Court File No. 223/21

ONTARIO
SUPERIOR COUR TOF JUSTICE
(Divisional Court)

BETWEEN:

DAVID DANESHVAR

Applicant

- and -

HER MAJESTY THE QUEEN IN RIGHT OF ONTARIO AS REPRESENTED BY THE MINISTER OF HEALTH, and the HONOURABLE CHRISTINE ELLIOTT, MINISTER OF HEALTH for the PROVINCE OF ONTARIO

Respondents

AFFIDAVIT OF DR. ARJUMAND SIDDIQI
(Sworn March 16, 2021)

I, Dr. Arjumand Siddiqi, Associate Professor at The University of Toronto, of the City of Toronto, in the Province of Ontario AFFIRM AND SAY:

About Me

1. My name is Arjumand Siddiqi. I currently reside in Toronto, Ontario, Canada. I have direct knowledge of the information contained herein. Where I do not have direct knowledge and instead believe the information to be true, I have identified the source of the belief.
2. I am Professor and Division Head of Epidemiology at the Dalla Lana School of Public Health, University of Toronto, where I hold the Canada Research Chair in Population Health Equity. My expertise is in social epidemiology, in particular the study of health equity.
3. I received my B.Sc. (Rehabilitation Sciences – Occupational Therapy) from McGill University in 1997, my MPH from Boston University (School of Public Health) in 2000 and my Sc.D. from Harvard University (the Harvard T.H. Chan School of Public Health)

AS

in 2005. My knowledge of health equity issues comes from my training and more than 15 years of academic work and consulting to government (e.g. Public Health Agency of Canada) and international agencies (e.g. World Health Organization).

4. Since 2010, I have worked as a professor at the Dalla Lana School of Public Health, University of Toronto. I was first hired as an Assistant Professor. In 2015, I was promoted to Associate Professor with Tenure. In 2020, I was promoted to Full Professor.
5. Since graduating with my Sc.D. in 2005, I have continuously held positions in academic institutions, where my primary responsibilities were to teach and conduct research on matters of health equity.
6. From 2005-2006, I held a non-faculty research and administrative position at the National Center for Children and Families at Columbia University, NY. From 2006-2007, I was an Assistant Professor in the Public Health Program at the University of Tennessee. From 2007-2010, I was an Assistant Professor at the Gillings School of Global Public Health at the University of North Carolina-Chapel Hill. In 2010, as mentioned above, I became Assistant Professor at the Dalla Lana School of Public Health, University of Toronto.
7. I am a Social Epidemiologist. I study and teach about health inequities, including their measurement, their causes, and the policies that can mitigate (or exacerbate) them. My work mainly focuses on jurisdictions in Canada and in what are typically considered its 'peer countries,' such as The United States and The United Kingdom. I focus on health inequities across racial groups, socioeconomic (i.e., income, education, and occupational) groups, and immigrant groups. Much of my work considers the roles of public policies (e.g., income assistance policies and employment insurance) for bringing about health equity.

AS

8. I am a Member of the Ontario Science Table for COVID-19, through which I have co-authored a briefing memo on equity considerations for COVID-19 vaccinations in Ontario. I am also a Member of the Toronto Race-Based Data Group for COVID-19, and a Member of the Black Health Equity Working Group for COVID-19. During the COVID-19 pandemic, I have consulted to several authorities, including local health units and the Public Health Agency of Canada. I have also been conducting research on inequities in incidence of COVID-19, inequities in behaviors associated with COVID-19 (e.g. handwashing, social distancing, staying at home), and the extent to which provincial jurisdictions are tracking metrics of equity in COVID-19.

9. As a result of my professional and educational experience, I have significant experience in the areas of assessing health equity and inclusion in health care delivery, particularly for those experiencing social and economic inequities such race, and poverty and the impact of the delivery of such programs on socially and economically at-risk populations.

10. For further information about my qualifications, please see my curriculum vitae, which is attached as **Schedule "1"**.

11. I am aware of my duty to the Court when acting as an expert in a proceeding. I have attached my signed Acknowledgement of Expert Duty (Form 53) to confirm my acceptance of my duties (**Schedule "2"**).

12. I am also aware of my obligations pursuant to a non-disclosure agreement I was required to sign when I agreed to provide my services pro bono as a part of the impressive team of COVID advisors assembled by the province. While I am not at liberty to provide the detailed vaccine equity advice provided by myself and my colleagues at the various Tables, I provide this information through reference to publicly available documents such as the

AS

vaccine equity guidelines and the vaccine equity workbook issued by the province. I also reference the affidavit of Dr. Rachlis in his affidavit as well as other public statements. Based on those, it can reasonably be concluded that the province had been well advised about the complexities and resources required to provide vaccinations on an equitable basis.

Outline

13. This affidavit is broken down into the following sections:

    a. Ontario's vaccination program, including current equity considerations embedded in The Program;
    b. Scope of the current equity-related issues in Ontario's vaccination program;
    c. International comparisons to Ontario's program; and
    d. Ways to rectify the existing shortcomings;

14. In order to provide clarity, some definitions are required at the outset.

15. I refer to "at risk" and "high risk" interchangeably to denote communities or populations that are either known to have higher levels of COVID-19 infections than the general population, or have more disease severity (see **Exhibit "3"** and **"4"**).

16. "Inequity" refers to unequal access or outcomes that are experienced between social groups in society, due to unjust reasons (see **Exhibit "5"**). For example, vaccine inequities across racial groups refers to unequal access to vaccination across racial groups due to unjust reasons, such as registration systems, locations of vaccinations, and communication strategies that are discriminatory by virtue of their explicit or implicit lack of accounting for the needs of a group that is disadvantaged in their resources and other social conditions.

Ontario's Vaccination Program

17. I am unaware of vaccine equity planning done by the province during Phase 1 apart from what formed part of the initial roll out. I am certainly unaware why the province did not

AS

require PHUs to begin vaccine equity planning and provide them with the requisite provincial resources prior to or during Phase 1. Speaking with respect to the priority groups with which I am most familiar, Black and Brown persons, having this time to plan and begin preliminary steps for implementation prior to vaccine could be described as essential to PHUs ability to implement a timely and equitable vaccination program for at risk members of these populations. There is good reason to believe the same would hold true for the equitable vaccination of members of other prioritized at-risk populations.

18. As stated by the Ontario Ministry of Health website, their Vaccine Plan currently involves three phases (**Exhibit "3"**).

19. Phase 1, which runs from December, 2020 to March, 2021, aims to vaccinate the following groups: congregate living seniors, health care workers, adults in First Nations, Metis and Inuit populations, adult chronic home care recipients, adults over 80 years of age and towards the end of the Phase, the province added persons experiencing homelessness.

20. Phase 2, which runs from April, 2021 to July, 2021, aims to vaccinate adults 60 to 79 years of age, high-risk congregate settings (such as shelters, community living), individuals with high-risk chronic conditions, and their caregivers, those who cannot work from home, at-risk populations or communities, including Black and other racialized populations, and hot spots with historic and ongoing high rates of death, hospitalization, and transmission.

21. Finally, Phase 3, which runs continuously from July, 2021, aims to vaccinate all adults below the age of 59. The Government is currently in the final stages of Phase 1 of the vaccine distribution and the beginning of Phase 2.

AS

Scope of the Current Equity Issues

22. The Government of Ontario's plan charges the 34 local Public Health Units (PHU) to create their own strategies for vaccinated the population who reside in each of their jurisdictions. However, there is no information provided with respect to (a) how each PHU will ensure that equity considerations, such as prioritization Black and other racialized groups, will be embedded in their respective vaccine rollouts and, (b) whether there are any accountability or enforcement mechanisms to ensure PHUs adhere to equity considerations.

23. In my opinion, the delegating of responsibility for vaccine equity onto PHUs was done far too late and with far too little direction and resources with which to achieve equity. This will impact Black and other racialized groups, low income persons and the homeless, which are groups concerning which I have particular knowledge and expertise. I do not believe any degree of knowledge or expertise is necessary to be able to say the same holds true for other at-risk groups such as the disabled or the elderly. As a result, the province's program is not being carried out in an equitable way at either the provincial or PHU level to the extent it could and should have been.

24. As someone who contributed to the provinces Task Force process, the lack of information, direction and resources provided by the province to PHUs is deeply disappointing to me. It is clear that in Phase I, racialized individuals were not prioritized. More should and could have been done to facilitate access to racialized members of the groups prioritized for access to the vaccine. Based on what has occurred to date, the same equity issues will arise in Phase 2. PHUs have not been given the resources which would facilitate an more equitable distribution.

AS

25. There is some evidence that there is no government plan to implement the equity considerations it has stated on its website. For example, on February 26, 2021, the Ontario Science Table on COVID-19 relcased a science brief, on which I am a co-author, that advised the government to use a dual strategy based on age and neighborhoods of residence that are at high-risk (**Exhibit "4"**). The briefing note describes neighborhoods at high-risk as those characterized by: higher concentrations of essential workers, crowded housing, multigenerational family households, visible minorities and individuals with lower socioeconomic status. This memo, from a body that is intended to communicate the science to the COVID-19 Command Table of the Ontario Government, essentially provides suggestions for a strategy that might be used within and across PHUs. The strong implication of this brief is that there is, as of February 26, 2021, no plan in place.

26. Phase 1 of the vaccine rollout did not prioritize older adults (those over 80 years of age) in at-risk groups or areas, despite the known stark inequities in COVID-19 by individual- and neighborhood-level race and income (**Exhibits "6"** and **"7"**).

27. Despite the province announcing a March 15th start date for registration for the vaccine, many hospital (e.g., Sunnybrook, University Health Network) began a pre-registration process for the vaccine that was not publicized before it commenced (**Exhibits "8"** and **"9"**). As it commenced, television reports of it emerged. This is problematic for older, racialized adults, who may not speak English well enough to understand the information being presented. It is also problematic that pre-registration occurred through website-based sign-up. Given inequities in access to wi-fi and computer devices among Black and other racialized people in Toronto, this is highly problematic.

AS

28. On March 12, 2021, the Black Physicians Association of Ontario, the Black Health Alliance, the Black Opportunity Fund, and the Black North Initiative produced a Position Statement, asking the government to produce concrete plans to address Black vaccine uptake (**Exhibit "10"**). Again, this is evidence that the government has not produced strategies for ensuring that Black people, who represent the highest proportion of COVID-19 cases in Toronto, have full access to vaccines.

Comparisons to Other Jurisdictions

29. Recent evidence from the United States suggests that using an age-based prioritization framework – one that does not attend to race and other social characteristics, despite ample evidence of widespread racial and other inequities in COVID-19 – has been inequitable, with higher vaccination rates in wealthier neighborhoods (**Exhibits "11"** and **"12"**).

30. The mass vaccination methods, over which the province has retained direct control, would produce the same discriminatory vaccination outcomes as have occurred in the United States were it not for the vaccine equity efforts [if any] made by PHUs. As mentioned earlier, the province has impeded these efforts by not requiring that vaccine equity efforts in Phase 1 as specified in its own Guidelines and Workbook are implemented. Unless changes are made, the same equity issues will result in Phase 2.

What is Required

31. The Ontario Science Table has outlined a strategy for prioritizing both age and high-risk populations. As they suggest in their brief, this strategy does not interfere with other high-risk population vaccination priorities and strategies (**Exhibit "4"**).

AS

32. The Black Health Alliance, Black Physicians Association of Ontario, the Black North Initiative, and the Black Opportunity Fund have outlined several strategies that include the following:

    a. Develop plans that prioritize Black communities and neighbourhoods for vaccine distribution (amongst other efforts they suggest for this community, including testing sites).
    b. Allocate adequate resources to support community-led health promotion efforts including awareness campaigns, peer educator and health ambassador programs
    c. Partner with and resource community organizations from affected communities to support vaccine uptake.
    d. Ensure race-based data is collected in collaboration with Black communities to identify, address, and evaluate best practices to meet Black population health needs (**Exhibit "10"**).

33. In general, there appears to be a gap between stated intentions and concrete planning backed by resources. The Ontario government must make it clear what their plans are with respect to vaccine equity, and how they will be accountable for carrying out these plans successfully. Without doing so, these at-risk groups will be left behind.

34. The irony is that it is the vaccine equity responsibility of the province that the PHUs must now be compelled by the province to assume. The PHUs require resources from the province to be able to deliver vaccine equity. Yet it is the province that has the means and the obligation to monitor the vaccine equity being delivered by the PHUs and to intervene directly if the PHUs are failing to deliver. If this does not happen it is my opinion that some those in the province who are at greatest risk will die, who would not have died if vaccine equity had been promptly and properly implemented.

Conclusion

35. As the Ontario government continues to unroll its vaccine plan for the province, there appears to be a rather sizeable gap between their stated intention to use an equity lens,

AS

particularly from my vantage point for Black and other racialized people, and the strategies being used to vaccinate the province, which to date, do not demonstrate any concrete plans that would ensure equity in the vaccine rollout. Both the Ontario Science Table and a consortium of Black professional groups have put forward some concrete plans that would support vaccine equity. It is my opinion that members of other prioritized groups are going to be placed similarly at risk unless immediate action is taken.

36. I make this affidavit in support of David Daneshvar and for no other or improper purpose.

Affirmed before me by video conference by Dr. Arjumand Siddiqi of the City of Toronto, in the Province of Ontario, before me in the City of Vaughn, in the Province of Ontario, on March 16, 2021, in accordance with O. Reg 431/20, Administering Oath or Declaration Remotely.

Commissioner for Taking Affidavits
Anoop Kalsi, LSO # P13598

Arjumand AS

Dr. Arjumand Siddiqi

AS

This is Exhibit **1** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 12 day of March, 2021.

