Director Dr. Rochelle Walensky said that a data review by her agency revealed that 99.5% of the people who died from COVID-19 over the past 6 months were unvaccinated.<sup>60</sup> Similarly, US Surgeon General Dr. Vivek Murthy added that nearly every recent death due to COVID-19 could have been prevented. In an accompanying advisory, Murthy wrote: “Health misinformation is a serious threat to public health. It can cause confusion, sow mistrust, harm people's health, and undermine public health efforts. It's one of several reasons why people are not getting vaccinated.”

#### *Health of the US before the pandemic?*

In 2018, the US spent approximately \$3.6 trillion on health care – a level of spending that makes the American health care system, by far, the most expensive in the world.<sup>61</sup> Yet, a Commonwealth Fund brief reported that the US had worse health outcomes compared to other high-income countries.

A widely cited study noted that Americans, prior to the pandemic, already had a high prevalence of unhealthy lifestyles, risk factors, and underlying chronic disease, as well as a shorter life expectancy compared with residents of all other high-income countries. Researchers analyzed data from 2 major ongoing cohort studies, the Nurses' Health Study ( $n = 78,865$ ) and the Health Professionals Follow-up Study ( $n = 44,354$ ) which, when combined with National Health and Nutrition Examination Survey data as well as mortality data from the CDC, were used to estimate life expectancy in the US population. Five low-risk lifestyle factors were considered: not smoking; body mass index  $18.5$  to  $24.0$   $\text{kg}/\text{m}^2$ ;  $\geq 30$  min/day of moderate-to-vigorous PA; moderate alcohol intake; and a healthy diet score. During up to 34 years of follow-up, adherence to all 5 lifestyle-related factors significantly increased life expectancy at age 50 years for both men and women, 12.2 and 14.0 years, respectively. The most physically active cohorts of men and women demonstrated 7- to 8-year gains in life expectancy!<sup>62</sup> The investigators concluded that Americans could narrow the life-expectancy gap between the US and other industrialized countries by adopting a healthier lifestyle, and that prevention should be a top priority for national health policy.

#### *Need for greater self-responsibility*

The cost of health care today in the US will soon approach 20% of the gross domestic product (\$1 out of every \$5 spent). It's simply not sustainable! We need to move from what has been referred to as a "reactive sick care system," to a more proactive health care model.<sup>63</sup> Consequently, self-responsibility (e.g., regular physical exams, completing health habit surveys and/or serial risk factor profiles, attaining certain risk factor goals) has become a greater priority in the contemporary health care environment.<sup>64</sup> Both the COVID-19 Pandemic and our poor health as a nation can be improved with a traditional American value: *self-responsibility*.

Failure to take responsibility for our own health unequivocally increases the risks of COVID-19 and leads to many of the underlying chronic diseases that worsen the impact of the virus, such as obesity, type 2 diabetes, and coronary artery disease.<sup>65</sup> Small, positive changes in what we eat, how often and vigorously we exercise, and avoiding cigarette smoking can have a profound and favorable effect on preventing and treating illness and disease – and that includes COVID-19. A healthcare model that supports individuals in making positive changes to their health would reduce the impact of chronic and acute conditions while reducing costs to other aspects of the healthcare system.

#### *Exercise, PA and cardiorespiratory fitness (CRF)*

Increased levels of PA and structured exercise have positive protective effects that are realized within only days of initiation.<sup>66</sup> Consistently meeting contemporary PA guidelines ( $\geq 150$  min of moderate-intensity or 75 min of vigorous PA per week, or combinations thereof), is associated with a reduced likelihood for hospitalization, intensive care unit admission, and death among patients with COVID-19.<sup>67</sup> Higher levels of CRF, expressed as peak oxygen consumption ( $\text{VO}_2$ ) in  $\text{mL O}_2 \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  or metabolic equivalents (METs; 1 MET =  $3.5$   $\text{mL O}_2 \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ), also appear to confer more favorable COVID-19 outcomes.<sup>68,69</sup> An initial "goal" exercise training intensity  $\geq 3$  METs provides the greatest relative reduction in mortality and improvement in survival.<sup>70</sup> Using the treadmill exercise mode as an example, this corresponds to walking at 2.0 mph, 3.5% grade, or on the level (0% grade) at 3.0 mph. Thereafter, exercise workloads, expressed as METs, should be progressively increased by using age-, sex-, and fitness adjusted target intensities for training.<sup>71</sup>

