

Navigating inequities: a roadmap out of the pandemic

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To cite: Ismail SJ, Tunis MC, Zhao L, *et al.* Navigating inequities: a roadmap out of the pandemic. *BMJ Global Health* 2021;**6**:e004087. doi:10.1136/bmjgh-2020-004087

Handling editor Seye Abimbola

Received 30 September 2020
Revised 30 November 2020
Accepted 3 December 2020



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ABSTRACT

The COVID-19 pandemic has exposed social inequities that rival biological inequities in disease exposure and severity. Merely identifying some inequities without understanding all of them can lead to harmful misrepresentations and deepening disparities. Applying an ‘equity lens’ to bring inequities into focus without a vision to extinguish them is short-sighted. Interventions to address inequities should be as diverse as the pluralistic populations experiencing them. We present the first validated equity framework applied to COVID-19 that sheds light on the full spectrum of health inequities, navigates their sources and intersections, and directs ethically just interventions. The Equity Matrix also provides a comprehensive map to guide surveillance and research in order to unveil epidemiological uncertainties of novel diseases like COVID-19, recognising that inequities may exist where evidence is currently insufficient. Successfully applied to vaccines in recent years, this tool has resulted in the development of clear, timely and transparent guidance with positive stakeholder feedback on its comprehensiveness, relevance and appropriateness. Informed by evidence and experience from other vaccine-preventable diseases, this Equity Matrix could be valuable to countries across the social gradient to slow the spread of SARS-CoV-2 by abating the spread of inequities. In the race to SARS-CoV-2 vaccines, this urgently needed roadmap can effectively and efficiently steer global leadership towards equitable allocation with diverse strategies for diverse inequities. Such a roadmap has been absent from discussions on managing the COVID-19 pandemic, and is critical for our passage out of it.

Using a comprehensive, proven tool like the Equity Matrix proposed by Dr Shainoor Ismail and colleagues is critical to avoid exacerbating inequities with the inequitable allocation of SARS-CoV-2 vaccines. Without such a roadmap to illuminate the diverse spectrum and sources of inequities to direct ethically just interventions, our passage out of this pandemic will inevitably be slow and bumpy.

NAVIGATING INEQUITIES: A ROADMAP OUT OF THE PANDEMIC

The COVID-19 pandemic has necessitated physical gaps between individuals with distancing, and exposed unjust gaps of disparities between populations. Without a thoughtful roadmap for the equitable

Summary box

- ▶ The COVID-19 pandemic has magnified inequities and threatens to exacerbate them with the inequitable allocation of scarce resources like vaccines.
- ▶ Using a ‘single vision’ equity lens to consider some inequities some of the time without understanding their sources and intersectionality leads to policies and programmes that blindly deepen disparities and further stigmatise and discriminate.
- ▶ Diverse interventions that are inclusive and respectful of all populations will be paramount to stop transmission of this virus and inequities.
- ▶ We present the first validated equity tool applied to COVID-19 that provides evidence and guides research on the full spectrum of health inequities, analyses their sources and interactions, and directs diverse and ethically just interventions appropriate for pluralistic societies.
- ▶ This Equity Matrix fills a gap in discussions on managing the COVID-19 pandemic, and is urgently needed to steer global leadership away from deepening disparities and towards equitable programmes and policies.

allocation of vaccines, this pandemic will lead to the exacerbation of inequities between and within countries. Like SARS-CoV-2, the affliction of the ‘social gradient’—where those at lower socioeconomic positions have inferior levels of health—inflicts all countries regardless of level of wealth.¹ The SARS-CoV-2 virus is novel, but disparities are not. It is no longer sufficient to don a ‘single vision’ equity lens to examine some disparities, some of the time. A comprehensive investigation of all health inequities and the complex reasons for these inequities is urgently needed for the implementation of fair, restorative interventions. Here, we present the first validated, successfully used equity framework applied to COVID-19 (table 1). Unlike anything in the literature to date, this framework illuminates the spectrum of health inequities, navigates their sources and intersections, and helps avoid deepening disparities through ethically just policies. Such a roadmap is critical to steer global leadership towards the mitigation

Table 1 Equity matrix applied to COVID-19: identifying inequities, sources of inequities, and interventions to reduce inequities and improve access to vaccines

