Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Living with COVID-19 and preparing for future pandemics: revisiting lessons from the HIV pandemic

*Judith D Auerbach, Andrew D Forsyth, Calum Davey, James R Hargreaves, the Group for lessons from pandemic HIV prevention for the COVID-19 response**

Lancet HIV 2023; 10: e62–68

Published Online November 9, 2022 https://doi.org/10.1016/S2352-3018(22)00301-0

*See appendix for a full list of Group members and coauthors

School of Medicine, University of California San Francisco, San Francisco, CA, USA (Prof J D Auerbach PhD); **Berkeley, CA, USA** (A D Forsyth PhD); **Department of Epidemiology and Population Health** (C Davey PhD) **and Department of Epidemiology and Evaluation** (Prof J R Hargreaves PhD), **London School of Hygiene & Tropical Medicine, London, UK**

Correspondence to: Dr Calum Davey, Department of Epidemiology and Population Health, London School of Hygiene & Tropical Medicine, London WC1H 9SH, UK **calum.davey@lshtm.ac.uk**

See Online for appendix

In April, 2020, just months into the COVID-19 pandemic, an international group of public health researchers published three lessons learned from the HIV pandemic for the response to COVID-19, which were to: anticipate health inequalities, create an enabling environment to support behavioural change, and engage a multidisciplinary effort. We revisit these lessons in light of more than 2 years' experience with the COVID-19 pandemic. With specific examples, we detail how inequalities have played out within and between countries, highlight factors that support or impede the creation of enabling environments, and note ongoing issues with the scarcity of integrated science and health system approaches. We argue that to better apply lessons learned as the COVID-19 pandemic matures and other infectious disease outbreaks emerge, it will be imperative to create dialogue among polarised perspectives, identify shared priorities, and draw on multidisciplinary evidence.

Introduction

In April, 2020, just months into the COVID-19 pandemic, an international group of public health researchers published three lessons learned from the HIV pandemic for the response to COVID-19, which were to: anticipate health inequalities, create an enabling environment to support behavioural change, and engage a multidisciplinary effort.[1] As the COVID-19 pandemic continues into a third year, we consider how these lessons resonate with what has happened, draw new lessons from HIV for the ongoing response, and consider what can be learned to help the world prepare for emerging and future pandemics.

The context has changed radically since the original piece was published.[1] In April, 2020, there was little access to SARS-CoV-2 testing and limited experience of treating COVID-19. No vaccines or drugs specifically for COVID-19 had been developed. The disease appeared to threaten all countries. Information about the viral, environmental, and immunological factors driving infections was insufficient to accurately inform the deployment of non-pharmaceutical interventions.[2] There were many unknowns about asymptomatic infections, aerosol transmission, predictors of severe illness, test sensitivity and specificity, and the emergence of viral variants.[3]

2 years later, there are antibody and antigen tests (including rapid tests that can be administered at home), highly effective mRNA and viral vector vaccines that prevent severe disease (and, to some extent, transmission),[4] and effective therapies that reduce symptoms and prevent deaths. This situation is in great contrast to the long trajectory of the development of effective HIV diagnostics, medications, and prevention technologies; however, these biomedical advances for SARS-CoV-2 have not halted the pandemic. By May, 2022, there had been more than 6 million deaths globally, with excess mortality estimated to be 2–4 times higher than this.[5,6] The virus has mutated, with the alpha (B.1.1.7), beta (B.1.351), delta (B.1.617.2), and omicron (B.1.1.529) variants and subvariants associated with successive waves of the pandemic. A recent *Lancet* Commission underscored the needless tragedy resulting from a global response best defined as cautious, uncoordinated, inequitable, and underfunded.[7] It is in this context that we revisit our three lessons from the HIV pandemic.

Lesson 1: anticipate health inequalities

In 2020, we advised that the global response to COVID-19 should anticipate and reduce the unequal burden of infection, severity of disease, and death rate borne by vulnerable groups, including people living in low-income and middle-income countries (LMICs). LMICs accounted for 85% of the estimated 15 million excess deaths between January, 2020 and December, 2021.[6] The true extent of these disparities is unknown, as variability in the speed and completeness of mortality data introduced stark differences in reported and estimated deaths within WHO regions, as evidenced in Asia (eg, China, India, and Pakistan), Africa (eg, Egypt, Nigeria, and South Africa), and the Americas (eg, Brazil, Colombia, and Mexico).[6]

Our concern about inequalities was based on the experience from HIV that pandemics expose societal fault lines. Social and economic disadvantages work synergistically with pre-existing chronic conditions to magnify health inequalities within and between countries.[8] In the case of HIV, the interplay between the virus and social determinants of health has long been understood to elevate rates of comorbid conditions and worsen health outcomes for disempowered groups and marginalised communities.[9] Further, interventions and policies introduced to respond to pandemics can inadvertently increase health inequalities, as people who are better able to access new technologies (eg, vaccines, tests, and drugs) or to adopt new behaviours (eg, working from home, physical distancing, and self-isolating following exposure) benefit more than individuals who are less able to make such changes.[10] For example, early in the spread of SARS-CoV-2, inequalities in Zambia emerged as wealthy individuals weathered the pandemic by staying at home

with their families and shopping in lower-density venues, whereas less privileged individuals were crowded into higher-density neighbourhoods and markets.[11]

