COVID-19 and impact of psychological stress on cardiovascular disease

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ABSTRACT

COVID-19 has caused a global pandemic of anxiety, fear and uncertainty. National lockdowns, high mortality, social isolation, economic recession, job losses and food insecurity resulting from COVID-19 are potent drivers of increased stress levels, anxiety and depression, and have placed a substantial strain on healthcare and economic systems. Depression, anxiety and physical isolation are strongly linked to incident cardiovascular disease (CVD) as well as poorer outcomes in established CVD – including coronary artery disease, stroke and heart failure. Acute stress-related disorders such as post-traumatic stress disorder, have been robustly and independently associated with multiple phenotypes of CVD, particularly in the first year after the psychiatric diagnosis. Unprecedented psychological stress imposed by COVID-19 on the global population bears the potential to cause a parallel epidemic of mental health disorders and a subsequent surge in CVD, warranting strategic planning by healthcare services to mitigate its impact. This potential for a mental health crisis would require both large-scale psychosocial interventions, and incorporation of mental healthcare into disaster management plans. Anxiety and depression, as the dominant emotional responses to the outbreak, warrant adequate training of healthcare personnel and the optimal use of technological advances to deliver acute mental healthcare interventions which are time-limited and culturally sensitive. SAHeart 2020;17:282-286

INTRODUCTION

The COVID-19 pandemic is a significant threat to "life as we knew it". Characteristics and rapid spread of COVID-19, coupled with implementation of drastic measures to curtail its impact, provoked a global climate of anxiety, fear and uncertainty. Despite governments' best intentions to protect the health of their citizens with measures such as national lockdowns, the consequent high mortality, social isolation, economic recession, job losses and food insecurity are potent drivers of increased stress levels, anxiety and depression. COVID-19 has placed a strain on healthcare and economic systems in ways that are significant and obvious. Beyond these considerations, COVID-19 poses a profound threat to our basic need for human connection. Widespread outbreaks of infectious disease, such as COVID-19, are associated with psychological distress and symptoms of mental illness.[1] Psychological distress and mental illness are recognised risk factors for cardiovascular disease (CVD) and confer a poor prognosis in patients with established CVD.[2-4] In addition, severe restrictions to movement during lockdown measures may lead to a surge of cardiometabolic risk factors such as physical inactivity, poor diet and weight gain, thereby causing exacerbations in CVD and potentially increasing CVD burden in the future, for which a cardiovascular health containment plan has been advised.

CVD has a complex interaction with COVID-19. First, CVD is a recognised risk factor for acquiring COVID-19 infection. Second, established and new-onset CVD is a predictor of COVID-19 severity and is associated with increased mortality.

Third, COVID-19 unmasks previously undiagnosed CVD, as well as causing acute decompensation of chronic CVD. In fact, many of the most widely documented extra-pulmonary manifestations of COVID-19 have involved the cardiovascular system: including new-onset hypertension, acute coronary syndromes (ACS), arrythmias and heart failure, worsening of pre-existing heart failure and coronary artery disease (CAD), as well as new presentations of viral myocarditis, Takotsubo and pulmonary embolism.[5,6] Unprecedented acute psychological stress imposed by the COVID-19 pandemic on the global population bears the potential to cause a parallel epidemic of mental health disorders and a subsequent surge in CVD (Figure 1). It is therefore timely to review recent literature and place into perspective the impact of psychological stress and mental health on CVD.