Factors that may contribute to health inequity	Why inequity may exist (differential access to healthcare, differential disease exposure/susceptibility/severity plus intersections with other factors*)	Examples of interventions to reduce inequity and improve access
Pre-existing condition (eg, chronic disease, immunocompromise, pregnancy, disability)	<ul style="list-style-type: none"> ▶ Differential disease severity has been shown to have large independent associations with chronic medical conditions (heart failure, diabetes, chronic kidney disease, dementia, liver disease) and obesity (body mass index, BMI≥40).¹⁰ ▶ Differential disease severity has been shown to have moderate independent associations with obesity (BMI>30), and haematological malignancy.¹⁰ ▶ No clear evidence of an independent association of differential disease severity in pregnancy currently exists¹⁰; however, the possibility has been suggested in some studies. ▶ People with disabilities may experience differential disease exposure due to challenges with infection prevention and control (IPC) measures† and residence in group home settings. <p><i>Multiple possible intersections such as: age, socioeconomic status (SES), place of residence, social capital, racialisation</i></p>	<ul style="list-style-type: none"> ▶ Include these populations in clinical trials to demonstrate efficacy and safety of interventions (following Research Ethics Board (REB) guidelines and First Nations Principles of Ownership, Control, Access and Possession (OCAP)⁴⁹ of data collection processes in their communities). ▶ Consider these populations as key groups for vaccination. ▶ Facilitate rides to immunisation clinics or home visits for those who are immobile to improve access to vaccine and testing for infection. ▶ Offer vaccination at healthcare visits for pre-existing conditions (eg, medical specialist appointments). ▶ Enable IPC measures† to reduce exposure.
Place of residence (eg, remote, overcrowding, homeless, institutionalisation)	<ul style="list-style-type: none"> ▶ Differential exposures in institutions exist with evidence of a high number of outbreaks in long-term care facilities (experiencing the majority of outbreaks), hospitals, prisons, shelters.⁵⁰ ▶ Outbreaks involving large numbers of reported cases have occurred in rural, and remote communities.⁵⁰ ▶ Differential disease severity has been shown to have large independent associations with homelessness.¹⁰ ▶ Homeless populations, and those living in shelters/group homes or in overcrowded neighbourhoods or homes (eg, migrant workers), as well as rural, remote and Indigenous communities have differential exposure and challenges with physical distancing and other IPC measures†, as well as potentially decreased access to healthcare. ▶ Indigenous communities have been disproportionately impacted in previous pandemics (eg, 2009 H1N1 influenza).⁴ <p><i>Multiple possible intersections such as: pre-existing condition, SES, education/literacy level, social capital, racialisation</i></p>	<ul style="list-style-type: none"> ▶ Include these populations in clinical trials of interventions (following REB guidelines and OCAP principles⁴⁹). ▶ Consider these populations as key groups for vaccination. ▶ Consider standing orders in institutions, and mobile clinics in hardly reached populations to improve access to immunisation. ▶ Enable IPC measures† to reduce exposure. ▶ Consider vaccinating all eligible individuals in remote areas facilitated by community members/leaders/advocates for efficient, effective use of resources. ▶ Support programmes and policies aimed to assist and empower systemically marginalised populations and improve access to healthcare.
Racialisation (including ethno-racial and ethno-cultural diversity, immigration or refugee status)	<ul style="list-style-type: none"> ▶ Differential disease severity has been shown to have large independent associations with some racialised populations.¹⁰ Evidence of higher rates of COVID-19 and differential disease severity in ethno-culturally diverse neighbourhoods exists.¹⁷⁻¹⁹ ▶ Racialised populations have differential access to healthcare, and may experience stigmatisation and discrimination. Lower vaccination rates have been observed in immigrant children and seniors for other vaccine-preventable diseases (VPDs).⁴¹ Visible minorities and Indigenous Canadians appear to be less willing than non-visible minorities to get an effective recommended SARS-CoV-2 vaccine.⁴² ▶ Immigrant/refugee populations or migrant workers may have differential exposure due to international travel. ▶ Racialised populations are disproportionately represented in precarious jobs and workplace settings such as in the food or healthcare sectors, and often reside in multigenerational living spaces, leading to differential exposure and transmission within communities. <p><i>Multiple possible intersections such as: SES, place of residence, occupation, pre-existing conditions, social capital, education/literacy level</i></p>	<ul style="list-style-type: none"> ▶ Include populations from diverse racial, ethnic and cultural backgrounds in clinical trials (following REB guidelines and OCAP principles⁴⁹). ▶ Address racialised barriers to accessing healthcare and support policies that target systemic racism and protect the rights of racialised groups. ▶ Improve access to testing and vaccination (eg, mobile clinics, publicly funded interventions) for racialised populations without further stigmatisation or discrimination, including those without health insurance (eg, migrant workers, asylum seekers). ▶ Engage trusted community leaders/partners/elders and liaise with relevant organisations (eg, immigration and refugee departments) in planning for immunisation programmes and communication materials. ▶ Provide culturally appropriate educational and communication materials in a variety of languages, media platforms and venues. ▶ Have translators and supports (eg, community members) available in clinics. ▶ Enable improved IPC measures† to reduce exposure.