The COVID-19 pandemic has led to disproportionate rates of infection, hospitalisation, and death in marginalised racial and ethnic groups, people with disabilities, socioeconomically disadvantaged communities, and people with higher clinical risk factors that increase COVID-19 severity and associated mortality.[12–14] For example, in the USA, inequalities in morbidity and mortality have been attributed in part to socioeconomic status, race, and ethnicity. Between May and November, 2020, excess deaths among people living in California, USA, aged 18–65 years were 31–39% higher for low wage, transportation, and agricultural workers than for non-essential workers. The highest excess mortality of all racial or ethnic groups in California were Black (28%) and Latinx (37%) individuals, due to their over-representation in employment conditions that require close proximity to others.[15]

In addition to direct health effects of infection, when countries restricted economic and social activity in response to the COVID-19 pandemic, the effects fell hardest on individuals who were worse off at the start of the pandemic. A World Bank study on the unequal impact of the COVID-19 pandemic on income, employment, and food security (as defined by national income levels and select sociodemographic variables) found that social and economic restrictions in 59 countries produced larger and more durable losses of income and employment and greater food insecurity in low-income countries than other countries, and these effects were most pronounced for women, young people, and those with lower education levels.[16] Further, a review of empirical studies on the effect of school closures showed that although learning loss was less severe than predicted, the pandemic increased learning inequality and curtailed the educational trajectories in older students.[17] Greater learning loss and higher dropout rates were observed in rural communities versus urban communities and among students with lower socioeconomic status versus higher socioeconomic status—particularly for adolescent girls and young women. Adolescent girls and young women also experienced worsened sexual and reproductive health outcomes, and there is an expected increase in child marriages in the coming years.[18–20]

COVID-19 inequalities between nations did not take long to manifest. One of the starkest examples was the competition among high-income countries (HICs) to secure safe and effective COVID-19 vaccines to protect their populations through bilateral purchase agreements with manufacturers that monopolised vaccines and supplies, causing delays in vaccine acquisition and roll-out for many LMICs.[21] A similar scenario is playing out with the announcement of a new WHO vaccine-sharing mechanism that will distribute scarce monkeypox vaccines to countries that can afford them, rather than to African nations that have endured outbreaks for decades.[22] With COVID-19, some LMICs were forced to deploy lower-cost and lower-efficacy COVID-19 vaccines, incurring inflated health-care costs and adverse social and economic outcomes attributable to prolonged efforts to curb transmission.[23] Many countries in Africa paused or scaled back their vaccination programmes due to concerns in Europe and North America about the effectiveness or safety of the lower-cost Oxford–AstraZeneca vaccine, which aggravated vaccination hesitancy and mistrust and disrupted other vaccination and essential health services.[24]

Inequities in access to the tools to fight COVID-19 facilitate the emergence of new viral variants capable of evading both vaccine-induced and naturally acquired host immunity.[25] Although the COVID-19 Vaccine Global Access facility was intended to ensure equitable access to vaccines through coordinated financing and procurement mechanisms,[26] HICs undermined international co-operation that could have kept prices affordable, shared intellectual property, globalised manufacturing capacity, and accelerated a return to pre-pandemic life.[27] At the time of writing, many LMICs have not acquired a single vaccine dose per person, implicating supply challenges.[28] The intersecting COVID-19 and HIV pandemics in southern Africa, home to the world's largest number of immunocompromised people, show the risks of inequitable access to health-preserving, life-extending diagnostics, treatments, vaccines, and essential health services.[29]

Lesson 2: create an enabling environment

Experience with HIV led us to anticipate the importance of addressing the social structures that constrain or enable health-related behaviours. Informed by a social ecological model,[30] we suggested in 2020 that, for clear public health messaging to be effective in the control of COVD-19, there would need to be strong political leadership, meaningful community engagement, and avoidance of stigmatisation and marginalisation.

There are some examples of good practice at the beginning of the pandemic, such as in Zimbabwe. Before the pandemic, Zimbabwe faced economic and climate shocks (including a severe drought and cyclone) that produced a recession in 2019, which took a substantial toll on the health system and exacerbated the pandemic. When COVID-19 emerged, the Zimbabwe Government unveiled a robust stimulus package to improve health systems, address the constraints faced by small-scale industries, and reduce poverty and hardship in vulnerable groups. Resources for the procurement of COVID-19 vaccines were obtained from governmental and private sector contributions.[31] A Cabinet Inter-Ministerial Task Force and a Chief Coordinator in the Office of the President and Cabinet were also put in place for a combined government and society response, coordination, and oversight.[32]

However, some political leaders in other countries engaged in withholding information, denialism, and misinformation about COVID-19,[33] which affected initial pandemic response, vaccination uptake, infections, and deaths.[34] In China, officials at the local level were held responsible for having delayed releasing information about the emergence and spread of SARS-CoV-2 in the early days of the outbreak.[35] In the USA and Brazil—two of the hardest-hit countries early in the pandemic—President Trump and President Bolsonaro downplayed, neglected, and actively denied the virus and the illness it caused.[36,37] Trump mocked physical distancing, pushed conspiracy theories, and promoted therapies for COVID-19 that were unproven and considered dangerous.[38] As a result, he became the single largest driver of COVID-19 misinformation by early 2020.[39] In Tanzania, the denialism promoted by President Magufuli, including his declaration that Tanzania was COVID-19 free, delayed the implementation of prevention measures and access to vaccines.[40] Globally, research has shown that right-wing political ideology and level of national identity were strongly related to resistance to established public health measures.[41]