PSYCHOLOGICAL STRESS AND CARDIOVASCULAR DISEASE

Depression and CVD

Depression is highly prevalent in the general population and is a risk factor for incident CAD, and for cardiovascular morbidity and mortality in patients with established CAD.[4] Twenty per-cent of patients with CAD and/or heart failure are depressed, and up to a third of stroke survivors experience depression.[3] A meta-analysis of 28 prospective cohort studies on depression and the development of stroke revealed that depression was significantly associated with increased risk of stroke morbidity and mortality.[7] Depressed patients with ACS have double the risk of future major adverse cardiovascular events (MACE), similar to diabetes.[4] Based on strength of evidence linking depression to poor prognosis in CAD, the American Heart Association published a Scientific Statement recommending that depression be elevated to the status of a risk factor in ACS (unstable angina and myocardial infarction) survivors.[8] Subsequently a meta-analysis of randomised-controlled studies demonstrated that the use of antidepressants in depressed patients with previous cardiovascular events significantly reduced the risk of MACE, including myocardial infarction, stroke and all-cause mortality.[9] Behavioural considerations in the context of depression also impact cardiovascular outcomes via complex mechanisms that involve high-risk health behaviours, such as smoking, sedentary lifestyle,
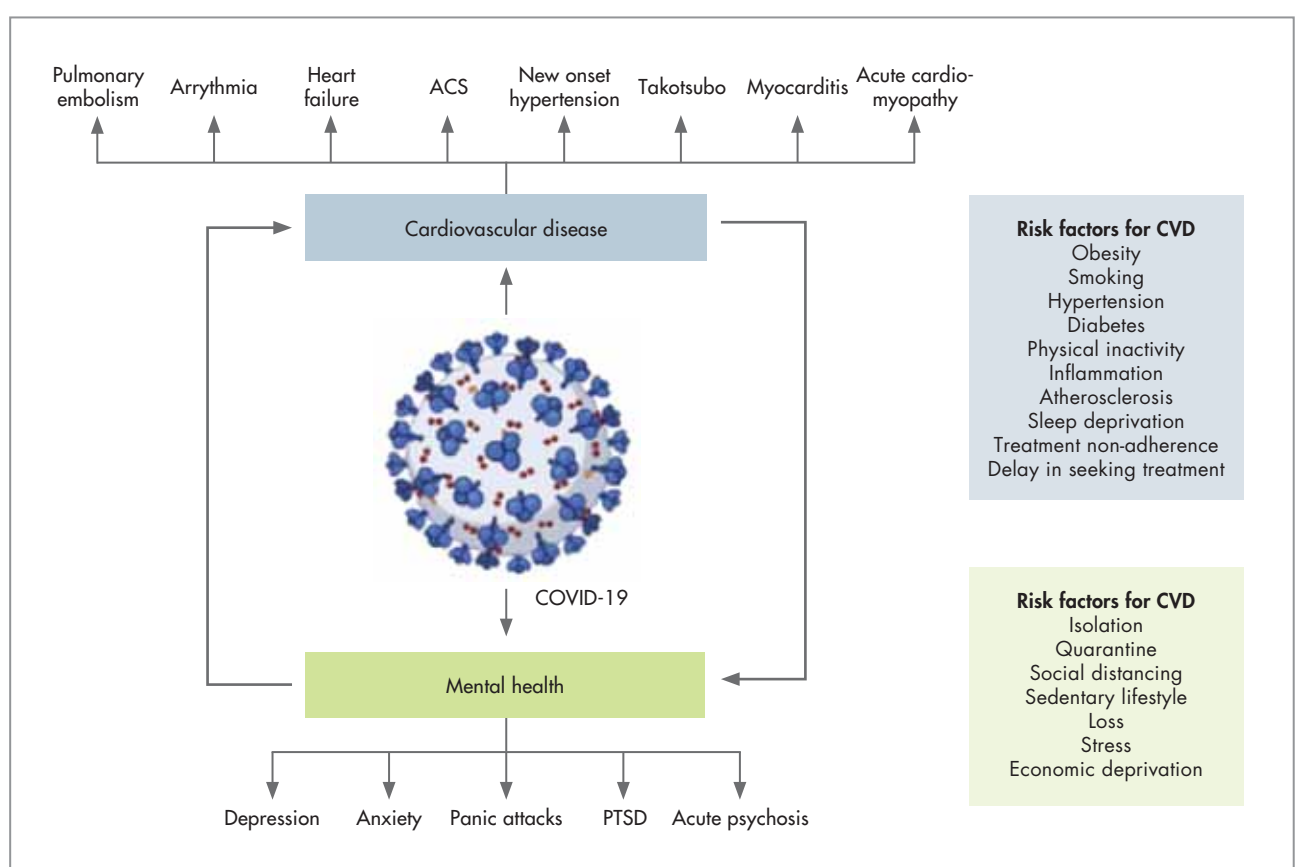

FIGURE 1: Interaction of COVID-19, psychological stress and cardiovascular disease.