Continued

Table 1 Continued

Factors that may contribute to health inequity	Why inequity may exist (differential access to healthcare, differential disease exposure/susceptibility/severity plus intersections with other factors*)	Examples of interventions to reduce inequity and improve access
Occupation	<ul style="list-style-type: none"> ▶ Healthcare workers/personnel have differential exposure and transmission to clients at high risk of severe illness. However, some in this group may have more access to and training in the use of PPE and other IPC measures†, so exposure risk could be significantly reduced compared with other groups.^{47 48} ▶ Essential services workers (eg, emergency workers, grocery/transit staff, meat/agriculture workers, teachers) and others who cannot work virtually as the economy reopens and have high social contact (with limited IPC measures†) have differential exposure. ▶ Outbreaks involving large numbers of reported cases have occurred in agricultural work settings, including those with congregate living for migrant workers.⁵⁰ ▶ Individuals who travel internationally for work may have differential exposure. <p><i>Multiple possible intersections such as: SES, racialisation, social capital</i></p>	<ul style="list-style-type: none"> ▶ Include these populations in clinical trials (following REB guidelines and OCAP principles⁴⁹). ▶ Consider these populations as key groups for vaccination. ▶ Offer alternate immunisation settings such as mobile, worksite, or after-hours immunisation clinics and testing. ▶ Enable improved IPC measures† to reduce exposure.
Gender identity/sex	<ul style="list-style-type: none"> ▶ Differential disease severity has been shown to have a large independent association with male sex,¹⁰ that may be linked to immunological sex differences or gendered differences in behaviours such as differential access to healthcare before progression of disease. ▶ Gendered differences in caregiver roles, gender-based violence and socioeconomic instability may result in differential direct and indirect impacts of the pandemic. <p><i>Multiple possible intersections such as: occupation, pre-existing conditions, SES, social capital, risk behaviours</i></p>	<ul style="list-style-type: none"> ▶ Consider gender/sex-inclusive vaccination policies. ▶ Address gendered barriers to accessing healthcare and vaccination programmes (eg, through social influencers). ▶ Support sex and gender-based analyses. ▶ Support programmes and policies aimed to assist and empower systemically marginalised populations and improve access to healthcare.
Religion/belief system	<ul style="list-style-type: none"> ▶ Religious beliefs about immunisation may result in differential access to vaccine. ▶ Gatherings of faith-based communities may lead to differential exposure. Outbreaks involving large numbers of reported cases have occurred in mass gatherings,⁵⁰ and cases linked to religious facilities continue to emerge. <p><i>Multiple possible intersections such as: racialisation</i></p>	<ul style="list-style-type: none"> ▶ Engage faith-based leaders in the development of educational materials and planning for immunisation programmes. ▶ Offer alternate immunisation settings such as at places of worship. ▶ Enable improved IPC measures† to reduce exposure. ▶ Support programmes and policies aimed to assist and empower systemically marginalised populations and improve access to healthcare.
Education/literacy level	<ul style="list-style-type: none"> ▶ Those with lower education or literacy levels potentially have decreased access to healthcare. Lower levels of education (or parental education in the case of children) have been associated with lower vaccination rates in all age groups for various VPDs.^{44 45} ▶ Those with lower education or literacy levels are less likely to be able to work from home, potentially leading to differential exposure. ▶ International students may have differential exposure if they travel internationally, and differential access to healthcare if not insured. <p><i>Multiple possible intersections such as: place of residence, occupation, pre-existing conditions, smoking, SES, racialisation</i></p>	<ul style="list-style-type: none"> ▶ Offer alternate immunisation and testing settings to improve access (eg, school-based vaccination programmes). ▶ Provide educational materials at appropriate literacy levels. ▶ Have translators available in clinics. ▶ Enlist multilingual family/community members to assist in communication.
Socioeconomic status (SES) (including income, and coverage of healthcare and healthcare interventions)	<ul style="list-style-type: none"> ▶ Differential disease severity has been shown to have large independent associations with low socioeconomic status.¹⁰ ▶ Populations with lower income status and inability to pay for IPC resources, higher risk occupations with limited IPC measures†, job insecurity and inability to work from home have differential exposure. ▶ Lack of healthcare insurance or inability to pay for healthcare interventions may result in differential access. Vaccination rates tend to be lower in lower socioeconomic groups for various VPDs even if vaccines are publicly funded.^{43 44} <p><i>Multiple possible intersections such as: place of residence, occupation, pre-existing conditions, social capital, education/literacy level, racialisation</i></p>	<ul style="list-style-type: none"> ▶ Include populations from a variety of SES backgrounds in clinical trials (following REB guidelines and OCAP principles⁴⁹). ▶ Improve access to testing and vaccination (eg, mobile clinics, publicly funded interventions) regardless of healthcare coverage. ▶ Enable improved IPC measures† to reduce exposure. ▶ Support programmes and policies aimed to assist and empower systemically marginalised populations and improve access to healthcare.