AK.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

A3

ARJUMAND ARA SIDDIQI

University of Toronto, Dalla Lana School of Public Health
155 College Street, Room 566, Toronto, Ontario, M5T 3M7, Canada
aa.siddiqi@utoronto.ca Tel: (416) 978-4017

EDUCATION

Doctor of Science, Social Epidemiology — 2000 – 2005
Department of Social and Behavioral Sciences
Harvard T. H. Chan School of Public Health, Harvard University
Boston, Massachusetts

Master of Public Health, Health Policy and Management — 1998 – 2000
Department of Health Services
School of Public Health, Boston University
Boston, Massachusetts

Bachelor of Science, Rehabilitation Science — 1993 – 1997
School of Physical and Occupational Therapy, McGill University
Montreal, Quebec

PRIMARY ACADEMIC APPOINTMENT

Dalla Lana School of Public Health, University of Toronto
Toronto, Ontario
Associate Professor with Tenure (Division of Epidemiology) — 2015 – Present
Assistant Professor (Division of Social and Behavioural Health Sciences) — 2010 – 2015

OTHER ACADEMIC APPOINTMENTS

Department of Sociology
Faculty of Arts and Science, University of Toronto
Toronto, Ontario
Non-Budgetary Cross Appointment — 2018 – Present

Munk School of Global Affairs and Public Policy
University of Toronto
Toronto, Ontario
Non-Budgetary Cross Appointment — 2018 – Present

Department of Health Behavior
Gillings School of Global Public Health, University of North Carolina – Chapel Hill
Chapel Hill, North Carolina
Adjunct Associate Professor — 2016 – Present
Adjunct Assistant Professor — 2010 – 2016
Assistant Professor — 2007 – 2010

American Pediatric Society/Society for Pediatric Research
Fellow — 2015 – Present

National Center for Children and Families
Teachers College, Columbia University
New York, New York
Research Affiliate — 2006 – Present
Associate Director — 2005 – 2006

AS

Chronic Disease Program, School of Public Health
Georgia State University
Atlanta, Georgia
Adjunct Assistant Professor
2014 – 2016

Carolina Population Center
University of North Carolina – Chapel Hill
Chapel Hill, North Carolina
Faculty Fellow
2008 – 2010

Department of Public Health
College of Education, Health, and Human Services, University of Tennessee
Knoxville, Tennessee
Assistant Professor
2006 – 2007

Human Early Learning Partnership
University of British Columbia
Vancouver, British Columbia
Faculty Research Associate
2006

OTHER APPOINTMENTS

University of British Columbia, Social Exposome Research Excellence Cluster
Vancouver, British Columbia
Affiliate Member
2020 – Present

St. Michael's Hospital, Center for Research on Inner City Health
Toronto, Ontario
Faculty Member, ACHIEVE Post-Doctoral Program
2012 – 2015

Canadian Institute for Advanced Research, Program on Successful Societies
Toronto, Ontario
Associate Program Member
2010 – 2011

World Health Organization, Commission on Social Determinants of Health
Geneva, Switzerland
Member, Early Child Development Network
2005 – 2006

World Bank, Human Development Unit
Washington, D.C.
Consultant
2003 – 2004

American Academy of Pediatrics, Consortium on Community Determinants of Child Health
Research Assistant
2001 – 2004

Harvard University, Civil Rights Project
Research Assistant
2002 – 2003

Harvard University, Division of Public Health Practice
Boston, Massachusetts
Research Specialist
2000 – 2001

Boston University, School of Public Health
Boston, Massachusetts
Research Coordinator
2000

AS

Canadian Back Institute
Vancouver, British Columbia
Occupational Therapist 1997 – 1998

EDITORSHIPS

- **Social Science & Medicine – Population Health**, Editorial Board Member (2016 – Present)
- **Journal of Epidemiology and Community Health** , Associate Editor (2014 – Present)
- **Proceedings of National Academy of Sciences**, Invited Editor (2017)
- **International Journal of Environmental Research and Public Health**, Guest Editor for special issue on Social Determinants of Health (2012 – 2013)
- **Social Science & Medicine**, Editorial Assistant, Social Epidemiology Section (2001 – 2004)

HONOURS AND AWARDS

- **University of Toronto** Robin Badgley Award for Teaching Excellence 2019
- **University of Toronto** Robin Badgley Award for Teaching Excellence (Early) 2014
- **Canadian Institute for Advanced Research** Global Academy Scholar 2008 – 2009
- **University of Tennessee** Provost's Junior Faculty Fellow 2006 – 2007
- **Harvard University** Saltonstall Graduate Award 2003 – 2004
- **Harvard School of Public Health** Graduate Scholarship 2000 – 2001

PEER-REVIEWED PUBLICATIONS

PA: Principal Author, **CPA:** Co-Principal Author, **CA:** Co-Author, **SRA:** Senior Responsible Author; **SPA:** Student Principal Author

Books

1. Basu S and **Siddiqi A.** (Contract Offered and Deffered). Public health epidemics and public policy solutions. Harvard University Press.

Chapters in Books or Edited Volumes (Published)

1. **Siddiqi A**, Hertzman C and Smith BT. 2018. The Fundamental Role of Socioeconomic Resources for Health and Health Behaviors. In: EB Fisher (Ed) Principles of Behavioral Medicine. New York: Springer Press. [PA, SRA]
2. **Siddiqi A**, Kawachi I, Berkman L, Subramanian S.V., and Hertzman C. 2014. Variation of Socioeconomic Gradients in Children's Developmental Health Across Advanced Capitalist Societies: Analysis of 22 OECD Nations. In: Navarro V and Muntaner C (Eds). The Financial and Economic Crises and their Impact on Health and Social Well-being. Amityville, New York: Baywood Publishing Company, Inc. [PA, SRA]
3. Hertzman C and **Siddiqi A.** 2013. Can communities succeed when states fail them? A case study of early human development and social resilience in a neoliberal era. In: PA Hall and M Lamont (Eds). Social Resilience in the Neoliberal Era. New York: Cambridge University Press. [CPA] (C. Hertzman, deceased).

AS

4. Keating DP, **Siddiqi A** and Nguyen QC. 2013. National differences in population health and development. In: PA Hall and M Lamont (Eds). Social Resilience in the Neoliberal Era. New York: Cambridge University Press. [CPA] (Daniel Keating: keatingd@umich.edu)

5. **Siddiqi A.** 2013. Historical perspectives on racial/ethnic inequalities. In: A Doolin (Ed.). Encyclopedia of Race and Racism, 2nd Edition. New York: Macmillan Reference USA. [PA, SRA]

6. Powell-Hammond W and **Siddiqi A.** 2013. Social Determinants of Medical Mistrust among African American Men. In: HM Treadwell, C Xanthos, KB Holden, and RL Braithwaite (Eds.). Social Determinants of Health among African-American Men. Atlanta, GA: Morehouse University. [CPA] (Wizdom Powell: wizdomp@email.unc.edu)

7. Hertzman C, Irwin L, **Siddiqi A**, Hertzman E and Vaghri Z. 2012. Early Childhood Strategies For Closing the Socioeconomic Gap in School Outcomes. In: J Heymann and A Cassola (Eds.). Lessons in Educational Equality. Successful Approaches to Intractable Problems Around the World. New York: Oxford University Press. [CA] (Clyde Hertzman, deceased)

8. **Siddiqi A**, Hertzman E, Irwin LG and Hertzman C. 2011. Early Child Development: A Powerful Equalizer. In: The Commission on Social Determinants of Health Knowledge Networks, JH Lee and R Sadana (Eds.). Improving Equity in Health by Addressing Social Determinants. Geneva: World Health Organization. Translated into Chinese, Spanish and French. [PA]

9. Hertzman C and **Siddiqi A.** 2009. Population Health and the Dynamics of Collective Development. In: PA Hall and M Lamont (Eds.) Successful Societies: How Institutions and Cultural Repertoires Affect Health and Capabilities. Cambridge, UK: Cambridge University Press. [CPA] (Clyde Hertzman, deceased)

10. **Siddiqi A**, Bobak M, and Hertzman C. 2009. The Social Epidemiology of Population Health During the Time of Transition From Communism in Central and Eastern Europe. In: S. Babones (Ed.). Social Inequalities and the New Public Health: Four Pathways to Understanding Social Determinants of Health. Bristol, UK: The Policy Press. [PA]

11. Maggi S, Irwin LG, **Siddiqi A**, Poureslami I, Hertzman E and Hertzman C. 2005. Knowledge Network for Early Child Development Analytic and Strategy Review Paper: International Perspectives on Early Child Development. Vancouver, BC: University of British Columbia, Human Early Learning Partnership. Prepared for the World Health Organization Commission on Social Determinants of Health. Available from: http://www.who.int/social_determinants/resources/ecd.pdf. [CA] (Stefania Maggi: stefania_maggi@carleton.ca)

12. Hertzman C, **Siddiqi A**, and Bobak M. 2002. The Population Health Context for Gender, Stress, and Cardiovascular Disease in Central and Eastern Europe. In: G Weidner, MS Kopp and M Kristenson (Eds.) Heart Disease: Environment, Stress, and Gender. Washington, DC: IOS Press and NATO Scientific Affairs Division. [CA] (Clyde Hertzman, deceased)

Journal Articles (Published)

1. Amri M, Jessiman-Perreault G, **Siddiqi A**, O'Campo P. 2021. Scoping review of the World Health Organization's underlying equity discourses: Apparent ambiguities, inadequacy, and contradictions. International Journal for Equity in Health. 20:70. https://doi.org/10.1186/s12939-021-01400-x

2. Datta G, **Siddiqi A**, Lofters A. 2021. Transforming race-based health research in Canada. Canadian Medical Association Journal. 193(3):E99-E100. https://doi.org/10.1503/cmaj.201742

3. Blair A, Parnia A, **Siddiqi A.** 2021. A time-series analysis of testing and COVID-19 outbreaks in Canadian federal penitentiaries to inform prevention and surveillance efforts. Canada Communicable Disease Report. 47(01):66-76. https://doi.org/10.14745/ccdr.v47i01a10

4. Lee-Foon NK, Logie CH, **Siddiqi A**, Grace D. 2020. "I just trust what Google says, it's the Bible": Exploring young Black gay, bisexual and other men who have sex with men's evaluation of sexual health information sources in Toronto, Canada. Canadian Journal of Human Sexuality. 29(3): 275-288. https://doi.org/10.3138/cjhs.2020-0026

AS

5. Smith-Cannoy H, Wong WH, **Siddiqi A**, Tait C, Parnia A. 2020. When Everyone Agrees: Human Rights Norms on Women and Children and Their Effects on Health. International Journal of Human Rights. 24(10):1537-1571. http:/dx./doi.org/10.1080/13642987.2020.1743975

6. Vahid Shahidi F, Parnia A, **Siddiqi A**. 2020. Trends in socioeconomic inequalities in premature and avoidable mortality in Canada, 1991-2016. Canadian Medical Association Journal. 192(39):E1114-E1128. https://doi.org/10.1503/cmaj.191723

7. Chiang J, Arons A, Pomeranz JL, **Siddiqi A**, Hamad R. 2020. Geographic and longitudinal trends in the media framing of obesity in the US. Obesity. 28(7):1351-1357. https://doi.org/10.1002/oby.22845

8. Tait C, Zewge-Abubaker N, Wong W, Smith-Cannoy H, **Siddiqi A**. 2020. Did the UN Convention on the Rights of the Child reduce child mortality around the world? BMC Public Health. 20:707. DOI: https://dx.doi.org/10.1186/s12889-020-08720-7

9. Merckx J, **Siddiqi A**, Kaufman JS. 2020. Unjustified assertions regarding of race and ethnicity in clinical decision making (Re: The effect of ethnicity on semen analysis and hormones in the infertile patient). Canadian Urological Association Journal. 14(4):142-143. DOI: https://dx.doi.org/10.5489/cuaj.6265

10. Jairam JA, Vigod S, O'Campo P, Park AL, **Siddiqi A**, Ray JG. 2020. Neighbourhood income and risk of having an infant with concomitant preterm birth and severe small-for-gestational age birthweight. Journal of Obstetrics & Gynaecology Canada. 42(2):156-162. DOI: https://dx.doi.org/10.1016/j.jogc.2019.06.014

11. Parnia A, **Siddiqi A**. 2020. Socioeconomic disparities in smoking are partially explained by chronic financial stress: A marginal structural model of older U.S. adults. Journal of Epidemiology and Community Health. 74(3):248-254. DOI: https://dx.doi.org/10.1136/jech-2019-213357

12. Gomaa N, Glogauer M, Nicolau B, Tenenbaum H, **Siddiqi A**, Fine F, Quinonez C. 2020. Stressed-out oral immunity: A gateway from socio-economic adversity to periodontal disease. Psychosomatic Medicine. 82(2):126-137. DOI: http://dx.doi.org/10.1097/PSY.0000000000000774

13. Vahid Shahidi F, Mutaner C, Shankardass K, Quinonez C, **Siddiqi A**. 2020. The effect of welfare reform on the health of the unemployed: evidence from a natural experiment in Germany. Journal of Epidemiology and Community Health. 74(3):211-218. DOI: http://dx.doi.org/10.1136/jech-2019-213151

14. Ramraj C, Pulver A, O'Campo P, Urquia M, Hildebrand V and **Siddiqi A.** 2020. A scoping review of socioeconomic inequalities in distributions of birth outcomes: Through a conceptual and methodological lens. Maternal and Child Health Journal. 24:144-152. DOI: http://dx.doi.org/10.1007/s10995-019-02838-w

15. Benavente Fernandez I, **Siddiqi A**, Miller SP. 2020. Socioeconomic status and brain injury in children born preterm: Modifying neurodevelopmental outcome. Pediatric Research. 87:391-398. DOI: https://dx.doi.org/10.1038/s41390-019-0646-7

16. **Siddiqi A**, Sod-Erdene O, Hamilton D, McMillan Cottom T, Darity W. 2019. Growing sense of social status threat and concomitant deaths of despair among whites. SSM Population Health. 9:100449. DOI: http://dx.doi.org/10.1016/j.ssmph.2019.100449 [PA, SRA]

17. Ramraj C, **Siddiqi A**, El-Amin S, Hamilton D. 2019. What matters more, maternal characteristics or the returns for possessing them? Using decomposition analysis to explain racial disparities in infant mortality in the United States. Race and Social Problems. 11(4):282-289. DOI: http://dx.doi.org/10.1007/s12552-019-09268-x [CA, SPA] (Chantel Ramraj: chantel.ramraj@mail.utoronto.ca)

18. Fafard St-Germain AA, **Siddiqi A**. 2019. The relation between household food insecurity and children's height in Canada and the United States: A scoping review. Advances in Nutrition. 10(6):1126-1137. DOI: http://dx.doi.org/10.1093/advances/nmz034 [SRA, SPA]