ACS = acute coronary syndrome, CVD = cardiovascular disease, PTSD = post-traumatic stress disorder.

unhealthy diet and weight gain, delay in seeking treatment, and non-adherence to cardiovascular medication (Figure 1).[3,10]

Anxiety disorders and CVD

Anxiety disorders are associated with an elevated risk of a range of cardiovascular events. In a meta-analysis of 46 studies, anxiety was associated with a 41% higher risk of cardiovascular mortality and CAD, a 71% higher risk of stroke, and a 35% higher risk of heart failure.[11] More recently, 130 000 patients with acute stress-related psychiatric disorders were compared to sibling and population controls: stress related disorders (e.g. post-traumatic stress disorder – PTSD) were found to be robustly and independently associated with multiple phenotypes of CVD, particularly in the first year after the psychiatric diagnosis.[2] In sibling-based comparisons, the hazard ratio (HR) for any CVD was 1.64, and with notable HRs of 6.95, 5.00 and 3.37 for heart failure, conduction disorders and cardiac arrest, respectively, during the first year after the diagnosis of a stress-related disorder.[2] In the absence of underlying CAD, acute psychological stress is recognised as a likely precipitant of Takotsubo, with elevated levels of circulating catecholamines in response to acute stressors playing a key role in the underlying pathophysiology.[12]

Social isolation and CVD

Social isolation has obvious undesirable psychological consequences.[13] In addition, social isolation is associated with elevated blood pressure, accelerated atherosclerosis and CAD, and increased cardiovascular and all-cause mortality.[14,15] Similarly, animal models have demonstrated that isolated mice develop more atherosclerosis than those housed in groups.[16] Molecular mechanisms have not been fully elucidated, but may involve the hypothalamic-pituitary-adrenocortical (HPA) axis and sympathetic nervous system activation, glucocorticoid resistance, enhanced myelopoiesis, upregulated proinflammatory gene expression, and oxidative stress.[16] Influence of social isolation on cardiovascular mortality is comparable to well-established cardiovascular risk factors with the odds being similar to moderate smoking (15 cigarettes/day) and alcohol consumption (6 drinks/day), and exceeding the risks conferred by physical inactivity and obesity.[17] A meta-analysis reported that loneliness and social isolation were associated with a 29% increased risk of incident CAD and a 32% increase in stroke risk.[18]

COVID-19 and mental health

Added to the fear of contracting the virus, there are significant changes to our daily lives as our movements are restricted in support of efforts to contain and slow the spread of the virus.

Faced with new realities of losses, working from home, temporary unemployment, home-schooling of children, and lack of physical contact with other family members, friends and colleagues, COVID-19 has great potential to cause mental illness.[19] There are multiple mechanisms through which COVID-19 impacts mental well-being (Figure 2).

Anxiety and depression are reported as the dominant emotional response to an outbreak. The need for adequate training of healthcare personnel and the optimal use of technological advances to deliver mental healthcare is paramount.[20,21] Two recent publications from Canada have discussed the mental health impact of COVID-19 from the viewpoint of health anxiety.[22,23] During an outbreak of infectious disease, particularly in the presence of extensive mainstream and social media coverage, health anxiety can become excessive. At an individual level, this can manifest as maladaptive behaviour such as repeated medical consultation, an increase in compensatory strategies or avoiding healthcare when genuinely ill. People with underlying mental illness have been reported to be experiencing greater psychological distress during the COVID-19 pandemic.[24] The COVID-19 pandemic has alarming implications for individual and collective health, as well as for emotional and social functioning. In addition to providing medical care, already stretched healthcare providers have an