At the community level, there are numerous examples of engagement that led to improved uptake of COVID-19 information and services, including among some of the most vulnerable populations. For example, a coordinated, community-centred partnership among organisations providing health care to homeless people in northwest London, UK, resulted in more than 70% of people experiencing homelessness being offered their first COVID-19 vaccine, and almost 1500 people being vaccinated by mid-March of 2021.[42]

Engaging communities in the control of COVID-19 has been influenced in many contexts by misinformation, which in turn has proven to be one of the most important dynamics of the COVID-19 pandemic.[43] Greater understanding of the mechanisms and effect of misinformation—including the role of social media—in different settings is essential for mitigating future pandemics.[44,45] So-called infodemics have been a global occurrence, driven by social structures. Survey research among English-speaking respondents in southern Africa found moderate levels of agreement with several common false statements related to COVID-19 (eg, drinking hot water flushes out the virus and COVID-19 has little effect on Black people compared with White people). Agreement with false statements was associated with being older, being a woman, having less education, being unemployed, and residing in east Africa.[46] An analysis of rural areas in a number of African countries, where a proactive approach to combat COVID-19 was taken by governments and public health officials, found that misinformation and an absence of accurate health information were fuelled by such factors as poor living conditions, poor health literacy, the influence of culture and religion, and political instability.[47]

Misinformation was not the only impediment to universal understanding of the risks of COVID-19 and to taking preventive action. The COVID-19 pandemic has also been marked by high levels of uncertainty, challenging health promotion efforts.[48] Ever-changing public health recommendations and policies—based on a constantly evolving pandemic—appeared to cause confusion and anxiety (exacerbated by social media) and enabled mistrust of government, scientists, and public health officials to flourish.[49] Misinformation and mistrust also contributed to heterogeneity in vaccine uptake across countries. For example, vaccine hesitancy and low uptake in Zambia was affected by myths and misinformation about COVID-19 and related vaccines, fear of adverse side-effects, and concern about vaccine efficacy.[50] In Uganda, beliefs that the non-pharmacological measures were a part of President Museveni's election campaign strategy led to refusals to comply.[51] In France, resistance to the requirement to hold a COVID-19 health pass was connected to concerns about curtailed civil liberties and conspiracy theories.

The risk of COVID-19-related stigma was also recognised early in the pandemic. Racism and discrimination directed towards people from east Asia emerged quickly.[52] The term "China virus" propagated through social media and catalysed acts of racism.[53] Early in the pandemic, people in sub-Saharan Africa blamed race and wealth for bringing the virus to Africa.[54] Additionally, COVID-19 revealed ageism linked to the more severe effects among older individuals.[55] Meanwhile, the removal of blanket restrictions in many countries signified a transfer of responsibility for pandemic control from the state to the individual, with the potential to catalyse fear, blame, and judgement within and between populations.[56] Similar concerns about stigma are being raised as monkeypox emerges as a potential pandemic, with initial cases primarily identified in gay men and other men who have sex with men.[57] We have learned from these experiences the importance of communicating risk to particularly vulnerable populations and to the overall population without further stigmatising specific—often already marginalised—groups.

Lesson 3: a multidisciplinary approach is essential

In early 2020, we noted that an important lesson from the decades-long HIV pandemic was the need for a multidisciplinary and integrated approach to fight COVID-19, addressing the complex interactions between viral pathogen, human behaviour, emerging protective tools and technologies, and social context. We argued that a multidisciplinary response would address an inherent challenge for epidemiological modelling in predicting infectious disease dynamics dependent on human interactions and behaviours that evolve over time.[58] We noted that national policies should be guided by a theory of change for population-level coverage of safe practices,

integrate understanding from a range of disciplines, and incorporate monitoring and evaluation of implementation strategies seeking to affect behaviour at the population level. The case we made for an integrated scientific response to the COVID-19 pandemic was based on an understanding of the myriad factors influencing the spread of infection.[59] Specifically, we anticipated that limited access to safe and effective vaccines, quality diagnostic testing, and efficacious treatments early in the pandemic would place a premium on uptake and adherence to non-pharmaceutical interventions, as recommended by public health authorities in LMICs and beyond. Input from behavioural and social scientists with expertise in these areas, along with perspectives from community members representing the eventual beneficiaries of prevention and care services, would complement input from biomedical scientists focused on vaccine and therapeutic development.