19. Sod-Erdene O, Vahid Shahidi F, Ramraj C, Hildebrand V, **Siddiqi A**. 2019. Is social assistance boosting the health of the poor? Results from Ontario and three countries. Canadian Journal of Public Health. 110(4):386-394. DOI: http://dx.doi.org/10.17269/s41997-019-00206-3 [SRA, CPA]

AS

20. Benavente-Fernandez I, Synnes A, Grunau RE, Chau V, Ramraj C, Glass T, Cayam-Rand D, **Siddiqi A**, Miller SP. 2019. Association of socioeconomic status and brain injury with neurodevelopmental outcomes of very preterm children. JAMA Network Open. 2(5):e192914. DOI: http://dx.doi.org/10.1001/jamanetworkopen.2019.2914 [CPA]

21. Kerr J, Minh A, **Siddiqi A**, Muntaner C, O'Campo P. 2019. A cross-country comparison of alcohol, tobacco, and marijuana use among youth who are employed, in school or out of the labor force and school (OLFS). Journal of Youth Studies. 22(5): 623-641. DOI: http://dx.doi.org/10.1080/13676261.2018.1529862 [CPA] (Jelani Kerr: j.kerr@louisville.edu)

22. Nelson LE, James L, Lofters A, Berger P, Coleman T, Wilson CL, Nnorom O, Walcott R, **Siddiqi A**, Nguemo J, Etowa J, Mitchell MO, Rana J, and Husbands W. 2019. A recipe for increasing racial and gender disparities in HIV infection: A critical analysis of the Canadian guideline on pre-exposure prophylaxis and non-occupational post-exposure prophylaxis' responsiveness to the HIV epidemics among women and Black communities. Canadian Journal of Human Sexuality. 28(1):1-4. DOI: http://dx.doi.org/10.3138/cjhs.2018-0043 [CA] (Laron Nelson: Laron_Nelson@URMC.Rochester.edu)

23. Tait C, Abdillahi I, Wong W, Cannoy-Smith H, **Siddiqi A**. 2019. Can the health effects of widely-held societal norms be evaluated? An analysis of the UN-CEDAW Convention. BMC Public Health. 19:279. DOI: https://doi.org/10.1186/s12889-019-6607-6. [SRA, CPA, SPA]

24. Vahid Shahidi F, Mutaner C, Shankardass K, Quinonez C, **Siddiqi A**. 2019. The effect of unemployment benefits on health: A propensity score analysis. Social Science & Medicine. 226:198-206. DOI: http://dx.doi.org/10.1016/j.socscimed.2019.02.047 [SRA, CPA, SPA]

25. Vahid Shahidi F, Sod-Erdene O, Ramraj C, Hildebrand V, **Siddiqi A**. 2019. Government social assistance programmes are failing to protect the health of low-income populations: Evidence from the United States and Canada (2003-2014). Journal of Epidemiology and Community Health. 73(3):198-205. DOI: http://dx.doi.org/10.1136/jech-2018-211351 [SRA, CPA, SPA] (Faraz Vahid Shahidi: faraz.vahidshahidi@utoronto.ca)

26. Vahid Shahidi F, Ramraj C, Sod-Erdene O, Hildebrand V, and **Siddiqi A**. 2019. The impact of social assistance programs on population health: A systematic review. BMC Public Health. 19(1). DOI: http://dx.doi.org/10.1186/s12889-018-6337-1 [SRA, CPA, SPA] (Faraz Vahid Shahidi: faraz.vahidshahidi@utoronto.ca)

27. Vahid Shahidi F, Muntaner C, Shankardass K, Quiñonez C, **Siddiqi A.** 2018. Widening health inequalities between the employed and the unemployed: A decomposition of trends in Canada (2000-2014). PLoS ONE. 13(11):e0208444. DOI: http://dx.doi.org/10.1371/journal/pone/0208444 [SRA, CPA, SPA] (Faraz Vahid Shahidi: faraz.vahidshahidi@utoronto.ca)

28. Blair A, **Siddiqi A**, and Frank J. 2018. Canadian report card on investments in health equity across the life-course: Analysis of time trends and cross-national comparisons with the United Kingdom. SSM Population Health. 6:158-168. DOI: http://dx.doi.org/10.1016/j.ssmph.2018.09.009 [CPA] (Alexandra Blair: alexandra.blair@umontreal.ca)

29. Smith B and **Siddiqi A**. 2018. Professional Football Participation and Mortality. JAMA. 320(1): 91. DOI: http://dx.doi.org/10.1001/jama.2018.6701 . [SRA, CPA] (Brendan Smith: brendan.smith@oahpp.ca)

30. **Siddiqi A**, Shahidi FV, Hildebrand V, Hong A, Basu S. 2018. Illustrating a 'Consequential' Shift in the Study of Health Inequalities: A Decomposition of Racial Differences in the Distribution of Body Mass. Annals of Epidemiology. 28(4): 236-241. DOI: http://dx.doi.org/10.1016/j.annepidem.2018.02.003. [PA, SRA]

31. Leijser LM, **Siddiqi A**, Miller SP. 2018. Imaging evidence of the effect of socio-economic status on brain structure and development. Seminars in Pediatric Neurology. 27:26-34. DOI: http://doi.org/10.1016/j.spen.2018.03.004. [CA]

32. **Siddiqi A**, Rajaram A, and Miller S. 2018. Do Cash Transfer Programs Yield Better Health in the First Year of Life? A Systematic Review Linking Low-/Middle-Income and High-Income Contexts. Archives of Disease in Childhood. 103:920-926. DOI: http://dx.doi.org/10.1136/archdischild-2017-314301. [PA, SRA].

AS

33. **Siddiqi A**, Vahid Shahidi F, Ramraj C, Williams D. 2017. Associations Between Race, Discrimination and Risk for Chronic Disease in a Population-Based Sample from Canada. Social Science & Medicine. Dec(194): 135-141. DOI: https://doi.org/10.1016/j.socscimed.2017.10.009. [PA, SRA].

34. Basu S, Meghani A, and **Siddiqi A.** 2017. Evaluating the health impact of large-scale public policy changes: classical and novel approaches. Annual Review of Public Health. Mar 20;38:351-370. DOI: http://dx.doi.org/10.1146/annurev-publhealth-031816-044208. [SRA, CPA]. (Sanjay Basu: basus@stanford.edu).

35. Pomeranz JL, **Siddiqi A**, Bolanos GJ, Shor JA, Hamad R. 2017. Consolidated state political party control and the enactment of obesity-related policies in the United States. Preventive Medicine. Dec(105): 397-403. DOI: http://dx.doi.org/10.1016/j.ypmed.2017.08.028. (Jennifer Pomeranz: jlp284@nyu.edu) [CPA]

36. Gomaa N, Nicolau B, **Siddiqi A**, Tenenbaum H, Glogauer M, Quiñonez C. 2017. How does the social 'get under the gums?' The roles of socioeconomic position in the oral-systemic health link. Canadian Journal of Public Health. 108(3):e224–e228 doi: 10.17269/CJPH.108.5930. [CPA, SPA] (Noha Gomaa: noha.gomaa@mail.utoronto.ca)

37. Farmer J, McLeod L, **Siddiqi A**, Ravaghi V, Quiñonez C. 2016. Examining changes in income-related oral health inequality in Canada: A population-level perspective. Canadian Journal of Dental Hygiene. 50(2):65–71. [CPA, SPA] (Julie Farmer: julie.farmer@mail.utoronto.ca) **Winner of the Canadian Journal of Dental Hygiene Research Award for the Best Published Original Research Article in Volume 50, 2017.*

38. Basu S, Rehkopf D, **Siddiqi A**, Glymour MM and Kawachi I. 2016. (Commentary). Basu et al. Respond to "Interdisciplinary Approach for Policy Evaluation." American Journal of Epidemiology. 183(6): 542-543. DOI: http://dx.doi.org/10.1093/aje/kwv239. [CPA]. (Sanjay Basu: basus@stanford.edu).

39. Ramraj C, Vahid Shahidi F, Kawachi I, Darity S, Zuberi D, and **Siddiqi A.** 2016. Equally Inequitable? A Cross-National Comparative Study of Racial Health Inequalities in the United States and Canada. Social Science and Medicine. Jul (161): 19-26. DOI: http://dx.doi.org/10.1016/j.socscimed.2016.05.028. [SRA, CPA, SPA] (Chantel Ramraj: chantel.ramraj@mail.utoronto.ca).

40. Vahid Shahidi, **Siddiqi A**, and Muntaner C. 2016. Does social policy moderate the impact of unemployment on health? A multilevel analysis of 23 welfare states. European Journal of Public Health. 26(6): 1017-1022. DOI: http://dx.doi.org/10.1093/eurpub/ckw050. [CPA, SPA] (Faraz Vahid Shahidi: faraz.vahidshahidi@utoronto.ca).

41. Basu S, Rehkopf D, **Siddiqi A**, Glymour MM and Kawachi I. 2016. Health behaviors, mental health, and healthcare utilization among single mothers following 1990's welfare reforms. American Journal of Epidemiology. Mar;183(6):531-8. DOI: http://dx.doi.org/10.1093/aje/kwv249. [CPA] (Sanjay Basu: basus@stanford.edu).

42. Farmer J, McLeod L, **Siddiqi A**, Ravaghi V, Quiñonez C. 2016. Towards an understanding of the structural determinants of oral health inequalities: A comparative analysis between Canada and the United States. Social Science and Medicine – Population Health. Vol 2, 226-236. DOI: http://dx.doi.org/10.1016/j.ssmph.2016.03.009. [CPA, SPA] (Julie Farmer: julie.farmer@mail.utoronto.ca)

43. Gomaa N, Glogauer M, Tenenbaum H, **Siddiqi A,** Quiñonez C. 2016. Social-Biological Interactions in Oral Disease: A 'Cells to Society' View. PLoS ONE. 11(1): e0146218. DOI: http://dx.doi.org/10.1371/journal.pone.0146218. [CPA, SPA] (Noha Gomaa: noha.gomaa@mail.utoronto.ca)

44. **Siddiqi A**, Jones M, Bruce D, Erwin P. 2016. Do racial inequities in infant mortality correspond to variations in societal conditions? A study of state-level income inequality in the U.S., 1992–2007. Social Science & Medicine. 163: 49-58. DOI: http://dx.doi.org/10.1016/j.socscimed.2016.07.013. [CPA, SPA]

45. Vahid Shahidi F, De Moortel D, Muntaner C, **Siddiqi A.** 2016. Do flexicurity policies protect workers from the adverse health consequences of temporary employment? A cross-national comparative analysis. Social Science & Medicine – Population Health. Vol 2, 674-682. DOI: http://dx.doi.org/10.1016/j.ssmph.2016.09.005. [SRA, CPA, SPA] (Faraz Vahid Shahidi: faraz.vahidshahidi@utoronto.ca).

AS

46. Gilbert KL, Ray R, **Siddiqi A,** Shetty S, Baker EA, Elder K, and Griffith DM. 2016. Visible and Invisible Trends in African American Men's Health: Pitfalls and Promises for Addressing Racial, Ethnic and Gender Health Inequities. Annu. Rev. Public Health 2016. 37:295–311 DOI: http://dx.doi.org/10.1146/annurev-publhealth-032315-021556. [CPA] (Keon L. Gilbert: kgilber9@slu.edu)

47. Nelson LE, Wilton L, Moineddin R, Zhang N, **Siddiqi A**, Sa Ting, Harawa N, Regan R, Dyer T, Watson CC, Koblin B, del Rio C, Buchbinder S, Wheeler DP, & Mayer KH for the HPTN 061 Study Team. 2016. Economic, legal and social hardships associated with HIV risk among Black men who have sex with men in six US Cities. Journal of Urban Health, 93, 170-188. DOI: http://dx.doi.org/10.1007/s11524-015-0020-y. [CA] (Laron Nelson: Laron_Nelson@URMC.Rochester.edu)

48. Kovess-Masfety V, Husky M, Pitrou I, Fermanian C, Shojaei T, Chan Chee C, **Siddiqi A**, Beiser M. 2016. Differential impact of parental region of birth on negative parenting behavior and its effects on child mental health: Results from a large sample of 6 to 11 year old school children in France. BMC Psychiatry. 16:123. DOI: http://dx.doi.org/10.1186/s12888-016-0832-7. [CPA] (Viviane Kovess-Masfety: vkovess@gmail.com).

49. **Siddiqi A**, Wang S, Quinn K, Christy A, and Nguyen Q. 2016. Racial Disparities in Access to Care Under Conditions of Universal Coverage. American Journal of Preventive Medicine. 50(2): 220-225. DOI: http://dx.doi.org/10.1016/j.amepre.2014.08.004. [PA, SRA]

50. Brennenstuhl S, Worts D, **Siddiqi A**, Hildebrand V and McDonough P. 2015. Who has the Mother Lode of Health? A Comparative Study of Socioeconomic Inequalities in Health among Mothers of Young Children. Canadian Public Policy. 41(S2): S80-S88. DOI: http://dx.doi.org/10.3138/cpp.2014-075 [CA, SPA] (Sarah Brennenstuhl: sarah.brennenstuhl@utoronto.ca)

51. Ramraj C, Pulver A, **Siddiqi A**. 2015. Intergenerational Transmission of the Healthy Immigrant Effect (HIE) Through Birth Weight: A Systematic Review and Meta-Analysis. Social Science and Medicine. October 22; 146:29-40. DOI: http://dx.doi.org/10.1016/j.socscimed.2015.10.023. [SRA, CPA, SPA] (Chantel Ramraj: chantel.ramraj@mail.utoronto.ca).

52. Basu S, **Siddiqi A**. 2015. (Commentary). Basu and Siddiqi respond to "Context, behaviors, and hypertension inequalities." American Journal of Epidemiology. 182(4):358. DOI: http://dx.doi.org/10.1093/aje/kwv078. [SRA, CPA] (Sanjay Basu: basus@stanford.edu).