Continued

Table 1 Continued

Factors that may contribute to health inequity	Why inequity may exist (differential access to healthcare, differential disease exposure/susceptibility/severity plus intersections with other factors*)	Examples of interventions to reduce inequity and improve access
Social capital (social support/networks, trust)	<ul style="list-style-type: none"> ▶ Lack of support networks (eg, to remind or enable individuals and caregivers to attend to vaccination and other IPC measures†), and lack of trust (eg, in authorities making recommendations) may lead to differential access to healthcare interventions. ▶ Non-vaccination has been associated with single-parent families for other VPDS.⁴⁴ <p><i>Multiple possible intersections such as: SES, place of residence, occupation, age, pre-existing conditions, education/literacy level</i></p>	<ul style="list-style-type: none"> ▶ Empower trusted healthcare providers to recommend and provide vaccinations during patient visits. ▶ Improve trust in immunisation and other healthcare interventions through trusted leaders and social media influencers. ▶ Implement reminder/recall systems for immunisation. ▶ Offer childcare during immunisation visits.
Age	<ul style="list-style-type: none"> ▶ All ages are susceptible to COVID-19, but the rate of diagnosed COVID-19 cases generally increased with age earlier in the pandemic. As national lockdown measures relaxed, a significant increase in the proportion of cases in younger adult age groups has been observed.⁵⁰ ▶ Differential disease severity has been shown to have a very large independent association with increasing age.¹⁰ ▶ Children <10 years of age experience milder or asymptomatic infection but evidence of differential disease severity (ie, multisystem inflammatory syndrome) is emerging.⁵¹ <p><i>Multiple possible intersections such as: pre-existing conditions, social capital, SES</i></p>	<ul style="list-style-type: none"> ▶ Include populations from a variety of age ranges in clinical trials (following REB guidelines and OCAP principles⁴⁹). ▶ Consider the evidence of inequities related to age when sequencing groups for early vaccination. ▶ Consider promotion and education activities on platforms that access key age groups (eg, established social media, print media, mail campaigns in older ages). ▶ Consider vaccine programmes to protect those in contact with the elderly if vaccine efficacy is impaired due to immune senescence.
Other factors (eg, substance use disorders, smoking)	<ul style="list-style-type: none"> ▶ No large increased risk in hospitalisation in current or former smokers has been observed to date with limited data for associations with substance use disorders.¹⁰ However, data continues to evolve. ▶ These populations may have differential access to healthcare. ▶ Indirect impacts of the pandemic could lead to increased substance use, with increased substance-related deaths and harms. <p><i>Multiple possible intersections such as: SES, social capital, place of residence, pre-existing conditions, education/literacy level</i></p>	<ul style="list-style-type: none"> ▶ Include these populations in clinical trials (following REB guidelines and OCAP principles⁴⁹). ▶ Improve access to testing and vaccination (eg, mobile clinics, at substance use treatment centres) and offer publicly funded interventions. ▶ Enable improved IPC measures† to reduce exposure. ▶ Support programmes aimed to assist those with tobacco and substance use disorders.