However, in practice, many national COVID-19 scientific advisory councils were comprised of people with biomedical competencies essential to understanding a novel respiratory virus—eg, virology, immunology, pulmonology, epidemiology, or mathematical modelling—who were expected to provide guidance on topics in which they had little expertise. For example, Italy's Comitato Tecnico Scientifico tasked its biomedical experts with providing guidance related to child psychology, education, and neuropsychiatry.[60] Belgium's Group of Experts on Exit Strategy included experts in biomedicine and economics, but nobody to address the task of anticipating the social and behavioural implications of exiting from national lockdowns.[61] In the USA, the Biden administration's transitional COVID-19 Response Team included biomedical, public health, and health policy expertise but did not include other scientific perspectives pertinent to managing infectious disease outbreaks (such as risk communication; decision making in the face of uncertainty, misinformation, and disinformation campaigns; and adherence to public health guidelines).[62] Even in France[63] and the UK[64] (both of whom consulted experts in anthropology, sociology, information technology, behavioural science, and education), governmental advisory committees relied disproportionately on biomedical and allied sciences perspectives that marginalised or ignored views from other disciplines.[65]

We also highlighted the need to strengthen health systems, particularly in LMIC settings, and devise tailored, context-specific responses to COVID-19.[66] For example, deploying ventilators within a health-care system unable to house or maintain the equipment, or in a setting with erratic electricity supply, was not an appropriate strategy. Additionally, we cautioned against taking a vertical response to COVID-19—one of the failings of the response to HIV—to avoid undoing gains made in HIV, tuberculosis, and malaria.[67] However, this strategy did not occur. Focus and funding was pivoted to the COVID-19 effort, resulting in reductions in people accessing tuberculosis treatment and declines in global spending on diagnostic, treatment, and prevention services in 2020.[68] Once again, opportunities were missed to build more robust integrated services across multiple sectors crucial to addressing the long-term consequences—including other infectious diseases, mental health conditions, chronic conditions, and non-communicable diseases—exacerbated by the COVID-19 pandemic.

Discussion: emerging lessons for living with COVID-19 and pandemic preparedness

Our 2020 Comment[1] was perhaps the first but not the last to consider lessons from the HIV pandemic for the COVID-19 response. Since our Comment was published, several other commentaries (including *The Lancet*'s[7]) have offered a range of perspectives, many of which overlap with ours in regards to: looking out for the most vulnerable groups and taking a harm reduction approach, exerting scientific and political leadership, ensuring community engagement, and mitigating stigma.[69–73] A number of authors also focused on the need for an intersectoral and multidisciplinary approach, many specifically highlighting insights from HIV-related behavioural and social research.[74,75]

We recognise that our analogy with HIV is useful to a point. We never could have imagined the magnitude of the epochal global changes resulting from the COVID-19 pandemic, the speed and scale of which were unprecedented. COVID-19 has played out more quickly than HIV. It is unclear if we are near the beginning or approaching the end of this pandemic. A much higher proportion of the world's population has been exposed to SARS-CoV-2 and probably has some immunity, either through natural infection, vaccination, or both. Yet, the pandemic to date has shown that we must be cautious. Viral mutations leading to greater transmissibility, vaccine escape, and perhaps worse clinical outcomes remain a clear and present threat. Our predictions 2 years ago, although not perfect, resonate and lead us to ask: what lessons might we now seek to draw from our perspective for the next phase of this pandemic, and to inform a growing policy interest in pandemic preparedness?

Our initial lessons remain relevant for the next phase, with adaptation. The focus on inequalities is perhaps more relevant now than ever, given the importance of efficacious technologies and tools in the pandemic response. Like HIV, the early phase of the COVID-19 pandemic was driven by mobile populations, often from higher socioeconomic groups in HICs. It is in the longer, later phases of a pandemic that socioeconomic disadvantages come into play most heavily, driven in part by differential access to new technologies, tools, and non-pharmaceutical interventions among individuals, groups, and countries. To mitigate these disadvantages and broader inequalities, it is essential for LMICs to take

the lead in crafting and implementing pandemic responses in their settings through strengthened indigenous infrastructure and governance entities, such as Africa Centres for Disease Control and Prevention and the African Union.

Fostering an enabling environment for health promoting and health-seeking behaviours remains relevant to the later stage of the pandemic, particularly as fatigue with mitigation strategies and the funding thereof sets in. There have been long-standing concerns about donor fatigue in investing in the HIV response that might spill over to COVID-19. The global public health response community will have to face these concerns as new pandemics emerge and further push public patience and public (and private) funds.

Our third lesson is particularly resonant for ongoing pandemic preparedness efforts, which need to be more multidisciplinary and integrative. The Coalition for Epidemic Preparedness Innovations (CEPI) is perhaps the highest profile global initiative, with a mission to accelerate the development of vaccines and other biological countermeasures against epidemic and pandemic threats, so they can be accessible to all people in need. CEPI's focus is on proof of concept and safety testing of new vaccines, accelerating manufacturing and development, and improving country responses, with an emphasis on regulatory science. The UK Government launched a pandemic preparedness group in 2021 in support of CEPI, and will probably revise its pandemic preparedness plans following the public inquiry planned for 2022–23. The UK's current pandemic preparedness policy paper—last updated in November, 2020, and based on planning for an influenza pandemic—emphasises surveillance, modelling, infection prevention and control practices, stockpiling and authorising antivirals, advance purchase agreements for vaccines, vaccination, and surge planning. These approaches reflect the dominant view that rapid technological innovation represents the greatest hope for avoiding or limiting the effect of another global pandemic. Although these efforts are necessary, they are insufficient. All the modelling and the stockpiling of drugs, vaccines, and other technologies will be of little use in countries where health systems are weak and individuals are unable to follow public health guidance because of their socioeconomic circumstances. Moreover, we have learned time and time again with HIV that no single technology or approach will change the course of a pandemic; however, combination, integrated approaches might.

