



Views & Comments

Non-Communicable Diseases During the COVID-19 Pandemic and Beyond



Xiong-Fei Pan^{a,b,c}, Juan Yang^d, Ying Wen^e, Naishi Li^f, Simiao Chen^{g,h}, An Pan^a

^a Department of Epidemiology and Biostatistics, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology, Wuhan 430030, China

^b Division of Epidemiology, Department of Medicine, Vanderbilt University Medical Center, Nashville, TN 37203, USA

^c The George Institute for Global Health, University of New South Wales, Sydney, NSW 2042, Australia

^d Ministry of Education Key Laboratory of Public Health Safety, School of Public Health, Fudan University, Shanghai 200032, China

^e Department of Communicable Diseases Control and Prevention, Shenzhen Center for Disease Control and Prevention, Shenzhen 518055, China

^f National Health Commission Key Laboratory of Endocrinology, Department of Endocrinology, Peking Union Medical College Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100730, China

^g Heidelberg Institute of Global Health, Heidelberg Medical School, Heidelberg University, Heidelberg 69120, Germany

^h Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100730, China

1. Introduction

The coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has swept the globe as a pandemic [1]. As of 1 April 2021, there were about 129.5 million confirmed cases of COVID-19, and 2.8 million deaths attributable to COVID-19 [2]. While some countries have suppressed COVID-19, most governments worldwide are still mobilizing available resources to contain the spread of SARS-CoV-2 in communities, facilitate COVID-19 treatments in hospitals, expand COVID-19 vaccination, and accelerate drug and vaccine development [3].

COVID-19 and non-communicable diseases (NCDs) are closely interconnected. Underlying chronic conditions such as cardiovascular disease (CVD) and diabetes are predictors for severe illness and death from COVID-19 [4,5]. Accumulating evidence shows that certain types of acute damage to multiple organs in patients with COVID-19 may persist after hospital discharge [6]. In addition, containment and mitigation measures for COVID-19, such as home containment, social distancing, and travel restrictions, make it difficult for patients to access routine diagnosis and treatment services for NCDs. Such diseases can have lasting and even fatal consequences if acute services cannot be provided in a timely manner, such as dialysis for diabetic kidney disease, surgical procedures for coronary heart disease, and chemotherapy for acute myeloid leukemia. Although the current global focus is on combating the acute health threat of COVID-19, the ramifications of the pandemic in relation to the global burden of NCDs still need to be systematically assessed.

2. Link between COVID-19 and NCDs

Through the causative agent SARS-CoV-2, COVID-19 spreads quickly in a community and overwhelms the healthcare system if

left uncontrolled. COVID-19 differs from major NCDs in that it has a clear cause, rapid transmission, and a lack of effective treatments. However, as the pandemic is prolonged, researchers are gaining a deepened understanding of the multifaceted link between COVID-19 and NCDs (Table 1). First, pathophysiological pathways and mechanisms in disease development and progression are shared between COVID-19 and NCDs. Although all populations are generally vulnerable to SARS-CoV-2 infection, individuals with preexisting chronic conditions such as cancer, CVD, diabetes, and chronic obstructive pulmonary disease are more likely to have severe symptoms and fatal outcomes from COVID-19, as demonstrated by evidence from multiple populations [7]. Preexisting conditions may contribute to adverse outcomes of COVID-19 through mechanisms such as chronic inflammation and elevated expression of SARS-CoV-2 receptor (i.e., angiotensin-converting enzyme-2) in certain organs [8]. Furthermore, direct damage by SARS-CoV-2 to major organs (e.g., cardiac injury, arrhythmia, septic shock, acute kidney injury, and multi-organ failure [9]) may worsen preexisting conditions. In addition, there have been concerns over potential interactions between medications for NCDs such as angiotensin-converting enzyme inhibitors and COVID-19 progression [5]. COVID-19 can also leave patients with sustained negative health effects even after recovery. Some of the acute damage from COVID-19 can progress into long-lasting chronic conditions, such as respiratory function decline and cardiomyopathy [6]. Long-term follow-ups are thus essential in order to observe chronic conditions among COVID-19 survivors.