53. Kerr JC, Valois RF, **Siddiqi A**, Vanable P, and Carey MP. 2015. Neighborhood Condition and Geographic Locale in Assessing HIV/STI Risk Among African American Adolescents. AIDS and Behavior. Jun;19(6):10005-13. DOI: http://dx.doi.org/10.1007/s10461-014-0868-y. [CA] (Jelani Kerr: j.kerr@louisville.edu)

54. Woolfenden S, Williams K, Eapen V, Mensah F, Hayen A, **Siddiqi A**, and Kemp L. 2015. Developmental Vulnerability - Don't Investigate Without a Model in Mind. Child: Care, Health & Development. May;41(3):337-45. DOI: http://dx.doi.org/10.1111/cch.12181. [CPA] (Susan Woolfenden: susan.woolfenden@sesiahs.health.nsw.gov.au)

55. **Siddiqi A**, Jones M, and Erwin P. 2015. Does Higher Income Inequality Adversely Influence Infant Mortality Rates? Reconciling Descriptive Patterns and Recent Research Findings. Social Science and Medicine. 131: 82-88. DOI: http://dx.doi.org/10.1016/j.socscimed.2015.03.010. [PA, SRA]

56. **Siddiqi A**, Brown R, Nguyen Q, Loopstra R, and Kawachi I. 2015. Cross-national Comparison of Socioeconomic Disparities In Obesity in the United States and Canada. International Journal for Equity in Health.14:116. DOI: http://dx.doi.org/10.1186/s12939-015-0251-2. [PA, SRA]

57. Rajmil L, **Siddiqi A,** Taylor-Robinson D, Spencer N. 2015. Understanding the impact of the economic crisis on child health: the case of Spain. International Journal for Equity in Health. 14:95. DOI: http://dx.doi.org/10.1186/s12939-015-0236-1. [CPA] (Luis Rajmil: lrajmil@gencat.cat; lrajmil@imim.es)

58. Basu S, Hong A, and **Siddiqi A**. 2015. Using Decomposition Analysis to Identify Modifiable Racial Disparities in the Distribution Of Blood Pressure in the United States. American Journal of Epidemiology.182 (4):345-353. DOI: http://dx.doi.org/10.1093/aje/kwv079. [SRA, CPA] (Sanjay Basu: basus@stanford.edu)

AS

59. Vahid-Shahidi F, Muntaner C, and **Siddiqi A**. 2015. Economic Crisis, Unemployment, and Health: Conceptual and Methodological Issues in the Modelling Of National Contexts. Journal of Epidemiology and Community Health. 69:101-102. DOI: http://dx.doi.org/10.1136/jech-2014-204487. [SRA, CPA, SPA] (Faraz Vahid Shahidi: faraz.vahidshahidi@utoronto.ca)

60. Hamad R, Pomeranz JL, Siddiqi A, and Basu S. 2014. Large-Scale Automated Analysis of News Media: A Novel Computational Method for Obesity Policy Research. Obesity. 33(2): 296-300. DOI: http://dx.doi.org/10.1002/oby.20955. [CPA] (Rita Hamad: rhamad@stanford.edu)

61. Basu S, and **Siddiqi A.** 2014. Geographic disparities in US mortality: "hot-spotting" large databases. Epidemiology. 25(3): 468-470. DOI: http://dx.doi.org/10.1097/EDE.0000000000000085. [CPA] (Sanjay Basu: basus@stanford.edu)

62. **Siddiqi A**, Kawachi I, Keating DP and Hertzman C. 2013. A Comparative Study of Population Health in The United States and Canada during the Neoliberal Era, 1980-2008. International Journal of Health Services. 43(2): 193-216. DOI: http://dx.doi.org/10.2190/HS.43.2.b. [PA, SRA]

63. **Siddiqi A**, Ornelas IJ, Quinn K, Zuberi D and Nguyen QC. 2013. Societal Context and the Production of Immigrant Status-Based Health Inequalities: A Comparative Study of the United States and Canada. Journal of Public Health Policy. 34(2): 330-344. DOI: http://dx.doi.org/10.1057/jphp.2013.7. [PA, SRA]

64. Nguyen QC, Hussey JM, Halpern CT, Villaveces A, Marshall S, **Siddiqi A** and Poole C. 2012. Adolescent Expectations of Early Death Predict Young Adult Socioeconomic Status. Social Science and Medicine. 74(9): 1452-1460. DOI: http://dx.doi.org/10.1016/j.socscimed.2012.01.006. [CPA, SPA] (Quynh Nguyen: quynh.nguyen@health.utah.edu)

65. McLeod CB, **Siddiqi A**, Hall PA and Hertzman C. 2012. How Society Shapes the Health Gradient: Work-Related Inequalities in a Comparative Perspective. Annual Review of Public Health. 33: 59-73. DOI: http://dx.doi.org/10.1146/annurev-publhealth-031811-124603. [CPA] (Christopher McLeod: mcleodcb@interchange.ubc.ca)

66. **Siddiqi A**, Kawachi I, Berkman LF, Hertzman C, and Subramanian SV. 2012. Education Determines A Nation's Health, But What Determines Educational Outcomes? A Cross-national Comparative Analysis. Journal of Public Health Policy. 33(1): 1-15. DOI: http://dx.doi.org/10.1057/jphp.2011.52. [PA, SRA]

67. Jones-Smith JC, Gordon-Larsen P, **Siddiqi A,** and Popkin BM. 2011. Emerging Disparities in Overweight by Educational Attainment in Chinese Adults (1989-2006). International Journal of Obesity. 36(6): 866-875. DOI: http://dx.doi.org/10.1038/ijo.2011.134. [CPA, SPA] (Jessica Jones-Smith: jjoness@jhsph.edu

68. Jones-Smith JC, Gordon-Larsen P, **Siddiqi A,** and Popkin BM. 2011. Is the Burden of Overweight Shifting to the Poor Across the Globe? Time Trends Among Women in 39 Low- And Middle- Income Countries (1991-2008). International Journal of Obesity. 36: 1114-1120. DOI: http://dx.doi.org/10.1038/ijo.2011.179. [CPA, SPA] (Jessica Jones-Smith: jjoness@jhsph.edu)

69. Jones-Smith JC, Gordon-Larsen P, **Siddiqi A,** and Popkin BM. 2011. Cross-national Comparisons of Time Trends in Overweight Inequality by Socioeconomic Status Among Women Using Repeated Cross-Sectional Surveys From 37 Developing Countries (1989-2007). American Journal of Epidemiology. 173(6): 667-75. DOI: http://dx.doi.org/10.1093/aje/kwq428. [CPA, SPA] (Jessica Jones-Smith: jjoness@jhsph.edu)

70. Hajat A, Kaufman JS, Rose KM, **Siddiqi A,** and Thomas JC. 2011. Long-term Effects of Wealth on Mortality and Self-Rated Health Status. American Journal of Epidemiology. 173(2): 192-200. DOI: http://dx.doi.org/10.1093/aje/kwq348. [CPA, SPA] (Anjum Hajat: anjumh@uw.edu)

71. Hajat A, Kaufman JS, Rose KM, **Siddiqi A**, and Thomas JC. 2010. Do the Wealthy Have a Health Advantage? Cardiovascular Disease Risk Factors and Wealth. Social Science and Medicine. Dec; 71(11):1935-42. DOI: http://dx.doi.org/10.1016/j.socscimed.2010.09.027. [CPA, SPA] (Anjum Hajat: anjumh@uw.edu)

AS

72. Maggi S, Irwin LJ, **Siddiqi A**, and Hertzman C. 2010. The Social Determinants of Early Child Development: An Overview. Journal of Paediatrics and Child Health. 46(11):627-35. DOI: http://dx.doi.org/10.1111/j.1440-1754.2010.01817.x. [CA] (Stefania Maggi: stafania_maggi@carleton.ca)

73. Quinn K, Kaufman JS, **Siddiqi A**, and Yeatts KB. 2010. Stress and the City: Housing Stressors are Associated with Respiratory Health among Low Socioeconomic Status Chicago Children. Journal of Urban Health. 87(4): 688-702. DOI: http://dx.doi.org/10.1007/s11524-010-9465-1. [CPA, SPA] (Kelly Quinn: kellyq78@gmail.com)

74. Quinn K, Kaufman JS, **Siddiqi A**, and Yeatts KB. 2010. Parent Perceptions of Neighborhood Stressors are Associated with General Health and Child Respiratory Health Among Low-Income, Urban Families. Journal of Asthma. 47(3):281-9. DOI: http://dx.doi.org/10.3109/02770901003605324. [CPA, SPA] (Kelly Quinn: kellyq78@gmail.com)

75. Hertzman C, **Siddiqi A**, Hertzman E, Irwin LG, Vaghri Z, Houweling T, Bell R, Tinajero A, and Marmot M. 2010. Bucking the inequality gradient through early child development. British Medical Journal. 340:c468. DOI: http://dx.doi.org/10.1136/bmj.c468. [CPA] (Clyde Hertzman, deceased)

76. **Siddiqi A** and Nguyen Q. 2010. A Cross-National Comparative Perspective on Racial Inequities in Health: The United States versus Canada. Journal of Epidemiology and Community Health. 64(1):29-35. DOI: http://dx.doi.org/10.1136/jech.2008.085068. [PA, SRA]

77. **Siddiqi A**, Zuberi D, Nguyen Q. 2009.The Role of Health Insurance for Explaining Immigrant Versus Non-Immigrant Disparities in Access to Health Care: Comparing the United States to Canada. Social Science and Medicine. 69(10): 1452-1459. *Accompanying video stream on front page of Social Science & Medicine website. DOI: http://dx.doi.org/10.1016/j.socscimed.2009.08.030. [PA, SRA]

78. Hertzman C, **Siddiqi A**. 2008. Tortoises 1, Hares 0: How Comparative Health Trends between Canada and the United States Support a Long-term View of Policy and Health. Healthcare Policy. 4(2): p. 16-24. PMCID: PMC2645214. [CPA] (Clyde Hertzman, deceased)

79. Irwin LG, **Siddiqi A**, Hertzman C. 2008. The Equalizing Power of Early Child Development: From the Commission on Social Determinants of Health to Action. Child Health and Education. 1(3): p.146-161. ISSN: 1911-7558. [CPA] (Lori Irwin: lori.irwin@ubc.ca)

80. **Siddiqi A**, Subramanian SV, Berkman LF, Hertzman C, Kawachi I. 2007. The Welfare State as a Context for Children's Developmental Health: A Study of the Effects of Unemployment and Unemployment Protection on Reading Literacy Scores. International Journal of Social Welfare. 16(4): 314–325. DOI: http://dx.doi.org/10.1111/j.1468-2397.2007.00501.x. [PA]

81. **Siddiqi A**, Kawachi I, Berkman L, Subramanian SV, Hertzman C. 2007. Variation of Socioeconomic Gradients in Children's Development Across Advanced Capitalist Societies: Analysis of 25 OECD Nations. International Journal of Health Services. 37(1): 63-87. DOI: http://dx.doi.org/10.2190/JU86-457P-7656-W4W7. [PA]

82. **Siddiqi A**, Hertzman C. 2007. Towards an Epidemiological Understanding of the Effects of Long-Term Institutional Changes on Population Health: A Case Study of Canada Versus The USA. Social Science & Medicine. 64(3): 589-603. (*Named a 'Notable Release' by the Canadian Population Health Initiative, Canadian Institute for Health Information). DOI: http://dx.doi.org/10.1016/j.socscimed.2006.09.034. [PA]

83. **Siddiqi A**, Hertzman C. 2001. Economic Growth, Income Equality, and Population Health Among The Asian Tigers. International Journal of Health Services. 31(2): 323-333. DOI: http://dx.doi.org/10.2190/YFXB-E27P-HQDQ-04AM. [PA]

84. Spivak H, Prothrow-Stith D, **Siddiqi A**. 2001. (Commentary) An Early Warning Sign For Violence. Psychiatric Times. September, Volume XVIII, Issue 9. Available at: http://www.psychiatrictimes.com/articles/early-warning-sign-violence. [CPA] (Howard Spivak: h.spivak@cdc.gov).

85. Hertzman C, **Siddiqi A**. 2000. Health and Rapid Economic Change in the Late Twentieth Century. Social Science & Medicine. 51: 809-819. DOI: http://dx.doi.org/10.1016/S0277-9536(00)00062-9. [CPA] (Clyde Hertzman, deceased)

AS

Journal Articles (In Press)

1. **Siddiqi A**, Sod-Erdene O. Do small cause-of-death correlations throw into question the notion of a collective "deaths of despair" phenomenon? American Journal of Epidemiology. https://doi.org/10.1093/aje/kwab016

2. Lee-Foon NK, Logie CH, **Siddiqi A**, Grace D. Exploring young Black gay, bisexual and other men who have sex with men's PrEP knowledge in Toronto, Ontario, Canada. Culture, Health & Sexuality. https://doi.org/10.1080/13691058.2020.1837958

Journal Articles (Accepted)

1. Blair A, Warsame K, Naik H, Byrne W, Parnia A, **Siddiqi A**. Identifying gaps in COVID-19 health equity data reporting in Canada using a scorecard approach. Canadian Journal of Public Health.

2. Louie P, Upenieks L, **Siddiqi A**, Williams DR, Takeuchi DT. Race, flourishing, and all-cause mortality in the United States, 1995-2016. American Journal of Epidemiology.

Journal Articles (Submitted)

1. Vahid Shahidi F, Parnia A, **Siddiqi A**. Does receiving unemployment benefits reduce the risk of mortality associated with job loss? A population-based matched cohort study. International Journal of Epidemiology.

2. Ramraj C, Hildebrand V, O'Campo P, Urquia ML and **Siddiqi A**. A cross-national decomposition of socioeconomic inequalities in birth outcome distributions between Canada and the United States. Demography.

3. Mawani F, Ansara D, Smylie J, Forte T, Finn Mahabir D, Hyman I, **Siddiqi A**, McKenzie K, O'Campo P. Everyday discrimination and physical and mental health in Canada: an examination of effect modification by racialized/Indigenous identity, gender, and income. BMJ.

Journal Articles (In Progress)

1. Dossou-Kitti E, **Siddiqi A**. Cardiovascular disease and stroke among non-Hispanic Black African immigrants and US born non-Hispanic Blacks.

2. Hildebrand V, Siddiqi A. The great recession and birth weight among Black and White infants in the United States.

3. Hueniken K, **Siddiqi A**. Racial disparities in the health effects of the financial crisis.

4. Louie P, **Siddiqi A**. Is the racial paradox in mental health also present in Canada?

5. Nkiwane N, **Siddiqi A**. A critical appraisal of the race and health literature.

6. Parnia A, **Siddiqi A**. Generational changes in the health status of Canadians by race and ethnicity.

7. Parnia A, **Siddiqi A**. Racial inequalities in mortality in the context of post-20th century immigration: Analysis of census-linked death records from Canada.