Finally, to better apply lessons learned as the COVID-19 pandemic matures, it will be imperative to bring currently polarised perspectives together in national (and global) discussions involving structured considerations of priorities and trade-offs and using multi-disciplinary evidence from all stakeholder groups. Without such dialogue, we are destined to repeat mistakes and be ill-prepared to respond effectively to the next pandemic that is sure to come along.

Contributors

All authors contributed to the conceptualisation and outline of the manuscript. JDA and ADF wrote the initial draft of the manuscript. CD and JRH contributed to the initial draft. All authors reviewed and edited the initial draft and reviewed the final draft.

Declaration of interests

We declare no competing interests.

Acknowledgments

The Group dedicates this Viewpoint to the memory of James Gita Hakim, a beloved colleague and member of the Group, who died of complications from COVID-19 on Jan 25, 2021.

References

1 Hargreaves J, Davey C, the Group for lessons from pandemic HIV prevention for the COVID-19 response. Three lessons for the COVID-19 response from pandemic HIV. *Lancet HIV* 2020; **7:** e309–11.
2 Kissler SM, Tedijanto C, Goldstein E, Grad YH, Lipsitch M. Projecting the transmission dynamics of SARS-CoV-2 through the postpandemic period. *Science* 2020; **368:** 860–68.
3 Fang FC, Benson CA, Del Rio C, et al. COVID-19—lessons learned and questions remaining. *Clin Infect Dis* 2021; **72:** 2225–40.
4 Wilder-Smith A. What is the vaccine effect on reducing transmission in the context of the SARS-CoV-2 delta variant? *Lancet Infect Dis* 2022; **22:** 152–53.
5 The Economist. The pandemic's true death toll. 2022. https://www.economist.com/graphic-detail/coronavirus-excess-deaths-estimates (accessed May 23, 2022).
6 WHO. 14·9 million excess deaths associated with the COVID-19 pandemic in 2020 and 2021. 2022. https://www.who.int/news/item/05-05-2022-14.9-million-excess-deaths-were-associated-with-the-covid-19-pandemic-in-2020-and-2021 (accessed May 5, 2022).
7 Sachs JD, Karim SSA, Aknin L, et al. The *Lancet* Commission on lessons for the future from the COVID-19 pandemic. *Lancet* 2022; **400:** 1224–80.
8 Marmot M, Allen J. COVID-19: exposing and amplifying inequalities. *J Epidemiol Community Health* 2020; **74:** 681–82.
9 Gayle HD, Hill GL. Global impact of human immunodeficiency virus and AIDS. *Clin Microbiol Rev* 2001; **14:** 327–35.
10 Victora CG, Vaughan JP, Barros FC, Silva AC, Tomasi E. Explaining trends in inequities: evidence from Brazilian child health studies. *Lancet* 2000; **356:** 1093–98.
11 Saasa S, James S. COVID-19 in Zambia: implications for family, social, economic, and psychological well-being. *J Comp Fam Stud* 2020; **51:** 347–59.
12 Mesas AE, Cavero-Redondo I, Álvarez-Bueno C, et al. Predictors of in-hospital COVID-19 mortality: a comprehensive systematic review and meta-analysis exploring differences by age, sex and health conditions. *PLoS One* 2020; **15:** e0241742.
13 Shakespeare T, Ndagire F, Seketi QE. Triple jeopardy: disabled people and the COVID-19 pandemic. *Lancet* 2021; **397:** 1331–33.
14 Williamson EJ, McDonald HI, Bhaskaran K, et al. Risks of COVID-19 hospital admission and death for people with learning disability: population based cohort study using the OpenSAFELY platform. *BMJ* 2021; **374:** n1592.
15 Chen Y-H, Glymour M, Riley A, et al. Excess mortality associated with the COVID-19 pandemic among Californians 18-65 years of age, by occupational sector and occupation: March through November 2020. *PLoS One* 2021; **16:** e0252454.
16 Agrawal S, Cojocaru A, Montalva V, Narayan A, Bundervoet T, Ten A. COVID-19 and inequality: how unequal was the recovery from the initial shock? Washington, DC: World Bank, 2021.
17 Moscoviz L, Evans DK. Learning loss and student dropouts during the COVID-19 pandemic: a review of the evidence two years after schools shut down. 2022. https://www.cgdev.org/publication/learning-loss-and-student-dropouts-during-covid-19-pandemic-review-evidence-two-years (accessed June 16, 2022).
18 Kons K, Biney AA, Sznajder K. Factors associated with adolescent pregnancy in sub-Saharan Africa during the COVID-19 pandemic: a review of socioeconomic influences and essential interventions. *Int J Sex Health* 2022; **34:** 386–96.

19 Yukich J, Worges M, Gage AJ, et al. Projecting the impact of the COVID-19 pandemic on child marriage. *J Adolesc Health* 2021; **69:** S23–30.

20 Zulaika G, Bulbarelli M, Nyothach E, et al. Impact of COVID-19 lockdowns on adolescent pregnancy and school dropout among secondary schoolgirls in Kenya. *BMJ Glob Health* 2022; **7:** e007666.