This table may not include evidence which has evolved since it was initially developed.

*Multiple intersections between factors may exist; however, only a subset are highlighted in the table.

†Possible IPC measures include: handwashing, disinfecting surfaces, erecting physical barriers, maintaining physical distancing, using appropriate PPE.

PPE, personal protective equipment.

of the unfair burden of this pandemic on marginalised populations who systemically experience greater obstacles to health.

EQUITY MATRIX: A VALIDATED TOOL TO HELP FIX COMPLEX ISSUES

The Equity Matrix is the first peer-reviewed, published tool that comprehensively outlines how to methodologically assess and respond to critical equity issues in a timely, practical way. It is part of a broader framework that also integrates ethics, feasibility and acceptability to ensure appropriate implementation of public health recommendations.² The resources and time taken to develop this overall framework through 5 years of environmental scans, stakeholder consultations, surveys and literature reviews have reduced the resources and time taken to implement it. The evidence-informed equity tool supporting the overall framework has been validated for its utility and comprehensiveness, and successfully used for vaccines in recent years. Traditionally, most vaccine guidelines rigorously assess clinical factors such as efficacy and safety. While equity is increasingly considered conceptually, it is not explored systematically or transparently. The Equity

Matrix has been fundamental in guidance on COVID-19 immunisation by Canada’s National Immunization Technical Advisory Group (NITAG), the National Advisory Committee on Immunization,^{3 4} and may be valuable to other NITAGs and organisations around the world hastening to develop recommendations on COVID-19 health products based on principles of equitable access and fair allocation.⁵⁻⁷ Application of this matrix for the development of recommendations on the use of interventions such as SARS-CoV-2 vaccines will be critical to reduce, rather than exacerbate, inequities.

The pursuit of health equity has become a worldwide public health objective.¹ The Equity Matrix, though initially developed for vaccine guidance, can be applied across a broad spectrum of policy and programme interventions to pursue this objective. While complex in nature, health inequities share common features: they are systematic, avoidable and unfair.⁸ They arise because of the circumstances in which people grow, live, work, age, and the systems put in place to deal with illness.¹ They can be modified through altering institutions, policies and practices that cause inequitable distribution of power and resources.⁹ The Equity Matrix provides a

roadmap to navigate health inequities with interventions that uphold the ethical principle of justice with the socially just distribution of limited resources. It can be applied within and between countries and regions so that scarce initial supplies of SARS-CoV-2 vaccines are effectively distributed globally based on a gradient of risk rather than a gradient of wealth. It is also an inclusive tool to direct surveillance and research and unveil epidemiological uncertainties and evidence of yet undiscovered inequities of novel diseases like COVID-19.

Table 1 reflects the Equity Matrix we populated with emerging evidence for COVID-19 in consultation with other experts and stakeholders. It was used to inform guidance for the efficient, effective and equitable allocation of SARS-CoV-2 vaccines in the context of limited initial supplies in Canada⁴ as well as research priorities for clinical trials.³ The table incorporates results of a rapid review of risk factors for severe outcomes in Organisation for Economic Co-operation and Development member countries.¹⁰ Technical experts and policy-makers, in consultation with stakeholders across sectors, can populate the Equity Matrix with evidence relevant to the country or countries for which policies are being made. The completed tool can be adapted over time to succinctly and comprehensively summarise up-to-date evidence, and guide research and surveillance where evidence is lacking. The first column summarises biological and social factors that may contribute to health inequity. This allows the identification of groups at high risk, for whom reduced access to a public health intervention may further exacerbate the inequity. For each group identified, the sources of the inequity are explored (second column) to aid in the process of reviewing interventions that could address the inequity and improve access (third column).