FIGURE 2: Impact of COVID-19 on mental health.
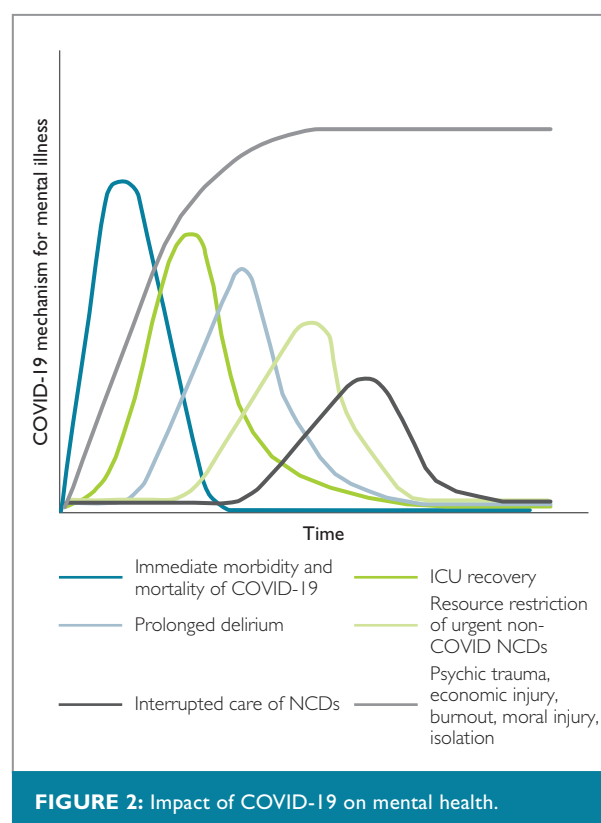
important role in monitoring psychosocial needs and delivering psychosocial support to their patients, peers, and the public – activities that should be integrated into general pandemic healthcare.[25]

Education and training regarding psychosocial issues should be provided to health system leaders, first responders, and all healthcare professionals. The mental health and emergency management communities should work together to identify, develop, and disseminate evidence-based resources related to disaster mental health, mental health triage and referral, needs of special populations, and death notification and bereavement care. Risk-communication efforts should anticipate the complexities of emerging issues such as prevention directives and evidence-based interventions relevant to pandemics, and should address a range of psychosocial concerns.[26,27] The importance of providing accurate information to the general public to minimise maladaptive responses such as ''panic'' and paranoia regarding the disease and its transmission cannot be overstated.[28]

COVID-19 IN AFRICA
South Africa is well established as the regional epicentre of the COVID-19 outbreak in Africa. Being a cosmopolitan ''rainbow'' nation has meant that frequent international travel of South Africans as well as influx of tourists during our summer resulted in the early import of COVID-19 ahead of the rest of the continent. Formidable challenges abound in African low- and middle-income countries, which are a melting pot of socio-economic determinants of health, including overcrowding, poor housing infrastructure, suboptimal hygiene, food insecurity, fragmented healthcare systems, limited access to healthcare due to restricted travel during lockdown, and the intersection of multiple infectious disease epidemics including tuberculosis, HIV and malaria in the context of rising non-communicable disease prevalence. However, despite these concerns, mortality rates from COVID-19 in Africa have been dramatically lower compared to North America, Europe, India and Brazil.[5]

VULNERABILITY OF HEALTHCARE WORKERS DURING COVID-19
While most segments of society were forced to slow activity during the COVID-19 surge, health services bore the brunt of the burden of responsibility to care for many new and existing patients with non-COVID-19 presentations and overwhelming and ever-increasing numbers of COVID-19 patients. The vulnerability of healthcare workers pertained not only to the increased risk of contracting SARS-COV-2, but also to the

increased and sustained psychological stress of having to care for large numbers of acutely and critically unwell patients, and many deaths. A tremendous responsibility of care fell on the shoulders of frontline health facilities and staff, who demonstrated fortitude despite their own medical and psychosocial vulnerabilities. Beyond the psychological stresses of increased workload, and burnout, many healthcare workers also had to contend with frequent disruptions to work life from rapid reconfiguration of clinical spaces and teams, and being redeployed to areas outside their usual realm of practice/expertise. Furthermore, concerns about depleting personal protective equipment while working with an infectious disease with no specific treatment was a constant source of stress. Many worried not only about themselves, but also about transmitting infection to family, friends and colleagues.