8. Parnia A, **Siddiqi A**. Mediation of the association between socioeconomic status and mortality: The role of stress and health behaviours.

9. **Siddiqi A**, Parnia A. Deaths of despair: A view from Canada.

10. Sreeram P, **Siddiqi A**. Race and maternal mortality in the OECD countries: A systematic review.

CAREER AWARDS

AS

Canada Research Chair in Population Health Equity (Tier 2)
Canadian Institutes of Health Research (CIHR)
$1,000,000 ($100,000/year)
2015 – 2025

GRANTS AND FUNDING

Year	Role	Amount	Title	Institution and Type
2020-2025	Co-Investigator	$525,000	Artificial intelligence for public health (AI4PH): A focus on equity and prevention	Canadian Institutes of Health Research –Summer Institute on Equitable AI for Public Health
2020-2022	Principal Investigator	$203,000	How unequal is health status across race/ethnic groups in Canada? Using Census-linked mortality data to answer the government's call for rigorous evidence	Canadian Institutes of Health Research – Project Grant
2019-2022	Co-Primary Applicant	$887,000	Using artificial intelligence to identify and predict delirium among hospitalized medical patients	Canadian Institutes of Health Research – Collaborative Health Research Projects (NSERC Partnered)
2019-2022	Co-Applicant	$359,000	Income inequality and population health in Canada and the US, 1990-2016	Canadian Institutes of Health Research – Project Grant
2020-2021	Principal Investigator	$75,000	Are Experiences of Discrimination Contributing to the Mental Health Status of Canada's Diverse Urban Population? Responding to the Call from the Federal Government's 2019-2022 Anti-Racism Strategy	Canadian Institutes of Health Research – Data Analysis Using Existing Databases and Cohorts – Operating Grant
2020	Co-Applicant	$20,000	Establishing a relationship between philosophy and epidemiological research and practice: Modelling ethical standards of health equity	Canadian Institutes of Health Research – Planning and Dissemination Grant
2019-2020	Principal Applicant	$25,000	An early-stage planning strategy for applying artificial intelligence to investigate opioid-related health inequities	Canadian Institutes of Health Research – Planning and Dissemination Grant
2017-2018	Co-Investigator (Principal Investigator: Brendan Smith)	$50,000	What determinants are driving the consistent trends in socioeconomic inequities in ischemic heart disease observed from 2000 to 2010? A decomposition analysis	Public Health Ontario – Project Initiation Fund Competition
2017-2018	Co-Investigator	$5,200,000	RFB #MCSS – 1235 – Evaluation Services for the Basic Income Pilot	Ministry of Community and Social Services (MCSS), Government of Ontario
2016-2018	Principal Investigator	$100,000	Can Government Social Assistance Programs Protect the Health of Society's Most Income-Insecure?	Ministry of Community and Social Services (MCSS), Government of Ontario

AS

Year	Role	Amount	Title	Institution and Type
2014-2017	Co-investigator (Principal Investigator: Morton Beiser)	$405,000	Lending a Hand to Our Future: Documenting, Assessing, and Treating PTSD in Refugee Children and Youth	Canadian Institutes of Health Research – Partnerships for Health System Improvement
2014 -2016	Co-investigator (Principal Investigator: Lance McCready)	$1,497,000	Youth Well Being in Toronto Neighbourhoods: Mapping Socio-Spatial Patterns	Canadian Institutes of Health Research – Team Grant
2013	Principal Investigator	$5,000	Research Travel Grant	Embassy of France
2012-2013	Principal Investigator	$100,000	Equally Inequitable? A Cross-National Comparative Study of Health Equity in Canada & the US	Canadian Institutes of Health Research – Operating Grant
2011-2012	Principal Investigator	$10,000	Connaught New Investigator Award	University of Toronto
2009-2010	Principal Investigator	$11,000	Carolina Population Center Junior	University of North Carolina, Chapel Hill
2009-2010	Principal Investigator	$7,500	Junior Faculty Development Award	University of North Carolina, Chapel Hill
2008-2010	Principal Investigator	$4,950	University Research Council Award	University of North Carolina, Chapel Hill
2008-2009	Principal Investigator	$50,000	Global Scholars Fellowship	Canadian Institute for Advanced Research
2007	Principal Investigator	$5,000	Faculty Enrichment Award	University of Tennessee
2007	Principal Investigator	$3,400	Social and Economic Determinants of Health Services Under Two Different Public Health Systems: A Comparison of the US and Canada	University of Tennessee
2007	Principal Investigator	$5,000	Assuring the Future of Public Health Systems Research	Robert Wood Johnson Foundation and the University of Kentucky

SUBMITTED GRANTS

Year	Role	Amount	Title	Institution and Type
2021-2024 (Submitted)	Co-Applicant	$1,080,000	Factors predictive of SARS-CoV-2 infection among racialized communities	Canadian Institutes of Health Research – Project Grant
2021-2024 (Submitted)	Co-Applicant	$230,000	Understanding the role of social-economic inequality on deaths due to drug overdose, suicide, and alcoholic liver disease in Canada	Canadian Institutes of Health Research – Project Grant

AS

2021	Co-Applicant	$100,000	Mitigating bias in machine learning models used in population health	Canadian Institutes of Health Research – Project Grant
2020-2023 (Submitted)	Principal Investigator (Canada)	$874,538	AI-powered federated predictive modelling of childhood neurodevelopment: Bridging the social science and health research divide	Tri-Council Agencies and UK Research and Innovation – Canada-UK Artifical Intelligence Initiative
2020-2023 (Submitted)	Co-Applicant	$215,000	Understanding the role of social-economic inequality on deaths of despair risk in a Canadian context	Canadian Institutes of Health Research – Project Grant

SCIENTIFIC CONFERENCE ACTIVITY

1. Carabali M, **Siddiqi A**. 2021. Symposium session. Cautionary tales for the measurement of health inequalities. Society for Epidemiologic Research 54th Annual Meeting. June 2021.

2. **Siddiqi A**. 2021. Panel Discussant. The hidden impacts of COVID-19. Meeting the Demands of a Rapidly Changing World. Canadian Society for Epidemology and Biostatistics 2021 Virtual Conference. June 2021.

3. Fuller A, **Siddiqi A**, Vahid Shahid F, Anderson L, Keown-Stoneman C, Maguire J, Birken C. 2020. Poster presentation. Distributional decomposition: A novel method for understanding inequities in child growth, behaviour, and development. Canadian Paediatric Society 97th Annual Conference. June 2020.

4. Fuller A, **Siddiqi A**, Vahid Shahid F, Anderson L, Keown-Stoneman C, Maguire J, Birken C. 2020. Poster presentation. Distributional decomposition: A novel method for understanding inequities in child growth, behaviour, and development. Pediatric Academic Societies 2020 Meeting. May 2020.

5. Lee-Foon N, Logie C, **Siddiqi A**, Grace D. 2020. Poster presentation. Exploring young, black gay, bisexual and other men who have sex with men's PrEP knowledge in Toronto, Ontario. 29th Annual Canadian Conference on HIV/AIDS Research. Canadian Association for HIV Research. May 2020.

6. Plaisime M, **Siddiqi A**. 2019. Oral presentation. Achieving racial equity in healthcare: A systematic review of how bias and institutional racism influences treatment of Black patients. Black Caucus of Health Workers. American Public Health Association 2019 Annual Meeting and Expo. November 2019. Philadelphia, Pennsylvania.

7. Dossou-Kitti E, **Siddiqi A**. 2019. Poster presentation. Cardiovascular disease and stroke among non-Hispanic Black African immigrants and US born non-Hispanic Blacks. 2019 National Medical Association Annual Convention and Scientific Assembly. July 2019. Honolulu, Hawaii.

8. **Siddiqi A**. 2019. Panel Discussant. Saving lives as an off-target effect: The impact of economic and social policies on population health. Society for Epidemiologic Research 2019 Annual Meeting. June 2019. Minneapolis, Minnesota.

9. Smith B, Smith M, **Siddiqi A**, Warren C, Rosella L. 2019. Poster presentation. Informing population health interventions using ethical criteria of health equity to reduce social inequities in type 2 diabetes: a modelling study using the Diabetes Population Risk Tool. Epidemiology and Biostatistics at the Nexus of Complex Health Challenges. Canadian Society for Epidemiology and Biostatistics 2019 Biennial Conference. May 2019. Ottawa, Ontario.

10. **Siddiqi A**. 2019. Keynote Speaker. (In)equities in access: Social work and the social determinants of health. Factor-Inwentash Faculty of Social Work, University of Toronto. April 2019. Toronto, Ontario.

11. Nguemo Djiometio JB, Nelson L, Husbands W, Wilson C, Coleman T, Rana J, **Siddiqi A**, et al. 2018. Oral presentation. Canadian guidelines on PReP may lack sufficient sensitivity for detecting HIV seroconversion risk in

AS

Black communities. HIV Endgame 3: Breakthrough Initiatives. Ontario HIV Treatment Network (OHTN) Annual Conference. December 2018. Toronto, Ontario.

12. **Siddiqi A**. 2018. Keynote Speaker. Structural Racism and Stigma in Healthcare. HIV Endgame 3: Breakthrough Initiatives. Ontario HIV Treatment Network (OHTN) Annual Conference. December 2018. Toronto, Ontario.

13. **Siddiqi A**. 2018. Keynote Speaker. Thinking Big: A Policy Context for Improving Child Outcomes across the Whole Population. Human Early Learning Partnership Fall Expo, University of British Columbia. November 2018. Vancouver, British Columbia.

14. Jairam JA, Vigod S, O'Campo P, Park A, **Siddiqi A**, Ray JG. 2018. Poster presentation. The Association between Maternal Residential Neighbourhood Income and Concomitant Preterm Birth and Severe Small-for-Gestational Age Birthweight. Dalla Lana School of Public Health Research and Practice Day. November 2018. Toronto, Ontario.

15. **Siddiqi A.** 2018. Oral presentation. Insights from examining the health impacts of social assistance policies in Canada, the United States, and the United Kingdom. Symposium on the Sociology of Global Health. International Sociological Association, World Congress of Sociology. July 2018. Toronto, ON.

16. **Siddiqi A.** 2018. Keynote Speaker. Reflections on Gathering Evidence for Health Inequities – A Tale of Achievement and Angst. International Network of Research on Inequalities in Child Health (INRICH). June 2018. Warwick, United Kingdom.

17. **Siddiqi A.** 2018. Panel Presentation. How Societies Structure the Health of Black People in Canada and the United States in Comparative Perspective. Black Policy Conference. Harvard Kennedy School. April 2018. Cambridge, Massachussetts.

18. Ramraj C, El-Amin S, **Siddiqi A**, Hamilton D. 2018. Poster presentation. What matters more, maternal characteristics or differential returns for having them? Using decomposition analysis to explain Black-White racial disparities in infant mortality in the United States. Racialized Maternal Health Conference by Mommy Monitor. Toronto, Canada.

19. Vahid Shahidi F, **Siddiqi A**, Muntaner C, Shankardass K, Quiñonez C. 2018. Oral presentation. Unemployment and Health in the Neoliberal Era: Towards a Political Economy of Widening Health Inequalities. Open Roundtable Session on the Sociology of Health - Part 2, XIX ISA World Congress of Sociology. Toronto, Ontario.

20. **Siddiqi A.** 2017. Keynote Speaker. What Should We Do to Address the Social Determinants of Health? Lessons Learned from Research and the Real World. Tennessee Public Health Association Conference, November 2017, Nashville, Tennessee.

21. **Siddiqi A**. 2017. Regional Spotlight Session. Policies and Health Inequalities around the Globe. Comparative Perspective on Policies and Health Inequalities. American Sociological Association. Montreal, QC.

22. **Siddiqi A.** 2017. Distinguished Keynote Speaker. McMaster Health Advocacy Symposium, McMaster University, Hamilton, Ontario. (Declined)

23. **Siddiqi A.** 2016. Plenary Panel on Syndemics. Session Panelist. Ontario HIV Treatment Network (OHTN) Annual Conference. November 2016. Toronto, Ontario. (Declined).

24. Gomaa N, Nicolau B, **Siddiqi A,** Tenenbaum H, Glogauer M, Quiñonez C. 2016. Oral presentation. Does Financial Stress Influence Immunity? The Case of Periodontal Disease. International Association for Dental Research. June 2016. Seoul, Republic of Korea.

25. **Siddiqi A**. Panellist. Racism: In sickness and in health. The 3rd Annual Pharren Mitchell Symposium. Department of Sociology, University of Maryland. April 2016, College Park, MD.

26. Ramraj C, Vahid Shahidi F, Kawachi I, Darity S, Zuberi D, and **Siddiqi A**. 2016. Poster presentation. Equally Inequitable? A cross-national comparative study of racial health inequalities in the United States and Canada. 2016

AS

Epidemiology Congress of the Americas. Miami, Florida.

27. **Siddiqi A.** Closing the Gap. 2016. 7th Annual Conference Gerald R. Ford School of Public Policy, University of Michigan + School of Public Policy and Governance, University of Toronto. March 2016. Toronto, Ontario. (Declined)

28. **Siddiqi A.** 2016. Oral presentation. International Studies Association (ISA). March 2016. Atlanta, Georgia.

29. Tait C, Ray R, Gilbert K, **Siddiqi A**, Basu S. 2016. Poster presentation. Mind the gap: Exploring the extent to which Black men's health varies across the United States. 2016 Epidemiology Congress of the Americas. Miami, Florida.

30. **Siddiqi A.** 2016. How do racial health inequalities in Canada compare to those in the United States? Black Physicians Association of Ontario, Annual CME Event. February 2016. Toronto, Ontario.

31. Ramraj C, Vahid Shahidi F, Kawachi I, Darity S, Zuberi D, and **Siddiqi A**. 2015. Oral presentation. Equally Inequitable? A cross-national comparative study of racial health inequities in Canada and the United States. Racial Justice Matters: Advocating for Racial Health Equity, Dalla Lana School of Public Health Student-Led Conference. October 2015, Toronto, Ontario.

32. **Siddiqi A.** 2015. Inaugural Forum on Population Health Equity. Harvard T.H. Chan School of Public Health. Discussant. September 2015. Boston, Massachusetts.