Second, COVID-19 infections and major NCDs are linked by common risk factors such as advanced age, male sex, certain ethnicities or races, obesity, smoking, and poverty [7,10,11]. On the one hand, these conventional risk factors for NCDs impose barriers against effective measures to prevent COVID-19, such as the use of personal protective equipment, social distancing, and personal hygiene [12]; on the other hand, some of these risk factors, such

Table 1
Connections between COVID-19 and NCDs and lessons from COVID-19 for NCDs.

Connections between COVID-19 and NCDs	Lessons from COVID-19 for NCDs
<ul style="list-style-type: none"> • Major NCDs increase likelihood of severe or fatal outcomes of COVID-19 • COVID-19 induces conditions that are likely to become NCDs • NCDs and COVID-19 share common risk factors that reinforce adverse health effects • NCDs and COVID-19 are driven by common upstream determinants and compete for resources 	<ul style="list-style-type: none"> • Like COVID-19, NCDs exert immense consequences but chronically • The approach for NCDs should target overarching systemic forces and environmental drivers such as socioeconomic inequity and inaccessible health system • Efforts for NCDs need to incorporate multi-pronged preventive and treatment measures • In addition to evidence-based practices, the precautionary principle should be proactively followed in certain scenarios for NCDs to minimize future adverse consequences • Health for all requests a vision for planetary health instead of a restrictive perspective of NCDs and/or infectious diseases

as advanced age, male sex, and obesity, lead to adverse outcomes in individuals with COVID-19 [7,10,13]. Containment and mitigation measures for COVID-19, including home containment, social distancing, and travel restrictions, can contribute to unhealthy lifestyles and risk behaviors such as a low-quality diet, smoking, excessive alcohol drinking, and physical inactivity [14], which predispose individuals to the risk and development of NCDs [15]. Such impacts can be particularly relevant since COVID-19 is unlikely to disappear and strict preventive measures will not be lifted in the short run.

Third, COVID-19 and NCDs are both influenced by major upstream determinants that range from policies and governance, health systems, economic development, social equity, education, and food security, to environmental changes. NCDs have long been framed as the products of these systemic forces that shape individual-level risk factors, and the upstream determinants have been conventionally regarded as the ultimate targets in addressing the global burden of NCDs [16]. Similar narratives have been proposed for COVID-19 [17,18]; there has also been a call for an integrated whole-system approach that recognizes the syndemic of COVID-19 and NCDs [19]. The continuing COVID-19 pandemic will reinforce the influence of these systemic determinants on NCDs. To date, COVID-19 has substantially disrupted health systems, induced economic recession, constrained societal integration, and even caused political instability in some countries, all of which tend to weaken current and future NCD efforts. In a World Health Organization (WHO) rapid assessment survey, 75% of countries reported disruptions to NCD services, and the magnitude of the disruptions corresponded to the transmission phases of the pandemic in different countries [20]. The competing resource mobilization for COVID-19 puts a strain on political will and financing for sustainable actions for NCDs, which particularly threatens the condition of NCDs in low-resource settings. Setbacks in social and economic developments, such as social instability, unemployment, and food insecurity, may even reverse prior progress that has been made against NCDs.

3. Lessons learnt from COVID-19 for NCDs thus far

The ongoing global efforts to combat COVID-19 form one of the largest and most comprehensive public health movements in human history. There are contrasting COVID-19 situations in

different countries and regions: 19 countries or regions have achieved the suppression of COVID-19, while 11 countries are still experiencing high levels of transmission, including high-income countries such as the United States [3]. In addition, a few European countries and the United States are facing a potential new wave of COVID-19 [2]. As well as providing references for work in other infectious diseases, some of these experiences are good lessons for addressing the chronic pandemic of NCDs worldwide, which continues to constitute a dominant burden of disease [21].

First of all, governments around the world should recognize that NCDs are imposing enduring and profound adverse health and non-health effects (Table 1). Although such effects are less imminent, the magnitude of the effects of NCDs far outweighs that of the COVID-19 pandemic, since NCDs account for three quarters of global deaths. Like COVID-19, NCDs cause disruptions to society and the economy; their effects can stretch beyond the health system to the labor market, social equity, and community stability [22]. In the COVID-19 pandemic era and beyond, the prevention and control of NCDs still need to be strengthened in national policies and governance. A sole focus on infectious diseases will divert due attention from the larger picture of the global burden of diseases.