While experts acknowledge that inequities must be taken into account when considering government interventions, there is no scientific consensus on how to effectively take action to reduce these inequities.¹¹ Evidence on interventions aimed at individual determinants of health and on the impact of intersectoral action on health equity is limited.^{12 13} This should not be interpreted as a lack of effect, but rather insufficient rigour in evaluations of these interventions.¹³ A systematic review conducted to inform the Equity Matrix found limited evidence on the effects of interventions on hospitalisation for or mortality from vaccine-preventable diseases, and the evidence from these trials was uncertain.¹⁴ Randomised trials of immunisation aimed at improving health equity (with control groups not offered recommended vaccines) is unethical, and measuring the outcome of health inequities related to many vaccine-preventable diseases requires long-term follow-up. Well-conducted, scientifically rigorous, ethical studies of interventions evaluating the impacts on health equity would be valuable to populate this tool. However, a paucity of such evidence should not preclude the implementation of ethically just interventions. Therefore, the third column of table 1 was completed with stakeholder

and expert input on interventions that could address inequities.

The Equity Matrix supports the inclusion of multi-sectoral interventions for structural, systemic changes needed to address inequities. However, given the urgent need for equitable health policies in this pandemic, table 1 focuses on short-term actions within the health sector with examples for immunisation specifically. The information summarised in this matrix is critical to ensure equity issues are appropriately addressed and integrated into expert health guidance, including recommendations on the optimal use of SARS-CoV-2 vaccines.

ILLUMINATING THE SPECTRUM OF HEALTH INEQUITIES

Evidence linking severe COVID-19 disease to biological risk factors such as advanced age and pre-existing conditions is well-established.^{15 16} Evidence continues to emerge separately about the links between COVID-19 and factors such as ethno-racial background.¹⁷⁻¹⁹ The Equity Matrix comprehensively illuminates an array of overlapping factors that compound health inequity.

The spectrum of factors included in the first column of this matrix was adapted from the PROGRESS-Plus model of health determinants and outcomes.²⁰ We expanded the categories captured in PROGRESS-Plus and added important health equity factors that were not explicitly included in the existing model, such as having pre-existing conditions, racialisation (including immigration or refugee status), age, and behaviours such as drug or alcohol use and smoking. The categorical inclusion of these factors ensures that they are unequivocally considered. These additional factors are all critically relevant to COVID-19 epidemiology and infectious diseases in general, and were among the most commonly investigated factors in a systematic review on health inequities related to vaccination.¹⁴ The resulting 'P²PROGRESS And Other Factors' framework was used to guide a rapid review on COVID-19 which included studies using multivariate analyses to adjust for potential confounders.¹⁰ Using this framework, the review illuminated independent biological risk factors (eg, advancing age and certain high risk conditions) and independent social risk factors (eg, racialisation, low income, homelessness) where evidence exists, as well as potential risk factors for severe outcomes of COVID-19 where evidence is sparse (eg, immigration or refugee status, living with a disability, substance use disorders). Disregarding potential inequities due to the absence of disaggregated data, such as in migrant workers differentially exposed to SARS-CoV-2, could undermine an effective pandemic response. Using the Equity Matrix to recognise that inequities may exist where evidence does not (yet) exist is important for ethically just interventions where people are treated with equal concern and respect.

NAVIGATING THE SOURCES AND INTERSECTIONS OF HEALTH INEQUITIES

Public policies should unravel inequities to avoid perpetuating them. The second column of the Equity Matrix outlines reasons why an inequity may exist, including differential access to healthcare, or, as outlined in the Quinn and Kumar framework,²¹ pathways through which various factors can influence the differential exposure, susceptibility, severity and consequences of infectious diseases. The matrix also illustrates how different factors converge to produce inequities. For example, inequities due to socioeconomic status intersect across multiple factors. Populations living in deprived areas, as well as visible minorities and immigrant populations, seem to be disproportionately affected by COVID-19 with differential severity in the USA,¹⁷ England¹⁸ and parts of Canada where data exists.¹⁹ The rapid review of evidence summarised in [table 1](#) found that low income and ethno-racial background were important independent risk factors for severe outcomes of COVID-19.¹⁰ This review also found that diabetes is an important independent risk factor for severe outcomes of COVID-19. The association between low income, ethno-racial background and risk of type 2 diabetes is well-established in many countries.^{22–24} Though found to be independently associated with increased risk of severe COVID-19, the intersection between these factors is important to acknowledge. The negative association between racism and physical health, mental health and health risk behaviours is well-established.²⁵ Even in countries with universal healthcare policies, evidence on differential access to quality healthcare among racialised populations exists.²⁵ Such intersections are especially important to note because the direct effects of genetic or biological host factors on disproportionately higher rates of severe COVID-19 in racialised groups remain unknown, and research into the contribution of policy, healthcare system and society-level determinants to the roots of such inequities is needed.²⁶

Male sex has been found to be an independent risk factor for severe outcomes of COVID-19,¹⁰ even though cases of COVID-19 appear to be equally distributed between the sexes worldwide.²⁷ Biological or immunological differences may contribute to this inequity,²⁸ but gendered differences in occupations and behaviours, such as differential access to healthcare before progression of disease, may also explain observed differences. While direct evidence on differences in severe outcomes due to male sex exists, indirect and direct impacts of the pandemic due to gendered differences in caregiver roles, gender-based violence and socioeconomic instability cannot be ignored.