21 Clark A, Jit M, Warren-Gash C, et al. Global, regional, and national estimates of the population at increased risk of severe COVID-19 due to underlying health conditions in 2020: a modelling study. *Lancet Glob Health* 2020; **8:** e1003–17.

22 Cheng M. WHO plans to share monkeypox vaccines amid inequity fears. 2022. https://apnews.com/article/covid-health-pandemics-united-nations-world-organization-a4848839d86d2d08-100000d918b6bd0d (accessed June 16, 2022).

23 Vashi AP, Coiado OC. The future of COVID-19: a vaccine review. *J Infect Public Health* 2021; **14:** 1461–65.

24 WHO. Risks and challenges in Africa's COVID-19 vaccine rollout. 2021. https://www.afro.who.int/news/risks-and-challenges-africas-covid-19-vaccine-rollout#:~:text=Slow%20rollout&text=Factors%20leading%20to%20delays%20include,are%20holding%20back%20the%20rollout (accessed Nov 9, 2021).

25 Ye Y, Zhang Q, Wei X, Cao Z, Yuan H-Y, Zeng DD. Equitable access to COVID-19 vaccines makes a life-saving difference to all countries. *Nat Hum Behav* 2022; **6:** 207–16.

26 Global Alliance for Vaccines and Immunizations. COVID-19 Vaccine Global Access (COVAX) facility. Preliminary technical design discussion document. 2020. https://www.keionline.org/wp-content/uploads/COVAX-Facility-Preliminary-technical-design-061120-vF.pdf (accessed Nov 9, 2020).

27 McAdams D, McDade KK, Ogbuoji O, Johnson M, Dixit S, Yamey G. Incentivising wealthy nations to participate in the COVID-19 Vaccine Global Access Facility (COVAX): a game theory perspective. *BMJ Glob Health* 2020; **5:** e003627.

28 WHO. WHO coronavirus (COVID-19) dashboard with vaccination data. 2022. https://covid19.who.int/ (accessed March 14, 2022).

29 Corey L, Corbett-Detig R, Beyrer C. Expanding efforts and support to respond to the HIV and COVID-19 intersecting pandemics. *JAMA* 2022; **327:** 1227–28.

30 DiClemente RJ, Salazar LF, Crosby RA. A review of STD/HIV preventive interventions for adolescents: sustaining effects using an ecological approach. *J Pediatr Psychol* 2007; **32:** 888–906.

31 KPMG. Zimbabwe: government and institution measures in response to COVID-19. 2020. https://home.kpmg/xx/en/home/insights/2020/04/zimbabwe-government-and-institution-measures-in-response-to-covid.html (accessed July 18, 2022).

32 Maulani N, Nyadera IN, Wandekha B. The generals and the war against COVID-19: the case of Zimbabwe. *J Glob Health* 2020; **10:** 020388.

33 Vinopal C. What we've learned about leadership from the COVID-19 pandemic. 2021. https://www.pbs.org/newshour/world/what-weve-learned-about-leadership-from-the-covid-19-pandemic#:~:text=-But%20it's%20clear%20that%20when,matter%20between%20life%20and%20death.%E2%80%9D (accessed April 6, 2021).

34 Albrecht D. Vaccination, politics and COVID-19 impacts. *BMC Public Health* 2022; **22:** 96.

35 Hou Z, Du F, Zhou X, et al. Cross-country comparison of public awareness, rumors, and behavioral responses to the COVID-19 epidemic: infodemiology study. *J Med Internet Res* 2020; **22:** e21143.

36 Friedman U. The coronavirus-denial movement now has a leader. 2020. https://www.theatlantic.com/politics/archive/2020/03/bolsonaro-coronavirus-denial-brazil-trump/608926/ (accessed Nov 9, 2020).

37 Hamblin J. Trump's pathology is now clear. 2020. https://www.theatlantic.com/health/archive/2020/10/trump-covid-denial/616946/ (accessed Nov 9, 2020).

38 Facher L. Fact-checking Trump's claims about hydroxychloroquine, the antimalarial drug he's touting as a coronavirus treatment. 2020. https://www.statnews.com/2020/04/06/trump-hydroxychloroquine-fact-check/ (accessed Nov 9, 2020).

39 Evanega S, Lynas M, Adams J, Smolenyak K. Coronavirus misinformation: quantifying sources and themes in the COVID-19 'infodemic'. *JMIR Preprints* 2020; published online Oct 19. https://doi.org/10.2196/preprints.25143 (preprint).

40 Carlitz R, Yamanis T, Mollel H. Coping with denialism: how street-level bureaucrats adapted and responded to COVID-19 in Tanzania. *J Health Polit Policy Law* 2021; **46:** 989–1017.

41 Agarwal R, Dugas M, Ramaprasad J, Luo J, Li G, Gao GG. Socioeconomic privilege and political ideology are associated with racial disparity in COVID-19 vaccination. *Proc Natl Acad Sci USA* 2021; **118:** e2107873118.

42 Queen's Nursing Institute. North west London homeless health partnership and groundswell rolling out of COVID-19 vaccine. 2022. https://qni.org.uk/resources/north-west-london-homeless-health-partnership-and-groundswell-rolling-out-of-covid-19-vaccine/ (accessed Sept 19, 2022).