Second, NCDs cannot be addressed without an approach that targets upstream systemic forces and environmental drivers. While most countries are still overwhelmed by COVID-19, the countries that have done well in handling the pandemic have mostly shown strong political will, wide social mobilization, and integrated collective actions that target both the whole population and high-risk groups. These countries are addressing some of the upstream determinants of the spread of COVID-19 through measures such as community support for lockdowns and social containment, national and local infection surveillance and reminder systems, concerted multi-sectoral activities for rapid detection and contact tracing, quick installation of temporary shelter hospitals and communal isolation facilities, and free timely treatments for COVID-19 in the health system [23–25]. In contrast, sources of failure can range from political inertia, social inequality, disinformation, and distrust of experts, to a lack of preparedness [3]. Given the similar political, social, and economic implications of NCDs, some of the measures aiming at wider determinants of health in the context of COVID-19 are transferable to the arena of NCDs, and should be highly regarded as future guidance for activities targeting NCDs.

Third, effective and cost-effective preventive measures should continue to be prioritized in addition to treatments for NCDs. Like the control of COVID-19, the control of NCDs requires tiered, multi-pronged strategies that encompass both effective prevention and treatments. Preventive measures deserve particular attention, although they are often ignored due to the requirement for long duration and their less obvious immediate effects. One of the legacies of early-stage COVID-19 care in China is the tiered-care strategy that includes home containment or communal isolation for high-risk individuals or suspected cases, temporary shelter hospitals for mild or moderate cases, and designated formal hospitals for more severe cases. Such a tiered arrangement improves the efficiency of care and minimizes the risk of overburdening the whole health system, which resonates to some extent with the current tiered healthcare delivery system in China [26]. In addition, COVID-19 cannot be controlled solely with clinical treatment; its suppression in countries such as China so far has been generally achieved by population-wide conventional interventions such as lockdowns, traffic restrictions, social distancing, and mask wearing [27,28]. The experience of the COVID-19 pandemic once again brings into the spotlight conventional population-based measures. Similarly, although some NCDs can be managed in clinical practice, the ultimate approach to control most NCDs will have to depend on reducing new cases through effective population-based

preventive measures. This reflection reinforces the WHO's recommendation to address the most modifiable lifestyle factors such as tobacco use, excessive alcohol, unhealthy diet, and physical inactivity for the prevention and control of NCDs [29].

Fourth, the precautionary principle deserves attention in certain scenarios for NCDs, despite the need for evidence-based practices. The quick suppression of COVID-19 in a few Asian countries reflects the merits of the precautionary principle in public health when facing uncertainties around the benefits and risks of interventions. Strict precautionary measures may prove to be particularly relevant for controlling infectious diseases in the earlier stages of transmission. This was demonstrated by the COVID-19 containment due to early and quick lockdowns, social distancing, and a wide use of face masks in some countries, despite the lack of initial evidence for their effectiveness [23,28]. While the countermeasures for COVID-19 are periodically updated as the evidence rapidly evolves, it is reasonable to suppose that applying the precautionary principle by responding proactively in an even earlier stage of the pandemic would have substantially reduced the number of infections and deaths [30]. The window of opportunity for NCDs is as important as that for COVID-19, especially in countries where NCD cases are rapidly increasing. Although evidence-based practices are the established standards, taking a precautionary approach before mature evidence is fully available may triumph over inertia or inaction in reducing NCDs in many scenarios. After all, policy making in NCDs involves the consideration of more than evidence, such as ethical issues, economic impact, and social stability.

Last but not least, actions to address NCDs should be contextualized within a vision for planetary health. The onset and development of the COVID-19 pandemic against the backdrop of global climate change and environmental degradation encourage us to broaden our view of health issues. Since NCDs can be regarded as socially transmitted conditions and since many infectious diseases become chronic with lingering health consequences, the dichotomies of infectious disease and NCDs need to be removed in order to reflect the common nature and roots of human health issues [31–33]. Emerging and reemerging infectious diseases constantly reenter and/or remain in the global disease landscape, due to increasing human-induced fluctuations within the ecosystems of humans, animals, pathogens, and the environment [34]. Clinical guidance and coping mechanisms must be routinely institutionalized in order to sustain quality clinical care for NCDs under such emergency scenarios, particularly those involving persistent epidemics or even pandemics. Similarly, NCDs can be conceived and interpreted within the same framework that incorporates the interactions of societies, civilizations, and ecosystems. The double burden of dominant NCDs and constant shocks of infectious diseases should drive us to rethink and safeguard the broader planetary health in order to attain sustainable human development and prosperity [35].