Disproportionate rates of infections with devastating consequences have occurred in previous epidemics among Indigenous Canadians,²⁹ and are being observed in the current COVID-19 pandemic among Indigenous Peoples in other countries.^{30 31} Differential disease exposure and severity in these populations are not only linked to differential access to quality healthcare, but

also systemic racism in society and the healthcare system, inequities in the social determinants of health such as adequate housing,³² and an underlying history of colonialism.³³ Similarly, migrant and ethnic minority populations have been disproportionately affected by infectious diseases and epidemics in the midst of economic crises in the past due to lack of access to healthcare and poor living conditions.³⁴ In the current pandemic, these populations are also subject to differential exposure to SARS-CoV-2 due to disproportionate representation and precarious occupations in sectors such as food and healthcare, deemed essential and not subject to lockdowns.³⁵ Reduced access to paid time off and personal protective equipment (PPE) or other infection prevention and control (IPC) measures in congregate living and work settings perpetuates transmission of infection within communities. Recognising the intersectionality of the social determinants of health in predisposing systemically marginalised populations to inequitable health outcomes is critical to changing the course of this pandemic.

A focus solely on biological explanations of disease is narrow and has been damaging to science and people. Labelling populations as 'vulnerable' without understanding the reasons for the increased risk in outcomes causes further stigmatisation and discrimination. The Equity Matrix allows for holistic reflections on biological and social inequities and their origins and intersections, rather than fragmented assessments that could perpetuate harmful misunderstandings, injustices and ineffective public health solutions.

IDENTIFYING HOW TO CLOSE, RATHER THAN WIDEN, THE GAP OF HEALTH INEQUITIES

Applying an 'equity lens' to bring inequities into focus without a vision to alleviate them is short-sighted. In order to be effective, public health actions in a pluralistic society cannot ignore diversity in disparities. Therefore, the Equity Matrix includes a third column, identifying practical interventions to reduce varied inequities. In the face of limited interventional resources such as vaccines and cost-prohibitive population-level programmes or product characteristics where vaccine effectiveness cannot support herd immunity, population-based risk assessments must extend beyond traditional biological risk factors to be successful and fair in immunisation strategies where some groups may get vaccine earlier than others.

To reduce morbidity and mortality of COVID-19 and minimise disruption to society, healthcare systems and the economy, specific strategies to increase access to interventions (such as immunisation) and respectfully engage systemically marginalised populations will be required, as summarised in [table 1](#). Pluralism is a prerequisite for success and respect for the diversity of communities and traditions is the key to open doors rather than a reason to put up walls. This has been evident in the success of Indigenous communities in Canada who, through

interventions grounded in their own traditions, self-determination and sovereign collection of Indigenous-specific COVID-19 data,³³ have had COVID-19 case rates that are four times lower and fatalities that are three times lower than the general population³⁶ despite systemic inequities. Respectful engagement of diverse populations is paramount in leading us out of this pandemic.

Public health interventions should navigate inequities in order to reduce them through inclusion, rather than exacerbate them with policies of neglect. For example, real efforts should be made to include populations from a variety of socioeconomic, gendered and racialised backgrounds in clinical trials. Unfortunately, an examination of a subset of published studies investigating the effects of COVID-19 treatment found that a third of the studies did not report ethno-racial data, and Black patients were under-represented in all studies relative to the burden of disease among Black communities in which the studies took place.³⁷ Such exclusions in vaccine clinical trials contribute to distrust and vaccine hesitancy.³⁸