43 PBS Newshour. Dr. Collins reflects on career at NIH, COVID response effort, work on genome sequencing. 2021. https://www.pbs.org/newshour/show/dr-collins-reflects-on-career-at-nih-covid-response-effort-work-on-genome-sequencing (accessed March 14, 2022).

44 Barua Z, Barua S, Aktar S, Kabir N, Li M. Effects of misinformation on COVID-19 individual responses and recommendations for resilience of disastrous consequences of misinformation. *Prog Disaster Sci* 2020; **8:** 100119.

45 Nsoesie EO, Cesare N, Müller M, Ozonoff A. COVID-19 misinformation spread in eight countries: exponential growth modeling study. *J Med Internet Res* 2020; **22:** e24425.

46 Osuagwu UL, Miner CA, Bhattarai D, et al. Misinformation about COVID-19 in sub-Saharan Africa: evidence from a cross-sectional survey. *Health Secur* 2021; **19:** 44–56.

47 Okereke M, Ukor NA, Ngaruiya LM, et al. COVID-19 misinformation and infodemic in rural Africa. *Am J Trop Med Hyg* 2020; **104:** 453–56.

48 MacGregor H. Novelty and uncertainty: social science contributions to a response to COVID-19. 2020. http://somatosphere.net/forumpost/novelty-and-uncertainty/ (accessed Sept 19, 2022).

49 Burgess RA, Kanu N, Matthews T, et al. Exploring experiences and impact of the COVID-19 pandemic on young racially minoritised people in the United Kingdom: a qualitative study. *PLoS One* 2022; **17:** e0266504.

50 Mudenda S, Chileshe M, Mukosha M, et al. Zambia's response to the COVID-19 pandemic: exploring lessons, challenges and implications for future policies and strategies. *Pharmacol Pharm* 2022; **13:** 11–33.

51 Nshakira-Rukundo E, Whitehead A. Changing perceptions about COVID-19 risk and adherence to preventive strategies in Uganda: evidence from an online mixed-methods survey. *Sci Afr* 2021; **14:** e01049.

52 Nature. Stop the coronavirus stigma now. *Nature* 2020; **580:** 165.

53 Budhwani H, Sun R. Referencing the novel coronavirus as the "Chinese virus" or "China virus" on Twitter: COVID-19 stigma. *J Med Internet Res* 2020; **2:** e19301.

54 Schmidt T, Cloete A, Davids A, Makola L, Zondi N, Jantjies M. Myths, misconceptions, othering and stigmatizing responses to COVID-19 in South Africa: a rapid qualitative assessment. *PLoS One* 2020; **15:** e0244420.

55 Fraser S, Lagacé M, Bongué B, et al. Ageism and COVID-19: what does our society's response say about us? *Age Ageing* 2020; **49:** 692–95.

56 Hargreaves JR, Logie CH. Lifting lockdown policies: a critical moment for COVID-19 stigma. *Glob Public Health* 2020; **15:** 1917–23.

57 Daskalakis D, McClung RP, Mena L, Mermin J, Centers for Disease Control and Prevention's Monkeypox Response Team. Monkeypox: avoiding the mistakes of past infectious disease epidemics. *Ann Intern Med* 2022; **175:** 1177–78.

58 Verelst F, Willem L, Beutels P. Behavioural change models for infectious disease transmission: a systematic review (2010–2015). *J R Soc Interface* 2016; **13:** 20160820.

59 Richards P. Ebola and COVID-19 in Sierra Leone: comparative lessons of epidemics for society. *J Glob Hist* 2020; **15:** 493–507.

60 Pistoi S. Examining the role of the Italian COVID-19 scientific committee. 2021. https://www.nature.com/articles/d43978-021-00015-8 (accessed March 14, 2022).

61 Zaki BL, Wayenberg E. Shopping in the scientific marketplace: COVID-19 through a policy learning lens. *Policy Des Pract* 2021; **4:** 15–32.

62 Lohse S, Canali S. Follow *the* science? On the marginal role of the social sciences in the COVID-19 pandemic. *Eur J Philos Sci* 2021; **11:** 99.

63 Atlani-Duault L, Chauvin F, Yazdanpanah Y, et al. France's COVID-19 response: balancing conflicting public health traditions. *Lancet* 2020; **396:** 219–21.

64 UK Government. List of participants of SAGE and related subgroups. 2022. https://www.gov.uk/government/publications/scientific-advisory-group-for-emergencies-sage-coronavirus-covid-19-response-membership/list-of-participants-of-sage-and-related-sub-groups (accessed March 14, 2022).

65 Colman E, Wanat M, Goossens H, Tonkin-Crine S, Anthierens S. Following the science? Views from scientists on government advisory boards during the COVID-19 pandemic: a qualitative interview study in five European countries. *BMJ Glob Health* 2021; **6:** e006928.

66 Assefa Y, Gilks CF, Reid S, van de Pas R, Gete DG, Van Damme W. Analysis of the COVID-19 pandemic: lessons towards a more effective response to public health emergencies. *Global Health* 2022; **18:** 10.

67 Chanda-Kapata P, Ntoumi F, Kapata N, et al. Tuberculosis, HIV/AIDS and malaria health services in sub-Saharan Africa—a situation analysis of the disruptions and impact of the COVID-19 pandemic. *Int J Infect Dis* 2022; published online March 25. https://doi.org/10.1016/j.ijid.2022.03.033.