4. The way forward

COVID-19 is one of the most challenging public health emergencies within the century. Although most countries are still in the midst of the crisis, we are optimistic that COVID-19 will be contained in the foreseeable future, as has already been achieved in some countries. However, success stories are rare for NCDs, and they will continue to pose major challenges to all countries. The intersection between COVID-19 and NCDs reminds us of the upstream determinants of health in our society. The legacies from the global COVID-19 fight should be borne in mind, and these lessons could be applied in national and international efforts to control NCDs. To achieve the sustainable development goal of

reducing premature deaths from NCDs by one third by 2030, the world needs to reflect and build on the current experiences and lessons gained from the global public health emergency, and act consistently to fight against NCDs.

Acknowledgements

This work was supported by the National Nature Science Foundation of China (81930124) for An Pan and the International Postdoctoral Exchange Fellowship Program of the China Postdoctoral Council (20180062) for Xiong-Fei Pan.

References

- [1] World Health Organization. Timeline: WHO's COVID-19 response [Internet]. Geneva: World Health Organization; 2021 [cited 2021 Apr 1]. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline>.
- [2] Johns Hopkins University and Medicine Coronavirus Resource Center. COVID-19 dashboard by the Center for Systems Science and Engineering at Johns Hopkins University 2021 [Internet]. Baltimore: Johns Hopkins University and Medicine Coronavirus Resource Center; [cited 2021 Apr 1]. Available from: <https://coronavirus.jhu.edu/map.html>.
- [3] Lancet COVID-19 Commissioners, Task Force Chairs, Commission Secretariat. Lancet COVID-19 Commission Statement on the occasion of the 75th session of the UN General Assembly. *Lancet* 2020;396(10257):1102–24.
- [4] Barron E, Bakhai C, Kar P, Weaver A, Bradley D, Ismail H, et al. Associations of type 1 and type 2 diabetes with COVID-19-related mortality in England: a whole-population study. *Lancet Diabetes Endocrinol* 2020;8(10):813–22.
- [5] Nishiga M, Wang DW, Han Y, Lewis DB, Wu JC. COVID-19 and cardiovascular disease: from basic mechanisms to clinical perspectives. *Nat Rev Cardiol* 2020;17(9):543–58.
- [6] Marshall M. The lasting misery of coronavirus long-haulers. *Nature* 2020;585(7825):339–41.
- [7] US National Center for Immunization and Respiratory Diseases. Evidence used to update the list of underlying medical conditions that increase a person's risk of severe illness from COVID-19 [Internet]. Bethesda: US National Center for Immunization and Respiratory Diseases; 2021 [cited 2021 Apr 1]. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/evidence-table.html>.
- [8] Alyammahi SK, Abdin SM, Alhamad DW, Elgendy SM, Altelt AT, Omar HA. The dynamic association between COVID-19 and chronic disorders: an updated insight into prevalence, mechanisms and therapeutic modalities. *Infect Genet Evol* 2021;87:104647.
- [9] Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 2020;395(10229):1054–62.
- [10] Williamson EJ, Walker AJ, Bhaskaran K, Bacon S, Bates C, Morton CE, et al. Factors associated with COVID-19-related death using OpenSAFELY. *Nature* 2020;584(7821):430–6.
- [11] Belanger MJ, Hill MA, Angelidi AM, Dalamaga M, Sowers JR, Mantzoros CS. Mantzoros COVID-19 and disparities in nutrition and obesity. *N Engl J Med* 2020;383(11):e69.
- [12] Chu DK, Akl EA, Duda S, Solo K, Yaacoub S, Schünemann HJ, et al. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. *Lancet* 2020;395(10242):1973–87.
- [13] O'Driscoll M, Ribeiro Dos Santos G, Wang L, Cummings DAT, Azman AS, Paireau J, et al. Age-specific mortality and immunity patterns of SARS-CoV-2. *Nature* 2021;590(7844):140–5.
- [14] Mattioli AV, Ballerini Puviani M, Nasi M, Farinetti A. COVID-19 pandemic: the effects of quarantine on cardiovascular risk. *Eur J Clin Nutr* 2020;74(6):852–5.
- [15] Kluge HHP, Wickramasinghe K, Ripplin HL, Mendes R, Peters DH, Kontsevaya A, et al. Prevention and control of non-communicable diseases in the COVID-19 response. *Lancet* 2020;395(10238):1678–80.
- [16] Marmot M, Bell R. Social determinants and non-communicable diseases: time for integrated action. *BMJ* 2019;364:l251.
- [17] Gray DM, Anyane-Yeboah A, Balzora S, Issaka RB, May FP. COVID-19 and the other pandemic: populations made vulnerable by systemic inequity. *Nat Rev Gastroenterol Hepatol* 2020;17(9):520–2.
- [18] Abrams EM, Szefer SJ. COVID-19 and the impact of social determinants of health. *Lancet Respir Med* 2020;8(7):659–61.
- [19] Horton R. Offline: COVID-19 is not a pandemic. *Lancet* 2020;396(10255):874.
- [20] World Health Organization. The impact of the COVID-19 pandemic on noncommunicable disease resources and services: results of a rapid assessment [Internet]. Geneva: World Health Organization; 2020 [cited 2021 Apr 1]. Available from: <https://www.who.int/pub>.
- [21] University of Washington Institute for Health Metrics and Evaluation. Global health data exchange [Internet]. Seattle: University of Washington Institute for Health Metrics and Evaluation; 2021 [cited 2021 Apr 1]. Available from: <http://ghdx.healthdata.org/gbd-results-tool>.