Adverse psychological reactions among healthcare workers have been reported during previous outbreaks of SARS, MERS and Ebola.[29] In a cross-sectional study of 1 257 healthcare workers in 34 Chinese hospitals treating COVID-19, a considerable proportion of participants reported symptoms of depression (50.4%), anxiety (44.6%), insomnia (34.0%), and distress (71.5%).[30] In this study, female healthcare workers, nurses and those based in Wuhan and working directly with COVID-19 patients were at highest risk of mental illness. In addition, a high prevalence of psychological symptoms was also observed in New York City healthcare workers during the COVID-19 peak, including symptoms of acute stress (57%), depression (48%) and anxiety (33%).[31] A recent meta-analysis summarised recommendations to address psychological problems in healthcare workers during novel outbreaks.[29] Health administrators, together with multidisciplinary mental health teams, need to incorporate programmes within their facilities to address mood and anxiety symptoms and issues related to burnout amongst hospital staff, who are a particularly vulnerable population at the frontline of infectious outbreaks.

CONCLUSION
The wide scope and spread of COVID-19 could lead to a true mental health crisis, especially in countries with high caseloads, which would require both large-scale psychosocial crisis interventions, and the incorporation of mental healthcare in disaster management plans in the future. Anxiety and depression, as the dominant emotional responses to the outbreak, warrant adequate training of personnel and the optimal use of technological advances to deliver acute mental healthcare. Widespread implementation of social distancing, isolation and quarantine policies in an attempt to quell the spread of the COVID-19 pandemic may result in increases in morbidity and mortality in non-communicable diseases, such as mental illness

and CVD. Healthcare services should be proactive in rolling out preventive and therapeutic strategies on a large scale to mitigate the impact of lockdown measures on the mental health and general health of citizens and communities. The long-term psychological impact of COVID-19 may take weeks or months to become fully apparent, and managing this impact requires a concerted effort not just from psychiatrists but from the healthcare system at large. Furthermore, there is a need to develop mental health interventions which are time-limited, culturally sensitive, and which can be taught to healthcare workers and volunteers.

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REFERENCES

1. Bao Y, Sun Y, Meng S, et al. 2019-nCoV epidemic: Address mental health-care to empower society. Lancet 2020;395:e37-e38.

2. Song H, Fang F, Arnberg, et al. Stress related disorders and risk of cardiovascular disease: Population based, sibling controlled study. BMJ 2019;365:l1577.

3. Cohen BE, Edmondson D, Kronish IM. State of the art review: Depression, stress, anxiety and cardiovascular disease. Am J Hypertens 2015;28:1295-1302.

4. Nicholson A, Kuper H, Hemingway H. Depression as an aetiologic and prognostic factor in coronary artery disease: A meta-analysis of 6 362 events among 146 538 participants in 54 observational studies. Eur Heart J 2006;27:2763-2774.

5. Chakafana G, Mutithu D, Hoevelmann J, et al. Interplay of COVID-19 and cardiovascular diseases in Africa: An observational snapshot. Clin Res Cardiol 2020; Epub ahead of print (doi: 10.1007/s00392-020-01720-y)

6. Ntusi NAB. COVID-19 and cardiovascular disease. S Afr Heart J 2020; 17:10-13.

7. Pan A, Okereke OI, Sun KI, et al. Depression and incident stroke in women. Stroke 2011;42:2770-2775.

8. Lichtman JH, Froelicher ES, Blumenthal JA, et al. Depression as a risk factor for poor prognosis among patients with acute coronary syndrome: Systematic review and recommendations. A scientific statement from the American Heart Association. Circulation 2014;129:1350-1369.

9. Kim Y, Lee YS, Kim MG, et al. The effect of selective serotonin reuptake inhibitors on major adverse cardiovascular events: A meta-analysis of randomised-controlled studies in depression. Int Clin Psychopharmacol 2019;34:9-17.