68 Chakaya J, Khan M, Ntoumi F, et al. Global Tuberculosis Report 2020—reflections on the global TB burden, treatment and prevention efforts. *Int J Infect Dis* 2021; **113** (suppl 1)**:** S7–12.

69 Al Saidi AMO, Nur FA, Al-Mandhari AS, El Rabbat M, Hafeez A, Abubakar A. Decisive leadership is a necessity in the COVID-19 response. *Lancet* 2020; **396:** 295–98.

70 Celum C, Barnabas R, Cohen MS, et al. Covid-19, Ebola, and HIV—leveraging lessons to maximize impact. *N Engl J Med* 2020; **383:** e106.

71 El-Sadr WM. What one pandemic can teach us in facing another. *AIDS* 2020; **34:** 1757–59.

72 Kutscher E, Greene RE. A harm-reduction approach to coronavirus disease 2019 (COVID-19)—safer socializing. *JAMA Health Forum* 2020; **1:** e200656.

73 Somse P, Eba PM. Lessons from HIV to guide COVID-19 responses in the Central African Republic. *Health Hum Rights* 2020; **22:** 371–74.

74 Haberer JE, van der Straten A, Safren SA, et al. Individual health behaviours to combat the COVID-19 pandemic: lessons from HIV socio-behavioural science. *J Int AIDS Soc* 2021; **24:** e25771.

75 Logie CH. Lessons learned from HIV can inform our approach to COVID-19 stigma. *J Int AIDS Soc* 2020; **23:** e25504.

THE LANCET
HIV

Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Auerbach JD, Forsyth AD, Davey C, et al. Living with COVID-19 and preparing for future pandemics: revisiting lessons from the HIV pandemic. *Lancet HIV* 2022; published online Nov 9. https://doi.org/10.1016/S2352-3018(22)00301-0.

Appendix: Full List of Group Members and Co-Authors

Prof. Judith D. Auerbach, PhD, School of Medicine, University of California San Francisco, San Francisco, CA, USA

Andrew D. Forsyth, PhD, Independent Consultant, Berkeley, CA, USA

Calum Davey, PhD, Department of Epidemiology and Population Health, London School of Hygiene & Tropical Medicine, London, UK

Prof. James R. Hargreaves, PhD, Department of Epidemiology and Evaluation, London School of Hygiene & Tropical Medicine, London, UK

Prof. James Blanchard, MD, Max Rady College of Medicine, University of Manitoba, Winnipeg, Canada

Prof. Virginia Bond, PhD, Department of Global Health and Development, London School of Hygiene & Tropical Medicine, London, UK; Zambart House, Lusaka, Zambia

Prof. Chris Bonell, PhD, Department of Public Health, Environments, and Society, London School of Hygiene & Tropical Medicine, London, UK

Rochelle A. Burgess, PhD, Institute for Global Health, University College London, London, UK

Prof. Tim Colbourn, PhD, Institute for Global Health, University College London, London, UK

Prof. Frances M. Cowan, MD, Liverpool School of Tropical Medicine, Liverpool, UK; Centre for Sexual Health and HIV/AIDS Research Zimbabwe, Harare, Zimbabwe

Aoife M. Doyle, PhD, Department of Infectious Disease Epidemiology, London School of Hygiene & Tropical Medicine, London, UK; The Health Research Unit Zimbabwe, Biomedical Research Training Institute, Harare, Zimbabwe

Prof. Mina Hosseinipour, MD, Department of Medicine, University of North Carolina Chapel Hill, NC, USA; UNC Project Tidziwe Centre, Lilongwe, Malawi

Lessa Lin, PhD, London School of Hygiene & Tropical Medicine, London, UK; Laboratory of Data Discovery for Health (D24H), Hong Kong, China

Agnes Mahomva, MBChB, Office of the President & Cabinet, Harare, Zimbabwe

Nyasha Masuk, MBChB, Independent Consultant, Harare, Zimbabwe

Webster Mavhu, PhD, Liverpool School of Tropical Medicine, Liverpool; Center for Sexual Health & HIV/AIDS Research, Harare, Zimbabwe

Owen Mugurungi, MD, AIDS & TB Programme, Ministry of Health & Child Care, Harare, Zimbabwe

Solomon Huruva Mukungunugwa, PhD, US Agency for International Development, Harare, Zimbabwe

Prof. Melissa Parker, DPhil, Department of Global Health and Development, London School of Hygiene & Tropical Medicine, London, UK

Prof. Lucy Platt, PhD, Centre for Research on Drugs and Health Behaviour, London School of Hygiene & Tropical Medicine, London, UK

Prof. Audrey Prost, PhD, Institute for Global Health, University College London, London, UK
Eugene Ruzagira, PhD, Medical Research College/Uganda Virus Research Institute, Entebbe; London School of Hygiene & Tropical Medicine, London, UK
Prof. Janet Seeley, PhD, Department of Global Health and Development, London School of Hygiene & Tropical Medicine, London, UK
Isaac Taramusi, MPH, National AIDS Council Zimbabwe, Harare, Zimbabwe
Raymond Yekeye, BA, National AIDS Council Zimbabwe, Harare, Zimbabwe