While there is a race to develop SARS-CoV-2 vaccines, public surveys indicate that there may not be a race to get one.^{39–42} Vaccine hesitancy has been deemed one of the top ten global health threats by the WHO in 2019⁴³ and could limit the success of a COVID-19 immunisation programme. In Canada, an examination of acceptability of SARS-CoV-2 vaccines, and coverage rates of existing vaccines, reveals additional issues contributing to inequities in groups already at high risk of severe COVID-19. Visible minorities and Indigenous Canadians appear to be less willing than non-visible minorities to get a SARS-CoV-2 vaccine that is effective and recommended.⁴² Though significant differences in willingness to get a SARS-CoV-2 vaccine have not been observed by sex or socioeconomic status in Canada,^{41 42} vaccination coverage rates in general have tended to be lower among men and those in lower socioeconomic groups,^{44 45} suggesting issues related to decreased access to vaccines. Even among healthcare workers, who tend to have higher vaccine coverage rates, uptake varies by ethnicity.⁴⁶ Studies have demonstrated protection against infection with the appropriate use of PPE in healthcare workers.^{47 48} Unfortunately, differential access to, and training in the use of PPE and other IPC measures intensifies inequities.

Key reasons for vaccine hesitancy include complacency, inconvenience in accessing vaccines, and lack of confidence.⁴³ Population differences in access to and trust in vaccines and healthcare, as well as intent to get a safe, effective SARS-CoV-2 vaccine, should influence the direction of effective interventions, as outlined in the Equity Matrix. For example, offering publicly funded vaccines in key high-risk groups, ensuring vaccines are safe and effective in all high-risk groups, and providing mobile immunisation clinics with recall and reminder systems could increase access to vaccines for many populations. Engaging social influencers and leaders of cultural and faith-based groups with community-driven efforts for coordinated public health approaches and immunisation

programme planning, and providing culturally sensitive educational materials in appropriate languages, literacy levels and media channels could combat misinformation and mistrust about vaccination in general, and SARS-CoV-2 vaccines specifically. Receiving a recommendation from a healthcare provider is linked to increased acceptance for vaccination in general,² and trust in doctors is a key factor in willingness to get a SARS-CoV-2 vaccine.⁴¹ Empowering healthcare providers and the public with transparent evidence-informed recommendations based on systematic analyses of critical equity issues, in addition to factors such as the safety and efficacy of interventions, is vital. Diverse strategies will be required for diverse inequities (see [table 1](#)).

CONCLUSIONS

Navigating health inequities using this roadmap can assist in the development of evidence-informed, pluralistic, socially just, effective policies that respect diversity rather than deepen disparities. Our systematic framework examining the spectrum of inequities and their sources enables policy makers around the world to direct public policies toward interventions and programmes that will reduce avoidable, unjust, unnecessary inequities in this pandemic and beyond.

The Equity Matrix also provides an inclusive tool to direct surveillance and research in order to unveil epidemiological uncertainties of novel diseases like COVID-19. Data disaggregation by variables such as racialised groups is critical to avoid assumptions or the exclusion of populations from the COVID-19 response. Without seeing these data, we turn a blind eye to inequities. While our matrix for COVID-19 may be limited by evidence available and will require input and experience of experts and stakeholders, its utility is enhanced as it draws on evidence and experience from other vaccine-preventable diseases. The Equity Matrix provides a comprehensive map identifying where additional research and surveillance into inequities, their intersections and evaluation of interventions to address inequities, is required.

In a journey where the desired destination is clear, but the path to success is less certain, a roadmap to navigate the unknowns and illuminate inequities that exist along the way has been absent, and is urgently needed. Our application of the Equity Matrix to COVID-19 sheds light on the ever-growing spectrum of inequities magnified by this pandemic, and leverages previous successes of its use to develop effective, comprehensive and timely guidance on track with the race for COVID-19 interventions. We urge policy makers in countries across the social gradient to use a tool like the Equity Matrix as a compass to direct ethically just policies towards interventions and programmes that will reduce disparities. Policies and research that ignore inequities, including their sources and intersections, will perpetuate them and inevitably slow our passage out of this pandemic and into a more equitable and just future.

Acknowledgements We thank the National Advisory Committee on Immunization (NACI), the NACI High Consequence Infectious Disease Working Group, the NACI Secretariat, the First Nations and Inuit Health Branch at Indigenous Services Canada, and the Sex and Gender Based Analysis Plus Network at the Public Health Agency of Canada for reviewing and providing input into the Equity Matrix applied to COVID-19 (table 1).

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Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement There are no data in this work.

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