10. Kronish IM, Rieckmann N, Halm EA, et al. Persistent depression affects adherence to secondary prevention behaviors after acute coronary syndromes. J Gen Intern Med 2006;21:1178-1183.

11. Emdin CA, Odutayo A, Wong CX, et al. Meta-analysis of anxiety as a risk factor for cardiovascular disease. Am J Cardiol 2016;118:511-519.

12. Templin C, Ghardri JR, Diekmann J, et al. Clinical features and outcomes of Takotsubo (stress) cardiomyopathy. N Engl J Med 2015;373:929-938.

13. Brooks SK, Webster RK, Smith LE, et al. The psychological impact of quarantine and how to reduce it: Rapid review of evidence. Lancet 2020;395:912-920.

14. Knox SS, Uvnas-Moberg K. Social isolation and cardiovascular disease: An atherosclerotic pathway. Psychoneuroendocrinol 1998;23:977-890.

15. Williams RB, Barefoot JC, Califf RM, et al. Prognostic importance of social and economic resources among medically treated patients with angiographically documented coronary artery disease. JAMA 1992;267:520-524.

16. Xia N, Li H. Loneliness, social isolation and cardiovascular health. Antioxid Redox Signal 2018;28:837-851.

17. Holt-Lunstad J, Smith TB. Loneliness and social isolation as risk factors for CVD: Implications for evidence-based patient care and scientific enquiry. Heart 2016;102:987-989.

18. Valtora NK, Kanaan M, Gilbody S, et al. Loneliness and social isolation as risk factors for coronary artery disease and stroke: Systematic review and meta-analysis of longitudinal observational studies. Heart 2016;102:1009-1016.

19. Dong L, Bouey J. Public mental health crisis during COVID-19 pandemic, China. Emerg Infect Dis 2020;26:1616-1618.

20. Lima CKT, Carvalho PMM, Lima IAAS, et al. The emotional impact of coronavirus 2019-nCoV (new coronavirus disease). Psychiatry Res 2020; 287:112915.

21. Lei L, Huang X, Zhang S, et al. Comparison of prevalence and associated factors of anxiety and depression among people affected by versus people unaffected by quarantine during the COVID-19 epidemic in Southwestern China. Med Sci Monit 2020;26:e924609.

22. Rajkumar RP. COVID-19 and mental health: A review of the existing literature. Asian J Psych 2020;102066.

23. Asmundson GJG, Taylor S. Coronaphobia: Fear and the 2019-nVoV outbreak. J Anxiety Disord 2020;70:102196.

24. Asmundson GJG, Taylor S. How health anxiety influences responses to viral outbreaks like COVID-19: What all decision-makers, health authorities, and health care professionals need to know. J Anxiety Disord 2020;71:102211.

25. Barber S, Reed L, Syam N, et al. Severe mental illness and risks from COVID-19. Retrieved on September 3, 2020: https://www.cebm.net/covid-19/severe-mental-illness-and-risks-from-covid-19/.

26. Pfefferbaum B, North CS. Mental health and the COVID-19 pandemic. N Engl J Med 2020;383:510-512.

27. Pfefferbaum B, Schonfeld D, Flynn BW, et al. The H1N1 crisis: A case study of the integration of mental and behavioural health in public health crises. Disaster Med Public Health Prep 2012;6:67-71.

28. Ho CS, Chee CY, Ho RC. Mental health strategies to combat the psychological impact of COVID-19 beyond paranoia and panic. Ann Acad Med Singapore 2020;49:1-3.

29. Kisely S, Warren N, McMohan L, et al. Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: Rapid review and meta-analysis. BMJ 2020;369:m1642.

30. Lai J, Ma S, Wang Y. Factors associated with mental health outcomes among health care workers exposed to Coronavirus Disease 2019. JAMA Netw Open 2020;3(3):e203976.

31. Shechter A, Diaz F, Moise N, et al. Psychological distress, coping behaviours, and preferences for support among New York healthcare workers during the COVID-19 pandemic. Gen Hosp Psychiatry 2020;66:1-8.