33. Ramraj C, Vahid Shahidi F, Kawachi I, Darity S, Zuberi D, and **Siddiqi A**. 2015. Poster presentation. Equally Inequitable? A cross-national comparative study of racial health inequalities in the United States and Canada. Inaugural Forum on Population Health Equity. Harvard T.H. Chan School of Public Health. Boston, Massachusetts.

34. Ramraj C, Wu S, Hong A, **Siddiqi A**. 2015. Oral presentation. A Cross-National Comparative Study of Racial Health Inequalities in Canada and The United States. Canadian Society for Epidemiology and Biostatistics. June 2015. Toronto, Ontario.

35. **Siddiqi A**. 2015. Oral presentation. Child Health Inequalities among Industrialized Countries: International Perspectives from Current Research. International Network for Research on Inequalities in Child Health. June 2015. Montreal, Quebec.

36. **Siddiqi A.** 2015. Oral presentation. Social Policies and Social Inequalities In Child Health. International Network of Research on Inequalities in Child Health (INRICH). Montreal, June 2015.

37. Ramraj C, Pulver A, **Siddiqi A.** 2015. Poster presentation. Intergenerational transmission of the healthy immigrant effect (HIE) through birth weight: A systematic review. Society for Epidemiologic Research. Denver, Colorado.

38. Ramraj C, Pulver A, **Siddiqi A.** 2015. Poster presentation. Intergenerational transmission of the healthy immigrant effect (HIE) through birth weight: A systematic review. Society for Pediatric and Perinatal Epidemiologic Research. Denver, Colorado.

39. **Siddiqi A**. 2015. Oral presentation. Inequality And Its Consequences In The Anglo-American Democracies. Centre for the Study of the United States, Munk School of Global Affairs. Curator of Panel. March 2015. Toronto, Ontario.

40. Ramraj C, Pulver A, **Siddiqi A.** 2015. Poster presentation. Intergenerational transmission of the healthy immigrant effect (HIE) through birth weight: A systematic review. Women's Xchange 2015 Spring Event. Women's College Hospital. Toronto, Ontario.

41. **Siddiqi A.** 2014. Health, Race and Disease Panel. Session Panelist. Global Blackness Conference. November 2014. Durham, North Carolina.

AS

42. **Siddiqi A.** 2014. Achieving convergence. Creating A Pandemic of Health: Contagious Ideas For A Healthy Future. Session Panelist. November 2014. Toronto, Ontario.

43. **Siddiqi A.** 2014. Human Development. Canadian Science Writers Association Annual Conference. Research Session Panelist. June 2014. Toronto, Ontario.

44. **Siddiqi A**. 2014. A Fresh Approach to Coalition Building: Five Professionals Demonstrate Strategies to Redress Race-Based Disparities. National Conference on Race & Ethnicity in American Higher Education (NCORE). May 2014. Indianapolis, Indiana.

45. **Siddiqi A**. 2014. The Early Years - Health Equity from the Start. The Canadian Public Health Association (CPHA). Session Panelist. May 2014. Toronto, Ontario. (Declined).

46. Wong A, **Siddiqi A**, Mahmud Farid H. 2014. Poster presentation. Multidisciplinary Team Perceptions of Factors Contributing to Disparities in Type 1 Diabetes Management in a Pediatric Population. International Society for Pediatric and Adolescent Diabetes. Toronto, Canada.

47. **Siddiqi A**, Hong A and Hildebrand V. 2014. Poster presentation. Do Inequalities in Obesity Reflect Underlying Inequalities in BMI? Society for Epidemiology Research. Seattle, Washington.

48. Brennenstuhl S, Worts D, Hildebrand V, **Siddiqi A**, McDonough P. 2014. A Comparative Study of Socioeconomic Inequalities in Health among Mothers of Young Children. Accepted for an oral presentation at Social Policy and Health Inequalities: An International Perspective, Montreal, May 2014.

49. **Siddiqi A.** 2014. Oral presentation. The Structures and Functions of Societies Which Support Human Health and Development. From Cell to Society. A CIFAR symposium in honour of the late Clyde Hertzman. Toronto, ON, February 2014.

50. Pitrou I, Beiser M, **Siddiqi A,** Weinberg L, Fermanian C, Shojae T and Kovess Masfety V. 2014. Oral presentation. Immigration Status and Negative Parenting Behaviours. Results from a Large Survey Among 6-11 Years Old French School Children. European Union Public Health Association Conference, Brussels, Belgium. November 2014.

51. **Siddiqi A**. 2013. Oral presentation. Can Societies Provide Resilience? A Comparison of Health during the Neoliberal Era in Canada and the United States. The Lupina Foundation & Comparative Program on Health and Society. The Munk School of Global Affairs. Toronto, Ontario.

52. Ahmed N, **Siddiqi A**. 2013. Oral presentation. Country Level Trends in Population Health and their Social Determinants. The 20th Canadian Conference on Global Health - Global Health in 2013: Are We Having An Impact? Canadian Society for International Health. Ottawa, Ontario.

53. Brennenstuhl S, Hildebrand V, **Siddiqi A**, Worts D and McDonough P. 2013. Oral presentation. Pathways to Socioeconomic Inequalities in Women's Health Dynamics: A Comparative Study. Canadian Public Health Association. Ottawa, Ontario.

54. **Siddiqi A**. 2013. Oral presentation. Population Perspectives on Child Health and Well Being. Plenary Presentation, International Network of Research on Inequalities in Child Health (INRICH). Stanford University, Palo Alto, California.

55. Brennenstuhl S, Hildebrand V, **Siddiqi A**, Worts D, and McDonough P. 2012. Oral presentation. A Comparative Study of Occupational-Based Inequalities in Women's Health Dynamics. Advancing Excellence in Gender, Sex and Health Research, IGH, CIHR. Montreal, Quebec.

56. **Siddiqi A**. 2011. What can Societies do to Reduce Inequities in Human Health and Development? Findings from Cross-National Comparative Perspectives. Oral presentation. Canadian Institute for Advanced Research Program on Experience Based Brain and Biological Development. Vancouver, British Columbia.

AS

57. **Siddiqi A.** 2011. Oral presentation. Understanding the Role of Society in Producing Disparities of Health and Human Development. Duke University Conference on Societal Determinants of Health Disparities. Durham, North Carolina.

58. **Siddiqi A.** 2011. Oral presentation. Comparative Perspectives on Inequities in Children's Health and Development: Implications for Societal Strategies. Robert Wood Johnson Foundation Symposium on the Social Determinants of Child Health. Ann Arbor, Michigan.

59. Quinn K, Kaufman J, Yeatts KB and **Siddiqi A.** 2011. Poster presentation. Housing and Neighborhood Stressors and Asthma Among Low-Income Chicago Children. Robert Wood Johnson Foundation Symposium on the Social Determinants of Child Health. Ann Arbor, Michigan.

60. Nguyen QC, Halpern CT, **Siddiqi A**, Marshall S, Villaveces A, Hussey JM, and Poole C. 2011. Poster presentation. Perceived survival expectations and socioeconomic status in young adulthood. American Congress of Epidemiology/Society for Epidemiologic Research. Montreal, Canada.

61. Keating DP, **Siddiqi A** and Nguyen QC. 2011. Poster presentation. Social disparities and national academic performance of adolescents. Society for Research in Child Development.

62. **Siddiqi A.** 2010. Oral presentation. The Societal Determinants of Health Disparities. National Health Disparities Conference. Philadelphia, PA.

63. Barber S, **Siddiqi A** and Bolland J. 2010. Poster presentation. Behaviors in context: Exploring the relationship between sense of community and risk behaviors among adolescents living in low-income neighborhoods in Mobile, Alabama. American Public Health Association. Denver, Colorado.

64. **Siddiqi A.** 2009. Oral presentation. Disparities of Health and Human Development in Cross-National Comparative Perspective. UNC Minority Health Conference. Chapel Hill, NC.

65. **Siddiqi A** and Nguyen QC. 2009. Poster presentation. Cross-national variation of income based disparities in obesity: United States versus Canada. Society for Epidemiologic Research. Anaheim, California.

66. **Siddiqi A.** 2008. Keynote Address: Early Child Development: A Global Right. Canadian Public Health Association Conference. Halifax, Nova Scotia.

67. **Siddiqi A.** 2008. Oral presentation. The role of health insurance for immigrant disparities in access to health care: A cross-national comparative perspective. American Public Health Association. San Diego, California.

68. **Siddiqi A.** 2008. Oral presentation. The Science of Eliminating Health Disparities. NIH Summit. National Harbor, Maryland.

69. **Siddiqi A,** Irwin L and Hertzman C. (Declined). Early Child Development: A Powerful Equalizer. Global Forum for Health Research. October, 2007. Beijing, China.

70. **Siddiqi A.** The use of Geographic (Cross-National) Comparisons to Understand the Root Causes of Health and Health Disparities. East Tennessee Public Health Forum. February 2007. Knoxville, Tennessee.

71. **Siddiqi A.** 2006. Oral presentation. Unemployment Protection and Children's Developmental Health: A Cross-National Comparison of the OECD Nations. Session on Social Determinants of Health: A Policy Perspective. Chaired by George Kaplan. Society for Epidemiologic Research. Seattle, Washington.

72. **Siddiqi A,** Subramanian SV, Berkman L, Hertzman C and Kawachi I. 2006. Poster presentation. The Welfare State as a Context for Children's Developmental Health: A Study of the Effects of Unemployment and Unemployment Protection. Second North American Congress of Epidemiology, American College of Epidemiology. June 2006. Seattle, Washington.

INVITED LECTURES

AS

1. **Siddiqi A.** The disproportionate impact of COVID-19 on equity seekers. Social Service Workers Coordinating Committee (SSWCC) 2021 Virtual Conference. Canadian Union of Public Employees – Ontario. March 11, 2021.

2. **Siddiqi A.** Racism and COVID-19 in Canada. School of Kinesiology and Health Studies, Queen's University. March 3, 2021.

3. **Siddiqi A.** Foresight Speaker Series. Strategic Policy and Planning Directorate, Public Health Agency of Canada. March 2, 2021.

4. **Siddiqi A.** Racial inequities in COVID-19. The Gendered Impact of the COVID-19 Pandemic Workshop. Equity, Diversity and Public Policy Initiative. Munk School of Global Affairs and Public Policy, University of Toronto. February 26, 2021.

5. **Siddiqi A.** Panelist. What are the big unanswered questions for epidemiology with respect to race? Public Health Conversations: Epidemiology and Race – Why and How We Study Racial Health Disparities. Boston University School of Public Health. February 26, 2021.

6. **Siddiqi A.** How can the provincial government effectively address/meet the health needs of young, Black womxn to improve their mental health outcomes and overall well-being? 1384 Fellowship Discussion Series. Operation Black Vote Canada. February 6, 2021.

7. **Siddiqi A.** Race, racism, and COVID-19 in Canada. Seminar Series. Department of Epidemiology and Biostatistics, Schulich School of Medicine and Dentistry, Western University. January 15, 2021.

8. **Siddiqi A.** Reflections on the use of socioeconomic status and race in epidemiologic research. Society for Epidemiologic Research 2020 Meeting. December 2020.

9. **Siddiqi A.** Sex and Gender-Based Analysis+ (SGBA+) and health equity in COVID-19 and beyond. PHACtually Speaking Seminar Series. Public Health Agency of Canada. December 10, 2020.

10. **Siddiqi A.** Public health and societal inequities. Joan Whitten Miller Leadership Series. Bishop Strachan School. November 30, 2020.

11. **Siddiqi A.** Race, racism, and COVID-19. Vohra Miller Lectures on Critical Public Health Issues. Institute for Pandemics, Dalla Lana School of Public Health, University of Toronto. November 24, 2020.

12. **Siddiqi A.** What accounts for Canadian health inequalities? McGill Epidemiology Seminar Series. Department of Epidemiology, Biostatistics, and Occupational Health, McGill University. November 16, 2020.

13. **Siddiqi A.** Race and COVID-19 determinants in Canada. Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, Harvard University. November 9, 2020.

14. **Siddiqi A.** Panelist. The biology of a pandemic. LSO Annual Policy Forum. Life Sciences Ontario. November 3, 2020.

15. **Siddiqi A.** Collecting and analyzing race-based data. Institute for Work and Health. September 25, 2020.

16. **Siddiqi A.** Panelist. Not safe enough — Listening to the science on the reopening of U of T. Canadian Union of Public Employees (CUPE), University of Toronto Faculty Association (UTFA), United Steel Workers (USW). August 24, 2020.

17. **Siddiqi A.** Keynote. Race, racism, and health in the context of COVID-19 and racial injustice. Canada Health Infoway. July 24, 2020.

18. **Siddiqi A.** Panelist. What economics misses about American racial inequality: An interdisciplinary perspective. Economics for Inclusive Prosperity & UC Berkeley Department of Economics. July 13, 2020.

19. **Siddiqi A.** Panelist. How population cohorts can support covid-19 research. Canadian Partnership for Tomorrow's Health & Dalla Lana School of Public Health, University of Toronto. June 24, 2020.

AS

20. **Siddiqi A.** When they don't see us: The importance of race-based data collection. 30@8:30 Virtual Series: The Impact of COVID-19 on Vulnerable Populations. Centre for Research and Innovation for Black Survivors of Homicide Victims (CRIB), Factor-Inwentash Faculty of Social Work, University of Toronto. April 22, 2020.

21. **Siddiqi A.** Panelist. COVID-19: The health consequences of the consequences. Dean's Seminar Series on Coronavirus. Boston University School of Public Health. April 16, 2020.

22. **Siddiqi A.** Panelist. Equity, rights, and global health during COVID-19. COVID-19 Webinar Series. Dalla Lana School of Public Health, University of Toronto. April 15, 2020.

23. **Siddiqi A.** Social policies and inequalities in health. Lunchtime Seminar Series. Munk School of Global Affairs and Public Policy. March 5, 2020. Toronto, Ontario.

24. **Siddiqi A.** Are we even headed in the right direction? Social epidemiology and the quest to understand how societal conditions produce health inequalities. Department of Social and Behavioral Science, Harvard T.H. Chan School of Public Health. March 2, 2020. Boston, Masssachusetts.

25. **Siddiqi A.** Panelist. The role of public health and health care professionals in addressing fundamental structural inequalities. The Boehm Lecture Series. Dalla Lana School of Public Health, University of Toronto. January 22, 2020. Toronto, Ontario.