#### *Obesity and dietary intake*

Obesity is a major risk factor for COVID-19 complications due to its adverse effects on type 2 diabetes, immune function, lung capacity

and cardiovascular health.<sup>72</sup> Nevertheless, among overweight or obese individuals, the health benefits of losing even 5% of body weight have been reported.<sup>73</sup> As an example of a dietary approach with a scientifically supported positive impact, the Mediterranean diet, for example, has been shown to elicit significant reductions in body weight and fat stores, systolic blood pressure, and inflammatory markers such as C-reactive protein.<sup>74</sup> In aggregate, these adaptations may help decrease COVID-19 incidence, severity, hospitalization, and mortality. Foods that increase levels of nitric oxide, such as beets, leafy greens, and lean meats such as bison, have also been shown to improve vascular health.<sup>75</sup> However, these dietary recommendations may be problematic in some underserved, low socioeconomic communities that are disproportionately impacted by the added costs and limited access to healthier foods.

#### *Smoking and secondhand smoke*

Because COVID-19 targets the lungs, quitting smoking and avoiding secondhand smoke are imperative. Cigarette smoking is responsible for 540,000 to 600,000 deaths each year. Moreover, on average, life expectancy is shortened by 10 to 12 years among lifelong smokers, as compared with those who never smoked.<sup>76</sup> Chronic exposure to secondhand smoke also increases the risk of heart disease by ~30%, after adjusting for confounding variables.<sup>77</sup> Fortunately, city- and country-wide smoking bans have invariably resulted in reduced population rates of cardiovascular events, especially among nonsmokers.<sup>78</sup>

#### *Vignette conclusion*

Perhaps the late General Norman Schwarzkopf summed it up best when asked how he would respond to an enemy attack. "Counterattack," he replied. When the enemy is COVID-19 or other viral mutations, the strategy is no different. Adopt a HL, favorably modify your risk factor profile, exercise regularly, and adhere to public health guidelines, as summarized by the 3-Ws: 1) Wait - don't go out if you have symptoms or had close contact with someone who has COVID-19; 2) Wash your hands; and 3) Wear a face covering. Perhaps a fourth W can be added - *Walk more*. Most importantly, *get vaccinated and stay up-to-date with booster shots*.

The COVID-19 Pandemic exposed significant disparities within certain population subsets that manifested through greater disease burden and worse outcomes. It became increasingly apparent that barriers to prevention and treatment are often fundamentally embedded within the social determinants of health. Accordingly, we need to equitably address these critical health modulators, including attitudes toward and enthusiasm for vaccine safety and effectiveness, as well as decreasing the incidence/prevalence of unhealthy lifestyles, risk factors, and underlying chronic disease.<sup>63</sup>

#### **Concluding reflections**

This paper set out to learn the lessons from the Pandemic related to healthy living behaviours, quality of life and non-communicable diseases. It did so by conducting a narrative review and through the vignette which was embedded in the literature that was specific to the case in question.

Given the diversity of the authorship team in terms of their nationality, profession, and experiences, naturally individuals placed different emphases on the lessons presented here. For example, whilst all agreed that there needs to be a great focus on both tackling structural inequalities in health and enhancing personal responsibility different authors focused more on one than the other. However, there was agreement that all the lessons presented here need to be heard and reflected on.

Readers are encouraged to work with their colleagues to formally review the lessons that can be learned from their own experiences and thereby to improve our preparedness for the next Pandemic. The

authors of this paper recognise that this work is a starting point and that the lesson which are presented here will need to be revisited as and when new evidence is published.

## Declaration of Competing Interest

None.

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