- [22] Nugent R, Bertram MY, Jan S, Niessen LW, Sassi F, Jamison DT, et al. Investing in non-communicable disease prevention and management to advance the Sustainable Development Goals. *Lancet* 2018;391(10134):2029–35.
- [23] Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19): summary of a report of 72314 cases from the Chinese Center for Disease Control and Prevention. *JAMA* 2020;323(13):1239–42.
- [24] You J. Lessons from South Korea's COVID-19 policy response. *Am Rev Public Adm* 2020;50(6–7):801–8.
- [25] Chen S, Zhang Z, Yang J, Wang J, Zhai X, Bärnighausen T, et al. Fangcang shelter hospitals: a novel concept for responding to public health emergencies. *Lancet* 2020;395(10232):1305–14.
- [26] Meng Q, Mills A, Wang L, Han Q. What can we learn from China's health system reform? *BMJ* 2019;365:12349.
- [27] Pan A, Liu L, Wang C, Guo H, Hao X, Wang Q, et al. Association of public health interventions with the epidemiology of the COVID-19. *JAMA* 2020;323(19):1915–23.
- [28] Jiang T, Wang H, Gao GF, Jiang X. Wearing face masks—the simple and effective way to block the infection source of COVID-19. *China CDC Weekly* 2020;2(16):268–9.
- [29] World Health Organization. Tackling NCDs: 'best buys' and other recommended interventions for the prevention and control of noncommunicable diseases [Internet]. Geneva: World Health Organization; 2017 [cited 2021 Apr 1]. Available from: <https://apps.who.int/iris/handle/10665/259232>.
- [30] Chen S, Jin Z, Bloom DE. Act early to prevent infections and save lives: causal impact of diagnostic efficiency on the COVID-19 pandemic [Internet]. Bonn: IZA—Institute of Labor Economics; 2020 [cited 2021 Apr 1]. Available from: <https://www.iza.org/publications/dp/13749/act-early-to-prevent-infections-and-save-lives-causal-impact-of-diagnostic-efficiency-on-the-covid-19-pandemic>.
- [31] Remais JV, Zeng G, Li G, Tian L, Engalgau MM. Convergence of non-communicable and infectious diseases in low- and middle-income countries. *Int J Epidemiol* 2013;42(1):221–7.
- [32] Allen LN, Feigl AB. Reframing non-communicable diseases as socially transmitted conditions. *Lancet Glob Health* 2017;5(7):e644–6.
- [33] Sheldon TA, Wright J. Twin epidemics of COVID-19 and non-communicable disease. *BMJ* 2020;369:m2618.
- [34] Morens DM, Fauci AS. Emerging pandemic diseases: how we got to COVID-19. *Cell* 2020;182(5):1077–92.
- [35] Whitmee S, Haines A, Beyrer C, Boltz F, Capon AG, de Souza Dias BF, et al. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation—Lancet Commission on planetary health. *Lancet* 2015;386(10007):1973–2028.