26. **Siddiqi A.** Panelist. The social responsibility of hospitals in health equity. University Health Network, Dalla Lana School of Public Health, and Partners in Health Canada. June 2, 2019. Toronto, Ontario.

27. **Siddiqi A.** Panelist. Black Resistance in Public Health: The Time is Now. Black Public Health Students' Collective, Dalla Lana School of Public Health, University of Toronto. March 28, 2019. Toronto, Ontario.

28. **Siddiqi A.** The impact of societal conditions on health: Reflections on the state of the evidence. Health Economics & Statistical Methods Seminar Series. Canadian Centre for Health Economics, University of Toronto. February 8, 2019. Toronto, Ontario.

29. **Siddiqi A.** Moderator. Wilkinson and Pickett on inequality: How inequality pollutes the mind – the lessons of The Inner Level. Dalla Lana School of Public Health, University of Toronto. February 6, 2019. Toronto, Ontario.

30. **Siddiqi A.** Panelist. Artificial Intelligence for Public Health Equity. Canadian Institutes of Health Research – Institute of Population and Public Health (CIHR-IPPH) & Canadian Institute for Advanced Research (CIFAR). January 25, 2019.

31. **Siddiqi A.** The impact of social policies on health: Reflections on the state of the evidence. Les Grandes conférences Paul-Bernard sur les inégalités sociales de santé. Léa-Roback Centre de Recherche sur les inégalités sociales de santé de Montréal. January 15, 2019. Montreal, Quebec.

32. **Siddiqi A.** Invited lecture. Centre Talks. Centre for Urban Health Solutions, St. Michael's Hospital. September 2018. Toronto, Ontario.

33. **Siddiqi A.** Why the 'pull yourself up by your bootstrap' rhetoric and accompanying neoliberal policies are making us sick. Race in the U.S., 2017 Henry Cohen Lecture Series of The Milano School of International Affairs, Management and Urban Policy. The New School Milano. September 2017. New York, New York.

34. **Siddiqi A.** Building Strong Brains. Plenary speaker. Tennessee's ACEs Initiative. Tennessee Commission on Children and Youth. April 2017. Nashville, Tennessee.

35. **Siddiqi A.** How can societies address the social determinants of health? Lessons learned from research and the real world. Charles N. Poskanzer Annual Lecture in Public Health. Health Department, SUNY Cortland. April 2017. Cortland, New York.

36. **Siddiqi A.** How should we study the health of societies? DLSPH Division of Social and Behavioural Sciences Seminar Series. October 2016. Toronto, Ontario.

AS

37. **Siddiqi A**. Racial Inequalities in Health. Faculty of Medicine, University of Toronto. March 2016. Toronto, Ontario.

38. **Siddiqi A.** Keynote Speaker. How Can Societies Address the Social Determinants of Health? Lessons Learned from Research and the Real World. O'Brien Institute Spring Forum – Energizing the discussion on Social Determinants of Health: Perspectives on inequalities in Alberta. University of Calgary's Cumming School of Medicine. June 2016. Calgary, Alberta.

39. **Siddiqi A.** From cells to society: The making and transforming of our health. Treehouse Talks Public Lecture Series. March 2015. Toronto, Ontario.

40. **Siddiqi A.** Do socioeconomic 'risks' of individuals tell us (enough) about health equity realities of populations? McGill University Social Statistics Speaker Series. 2015. Montreal, Quebec.

41. **Siddiqi A.** The Relative Health Status Associated with Blackness: Insights from a Cross-National Comparison. DLSPH Division of Social and Behavioural Sciences Seminar Series. December 2014. Toronto, Ontario.

42. **Siddiqi A**. Early Child Development and Social Resilience in the Neoliberal Era. Canadian Institute for Advanced Research. October 2013. Vancouver, Canada.

43. **Siddiqi A.** What Kinds of Questions Can We Ask (Answer) With Population Data? Brain and Behavior Seminar, Hospital for Sick Children. April 25, 2013.

44. Daneman D, **Siddiqi A**, Mehtar M. An introduction to social paediatrics and the role of education in the health of children and youth. Canadian Association of Pediatric Health Centers. March 12, 2013.

45. **Siddiqi A**. Immigrant Based Health Inequalities in Canada and the United States. DLSPH Division of Social and Behavioral Sciences Seminar Series. February 28, 2013.

46. **Siddiqi A**. Every Child Counts and Every Child Should Be Counted: Population Perspectives on Child Health. Grand Rounds at Hospital for Sick Children. November 28, 2012.

47. **Siddiqi A**. Gender as a Social Determinant of Health: Patterns and Mechanisms. Women's College Hospital Women's Health Rounds. October 3, 2012.

48. **Siddiqi A**. Why Are Health Inequalities Larger in Some Societies Than Others? A Comparison of Canada and the United States. St. Michael's Hospital Clinical Epidemiology and Research Methods Rounds. October 27, 2011.

49. **Siddiqi A**. Inequalities in Human Development: Evidence for Societal Strategies. The Joint Center of Excellence for Research on Immigration and Settlement. March 17, 2011. Toronto, Canada.

50. **Siddiqi A.** Cross-National Comparative Perspectives on Health and Health Disparities. Injury Prevention Research Center, UNC-Chapel Hill. February 2008. Chapel Hill, NC.

51. **Siddiqi A**. Comparative perspectives on social determinants of health and human development. College of Veterinary Medicine, University of Tennessee. 2007, Knoxville, Tennessee.

52. **Siddiqi A.** Comparative political economy approaches to health and human development. Human Early Learning Partnership, University of Britsh Columbia. 2007, Vancouver, BC.

53. **Siddiqi A**. Investigating Socioeconomic Health Inequalities in Resource Poor (and Rich) Nations. Canadian Institute for Advanced Research Program on Successful Societies. October 2007. Toronto, Canada.

54. **Siddiqi A.** Cross-National Variation in Socioeconomic Disparities of Health and Human Development: Gaining Insights for Building Equity-Based Societies. Ohio State University. May 2007. Columbus, Ohio.

AS

55. **Siddiqi A**. Cross-National Variation in Socioeconomic Disparities of Health and Human Development: Gaining Insights for Building Equity-Based Societies. University of North Carolina, Chapel Hill. April 2007. Chapel Hill, North Carolina.

56. **Siddiqi A**. Cross-National Variation in Socioeconomic Disparities of Health and Human Development: Gaining Insights for Building Equity-Based Societies. University of Maryland. April 2007. College Park, Maryland.

57. **Siddiqi A**. The role of social and economic policies as determinants of health and human development. Public Health Program, University of Tennessee. 2006, Knoxville, Tennessee.

58. **Siddiqi A**. Comparative Political Economy Approaches to Population Health. Columbia University School of Public Health. November 2005. New York, NY.

59. **Siddiqi A**. Political Economy and Children's Developmental Health: A Cross-National Perspective from the OECD Nations. Harvard Center for Population and Development Studies. April 2004. Cambridge, MA.

60. **Siddiqi A**. Cross-national differences in the income inequality-health association: Does social policy explain the variation? Columbia University. November 2003. New York, NY.

61. Hertzman C and **Siddiqi A**. Cross-national health comparisons over time as lends' on societal success. Canadian Institute for Advanced Research. May 2003. Ottawa, Canada.

62. **Siddiqi A**. Techniques for Management of Missing Data in Epidemiological Studies. Harvard University Methodological Working Group. October 2002. Boston, MA.

KNOWLEDGE TRANSLATION WORK

Public and Knowledge Translational Writing

1. Brown KA, Stall NM, Joh E, Allen U, Bogoch II, Buchan SA, Daneman N, Evans GA, Fisman DN, Gibson JL, Hopkins J, Van Ingen T, Malsev A, McGeer A, Mishra S, Razak F, Sander B, Schwartz B, Schwartz K, Siddiqi A, Smylie J, Juni P. 2021. A strategy for the mass distribution of COVID-19 vaccines in Ontario based on age and neighbourhood. Ontario COVID-19 Science Advisory Table. https://covid19-sciencetable.ca/sciencebrief/covid-19-vaccination-strategy-for-ontario-using-age-and-neighbourhood-based-prioritization/

2. **Siddiqi A**, Chung R, Ansloos J, Senior P. 2021. Addressing economic racism in Canada's pandemic response and recovery. Broadbent Institute. https://www.broadbentinstitute.ca/addressing_economic_racism_in_canada_s_pandemic_response_and_recovery

3. **Siddiqi A**. "The post-pandemic future: Race-based data collection can make our city more equitable." Published on August 19, 2020. Toronto Life. https://torontolife.com/city/the-post-pandemic-future-race-based-data-collection-can-make-our-city-more-equitable/

4. Duah-Kessie I, **Siddiqi A**, McKenzie K. 2020. No one left behind: Exploring thriving income disproportionality in the City of Toronto. Wellesley Institute. https://www.wellesleyinstitute.com/wp-content/uploads/2020/05/No-one-left-behind-1.pdf

5. **Siddiqi A**, Blair A, Parnia A. "A lack of data hides the unequal burden of COVID-19." Published on April 16, 2020. Toronto Star. https://www.thestar.com/opinion/contributors/2020/04/16/a-lack-of-data-hides-the-unequal-burden-of-covid-19.html

6. Hyman I, O'Campo P, Ansara D, **Siddiqi A**, Forte T, Smylie J, Finn Mahabir D, McKenzie K. 2019. Prevalence and predictors of everyday discrimination in Canada: Findings from the Canadian Community Health Survey. Wellesley Institute. https://www.wellesleyinstitute.com/wp-content/uploads/2019/10/Prevalence-and-Predictors.pdf [CA]

7. **Siddiqi A**, Sod-Erdene O, Vahid Shahidi F, Ramraj C, Hildebrand V. 2018. Do Government Social Assistance Programs Protect the Health of Society's Most Income-Insecure? An examination of Ontario and Comparable

AS

Jurisdictions in Canada, the United States, and the United Kingdom.Converge3, Institute of Health Policy, Management, and Evaluation, University of Toronto. https://converge3.ca/publication/evidence-social-assistance-programs-for-income-insecure/ [PA, SRA]

8. **Siddiqi A** and Sod-Erdene O. "Social assistance is not improving health." Published on July 16, 2018. Policy Options. (*Republished by ABCtech News, Brampton Guardian, Calgary Business, Canadian Business Journal, Canadian Healthcare Network, EvidenceNetwork.ca, Hamilton Spectator, Huffington Post, Kindersley Clarion, La Presse, Mississauga News, North Bay Nugget, Options Politique (French version), Ottawa Life, Our Windsor, Peterborough Examiner, St. Catherine's Standard, The Chronicle Journal, Times & Transcript, Waterloo Region Record, and West-Central Crossroads*). http://policyoptions.irpp.org/magazines/july-2018/social-assistance-is-not-improving-health/ [PA, SRA]

9. **Siddiqi A** and Vahid Shahidi F. 2018. Ontario 360 – Resolving Health Inequalities – Transition Briefing: A promising strategy for providing equal opportunities to health for all Ontarians. School of Public Policy & Governance. University of Toronto. https://on360.ca/30-30/health-inequalities-transition-briefing/ [PA, SRA]

10. **Siddiqi A** and Vahid Shahidi F. "Economic inequality is bad for our health." Published on April 25, 2015. Toronto Star. http://www.thestar.com/opinion/commentary/2015/04/25/economic-inequality-is-bad-for-our-health.html

11. Posen A, **Siddiqi A**, Hertzman C. 2015. Nurturing early childhood development in times of austerity in BC. Canadian Center for Policy Alternatives. [SRA, SPA] (Andrew Posen: Andrew.posen@mail.utoronto.ca)

12. **Siddiqi A**. 2012. Cross-national Comparisons Yield a Blueprint for Achieving Health Equity. MAGIC (Measuring and Managing Access Gaps in Care) Equity Blog. Ontario Ministry of Health and Long-Term Care. March 30th. www.longwoods.com/blog/cross-national-comparisons-yield-a-blueprint-for-achieving-health-equity-by-arjumand-siddiqi/ [PA, SRA]

13. Irwin L, **Siddiqi A** and Hertzman C. 2009. Desarrollo de la primera infancia: un potente ecualizador [Spanish]-[Early Child Development: a powerful equalizer]. Geneva, Switzerland: World Health Organization. Available from: http://www.who.int/entity/social_determinants/resources/ecd_kn_evidence_report_2007.pdf?ua=1. [CPA] (Lori Irwin: lori.irwin@ubc.ca)

14. **Siddiqi A**, Irwin LG, Hertzman C. 2007. Total Environment Assessment Model for Early Child Development. Evidence Report. Vancouver, BC: Human Early Learning Partnership, University of British Columbia. Available from: http://www.who.int/social_determinants/resources/ecd_kn_evidence_report_2007.pdf. [PA]

15. Irwin LG, **Siddiqi A** and Hertzman C. 2007. Early Childhood Development: A Powerful Equalizer. Coordinator's Notebook. 29: 29-34. Available from: http://ecdgroup.com/docs/lib_005322111.pdf. [CPA] (Lori Irwin: lori.irwin@ubc.ca)

16. Irwin LG, **Siddiqi A** and Hertzman C. 2007. Early Child Development: A Powerful Equalizer. Final Report for the World Health Organization Commission on Social Determinants of Health. June. Available from: http://earlylearning.ubc.ca/documents/46/. [CPA] (Lori Irwin: lori.irwin@ubc.ca)

17. **Siddiqi A**. 2006. Early Child Development as a Social Indicator. Discussion Paper for the World Health Organization Commission on the Social Determinants of Health. [PA]

18. **Siddiqi A**. 2006. Statement on Nurturant Environments and Early Child Development. World Health Organization Commission on the Social Determinants of Health. [PA]

19. **Siddiqi A**. 2006. Statement on Early Child Development and Life Course Perspectives on Population Health. World Health Organization Commission on the Social Determinants of Health. [PA]

20. Maggi S, Irwin LG, **Siddiqi A**, Poureslami I, Hertzman E, and Hertzman C. 2005. Analytic and Strategic Review Paper: International Perspectives on Early Child Development. World Health Organization Commission on the Social Determinants of Health. [CA] (Stefani Maggi: stefania_maggi@carleton.ca)

AS

21. Alderman H, Britto P, Engle P and **Siddiqi A.** 2003. Longitudinal Evaluation of Uganda Nutrition and Early Child Development Program. Report to the World Bank. Washington, DC. [CA] (Harold Alderman: halderman@worldbank.org)

Knowledge Translational Consultations

1. **Siddiqi A.** July 2020. Appearance before House of Commons of Canada's Standing Committee on Health re: Canadian response to the COVID-19 pandemic. Government of Canada.
2. **Siddiqi A.** 2020. Consultant on Occupational Exposure to COVID-19 Risk Tool. Public Health Ontario.
3. **Siddiqi A.** November 2019. Participant in social determinants of health roundtable to discuss and assess policy actions for the Ontario health system. Converge3, Dalla Lana School of Public Health, University of Toronto.
4. **Siddiqi A.** 2019. Peer reviewer for summary report on improving data availability related to Black Canadian youth. Department of Canadian Heritage, Government of Canada.
5. **Siddiqi A.** 2019. Chief Public Health Officer of Canada's Annual Report (Stigma and Discrimination) Committee. Public Health Agency of Canada.
6. **Siddiqi A.** 2019. Consultant to Chief Statistician of Canada re: data accessibility in Canada. Statistics Canada.
7. **Siddiqi A.** February 2019. Consultant to Privy Council Office re: income inequality. Government of Canada.
8. **Siddiqi A.** September 2018. Consultant to reporter on Canada's data deficit. The Globe and Mail.
9. **Siddiqi A.** 2018. Consultant to reporter on the new Ontario anti-racism legislation. The Globe and Mail.
10. **Siddiqi A,** Sod-Erdene O, Vahid Shahidi F, Ramraj C, Hildebrand V. 2018. Briefing - Results of DLSPH Project for Ontario Ministry of Community and Social Services. Ontario Ministry of Community and Social Services.
11. **Siddiqi A.** April 2017. Consultant to Colin Ellis, Producer for The Agenda with Steve Paikin. TVO. Segment on racial disparities in health outcomes for Black Ontarians.
12. **Siddiqi A.** 2017. Consultant re: Federal Sugar Tax in Canada. Maple Leaf Strategies.
13. **Siddiqi A.** 2017. Consultant to Senior Policy Advisor – Christopher Taylor. Ontario Anti-Racism Directorate.
14. **Siddiqi A.** 2017. Consultant re: social determinants of health, racial inequities, and migrant health in Canada. Service Insights and Experimentation Division, Immigration, Refugees and Citizenship Canada.
15. **Siddiqi A.** 2017. Consultant to Anna Boiko-Weyrauch, Reporter working with the newsroom of the Colorado Trust. Segment on health equity from the perspective of the social determinants of health. Colorado Trust.
16. **Siddiqi A.** 2015. Consultation with the Honourable Dr. Helena Jaczek, *Minister for Community and Social Services*. Discussion regarding the relationship between income and health and associated policy solutions. Ministry of Community and Social Services.
17. **Siddiqi A.** 2015. Maternal-Child Screening Committee. Ontario Provincial Council for Maternal and Child Health.
18. **Siddiqi A.** 2013. Legislative writing consultant, Title X – Health Equity Act. Asian Americans Advancing Justice.
19. **Siddiqi A.** 2013. Communities of Practice on Measures of Discrimination. Public Health Agency of Canada.
20. **Siddiqi A.** 2012. Nurturing the Health and Development of Children: Families, Communities, Societies. Ontario Ministry of Health Panel on Childhood Obesity. July 11, 2012.

AS

21. **Siddiqi A.** 2011. Income Inequality and Health in Canada and the United States: A Cautionary Tale. The Toronto Residents' Reference Panel on Household Income. November 5, 2011.

MEDIA COVERAGE

- Boston Globe
- Boston University Public Health Post
- Cape Breton Spectator
- CBC News
- The Daily Beast
- Global News
- The Globe and Mail
- The Hill Times
- iPolitics
- MedicalResearch.com
- The New York Times
- News 95.7 Halifax
- Newsweek
- Ontario Loud
- Open to Debate
- Policy Options
- Takepart
- Toronto Star
- University of Toronto News
- The Varsity

BOARD OF DIRECTORS AND OTHER ADVISORY ROLES

- **Ontario Ministry of Health**, Member, COVID-19 Sociodemographic Data Consultation Group (2020 – Present)
- **City of Toronto**, Member, Race Data Collection Advisory Group (2020 – Present)
- **Dalla Lana School of Public Health & Public Health Ontario**, Expert Member, Ontario COVID-19 Science Advisory Table (2020 – Present)
- **Broadbent Institute**, Expert Advisor, *Essential Solutions Project* (2020 – Present)
- **Wellesley Institute**, Research Advisory Board Member, *Community voices: Understanding perspectives on policies that promote health equity within marginalized neighbourhoods* (2019 – Present)
- **Modeling and Analytics for Justice in Health,** Advisory Board Member (2018 – Present)
- **National Collaborating Centre for Determinants of Health,** Advisory Board Member (2018 – Present)
- **University of Toronto Munk School of Global Affairs,** Advisory Committee Member, *Comparative Program on Health and Society International Conference* (2017)
- **Canadian Institutes for Health Information (CIHI)**, Member, Ethnicity/Race Expert Working Group, *Defining Stratifiers for Measuring Inequity in Health Care* (2017)
- **New Opportunities for Research Funding Agency Cooperation in Europe (NORFACE)**, International Advisory Group Member, *Dynamics of Inequality Across the Life-course: Structures and Processes (DIAL)* (2016)
- **Center for Research on Inner City Health, St. Michael's Hospital,** Advisor, *Urban HEART (Health Equity Assessment and Response Tool) @Toronto* (2013)
- **United Way of Toronto.** Member, Income Inequality Advisory Group (2011 – 2013)

PROFESSIONAL ACTIVITIES

- **Interdisciplinary Association of Population Health Science**
  - Member, Mentoring Program (2018 – Present)
  - Member, Program Committee (2018 – Present)
  - Member, Membership Committee (2017 – Present)

- **Canadian Institutes of Health Research (CIHR)**
  - Peer Reviewer, Public, Community and Population Health Committee, Project Grant: Spring 2019 and Fall 2019 Competitions (2019 – Present)
  - Member, College of Reviewers (2017 – Present)
  - Invitation to convening to discuss concerns related peer review process changes (July 13, 2016)
  - Social Sciences and Humanities Reforms Working Group (2012 – 2014)
  - Reviewer, Partnerships for Health Systems Improvement Grant Panel (2013)

- **Stanford University, Data Safety and Monitoring Board (DSMB),** Member, Project on Designing food voucher programs to reduce disparities in healthy diets (2016 – Present)

- **International Network of Research on Inequalities in Child Health,** Member (2011 – Present)

- **MIT COVID-19 Datathon,** Mentor (May 10-16, 2020)

- **Association of Nurses in AIDS Care,** Reviewer for Conference Abstracts, ANAC 2017 Conference (2017)

- **Samuel DuBois Cook Center on Social Equity,** Attendee of Convening of the Samuel DuBois Cook Center on Social Equity (2016)

- **Society of Behavioural Medicine's 38th Annual Meeting and Scientific Sessions,** Abstract Reviewer (March 29 -April 1, 2016)

- **Grand Challenges Canada (GCC) and the Canadian Institutes of Health Research (CIHR),** Member of the Saving Brains: Unlocking the Potential for Development Peer Review Committee (November 3-4, 2016)

- **WHO European Venice Office for Investment for Health and Development**, Reviewer for the Venice Appraisal and Development Tool for Governance to Address the Social Determinants of Health and the Reduction of Socially Caused Health Inequalities (2011)

- **Peer Reviewer for Academic Journals**: MDM Policy & Practice; BMC Public Health; Bulletin of the World Health Organization; Early Education and Development; Health and Place; International Journal of Health Equity; The Journal of the American Medical Association; Journal of Health Psychology; Journal of Public Health Policy; Lancet; Obesity; PloS One; Social Science and Medicine; Journal of Epidemiology and Community Health; Sociology of Health and Illness; Annals of Epidemiology; Canadian Medical Association Journal; American Journal of Epidemiology; JAMA Pediatrics

- **Society Memberships**: Interdisciplinary Association for Population Health Science, Society for Epidemiologic Research; American Public Health Association; Society for Research in Child Development; Society for Pediatric Research; Population Association of America

TEACHING

Classroom Instruction

University of Toronto
Social Determinants of Health (CHL 5105H and precursor CHL 7001H)
Lead instructor
2011-Present
Introduces students to the primary areas of research in social determinants of health, the evolution of findings to date, and the major discourses in the scientific literature.

University of Toronto
Master of Public Policy Capstone Course (PPG2003)
Co-Instructor
2019-2021

AS

University of Toronto
Independent Study Course
Lead Instructor
2020
Investigation of race and health in Canada.

University of Toronto
Epidemiologic Methods II (CHL5402H)
Co-Instructor
2020

University of Toronto
Independent Study Course
Lead Instructor
2017-2018
Investigation of the association between food insecurity and metrics of child growth.

University of Toronto
Advanced Methods for Social Determinants of Health Research (CHL 5127H and precursor CHL 7001H)
Lead instructor
2013-2014
Provides students with an opportunity to reflect on and negotiate important methodological issues encountered in research on social determinants of health.

University of Toronto
Social Paediatrics Summer Internship
Co-Lead
2013
Summer project for medical student on social determinants of child diabetes.

University of Toronto
Introduction to Public Health Sciences (CHL 5004H)
Contributing Instructor
2011-2014
Provided lecture on social determinants of health; in 2011 and 2012 participated on the course planning committee.

University of North Carolina, Chapel Hill
Social Determinants of Health (HBHE 700)
Lead instructor
2008-2011
Developed course; master's level; lecture based

University of North Carolina, Chapel Hill
Society and Health (HBHE 815)
Lead instructor
2008-2011
Developed course; doctoral level; seminar.

University of Tennessee
Principles of Epidemiology (PH540)
Lead instructor
2006-2007
Developed course; graduate level; lecture based.

University of Tennessee
Introduction to Biostatistics (PH530)
Lead instructor
2007

AS

Developed course; graduate level; lecture based.

Appalachian Epidemiology Institute
Advanced Epidemiology
Lead instructor
2007
Developed course; intensive summer course for graduate students and working professionals; lecture based.

Harvard University
Society and Health (SHH201)
Teaching Fellow/Head Teaching Fellow
2002-2004
Graduate level course.

University of Middle East (Boston College Summer Program)
Pediatrics in Public Health
Guest Lecturer
2001
Developed 2 to 3 lectures on public health for physicians from the Middle East and North Africa.

Guest Lectures in Courses

- **University of Toronto, Institute of Health Policy, Management, and Evaluation, Dalla Lana School of Public Health.** Master of Science in System Leadership and Innovation Program. 2021, Toronto, Canada.
- **University of Toronto, Munk School of Global Affairs and Public Policy**. Topics in Global Affairs VII: The Global Impact of COVID-19 (GLA2098H-F). October 2020, Toronto, Canada.
- **University of Toronto, Dalla Lana School of Public Health**. Introduction to Public Health (CHL5004H). September 2020, Toronto, Canada.
- **University of Toronto, Dalla Lana School of Public Health.** Survey Design and Social Research Methods in Public Health (CHL5203H). March 2019, Toronto, Canada.
- **University of Louisville, School of Public Health and Information Sciences.** Health inequalities in the neoliberal era. April 2017, Louisville, Kentucky.
- **University of Toronto, Undergraduate Health Studies Program.** Introduction to Epidemiology (HST373H1). March 2017, Toronto, Canada.
- **University of Toronto, Dalla Lana School of Public Health**. Biostatistics Seminar (CHL5424). January 2017, Toronto, Canada.
- **University of Toronto, Dalla Lana School of Public Health.** Advanced Quantitative Methods in Epidemiology (CHK5424H). January 2017, Toronto, Canada.
- **University of Toronto.** Individual Risks and Population Realities: Reflections on Methods and Findings in the Field of Social Epidemiology 2016, Toronto, Canada.
- **University of Toronto, Dalla Lana School of Public Health**. Special Topics in Biostatistics Seminar, 2016. Toronto, Canada.
- **University of Toronto, Dalla Lana School of Public Health**. Introduction to Public Health (CHL5004H). September 2016, Toronto, Canada.
- **University of Toronto, Fraser Mustard Institute for Human Development.** Graduate Collaborative Program in Human Development (CPHD). November 2014, Toronto, Canada.

AS

- **University of Toronto, Dalla Lana School of Public Health**. MPH Global Health Roundtable Seminar Series. October 2012, Toronto, Canada.
- **University of Toronto, Dalla Lana School of Public Health**. Introduction to Public Health (CHL5004H). September 2012, Toronto, Canada.
- **University of Toronto, Lawrence S. Bloomberg Faculty of Nursing.** Community Health. March 2012, Toronto, Canada.
- **University of Toronto, Dalla Lana School of Public Health**. Critical Perspectives in Public Health. November 2011, Toronto, Canada
- **University of Toronto, Dalla Lana School of Public Health**. Introduction to Public Health (CHL5004H). September 2011, Toronto Canada.
- **St. Louis University, Public Health Program** *(via Skype)*. Social Determinants of Health Inequities. June 2011.
- **University of Toronto, Dalla Lana School of Public Health**. Critical Perspectives in Public Health. October 2010, Toronto Canada.
- **University of Toronto, Lawrence S. Bloomberg Faculty of Nursing.** Health Inequalities in Cross-National Perspective. October 2010, Toronto Canada.
- **University of North Carolina.** Upward Bound Program. June 2010, Chapel Hill North Carolina.
- **University of North Carolina, Gillings School of Global Public Health, Department of Maternal and Child Health.** Health Disparities in US Context. March 2010, Chapel Hill North Carolina.
- **University of North Carolina, Gillings School of Global Public Health, Department of Epidemiology.** Social Epidemiology. March 2008, Chapel Hill North Carolina.
- **University of North Carolina. Gillings School of Global Public Health, Department of Health Behavior and Health Education.** Methods Seminar. March 2008, Chapel Hill North Carolina.
- **Duke University, Department of Statistics.** Introduction to Statistics. February 2008, Raleigh North Carolina.
- **University of North Carolina, Gillings School of Global Public Health, Department of Health Behavior and Health Education**. Social Determinants of Health Methods Seminar October 2007, Chapel Hill North Carolina.
- **University of Tennessee - College of Education, Health and Human Sciences**. Health 305 - Adolescent Health. October 2006, Knoxville Tennessee.
- **University of North Carolina. Health and Wellness Program**. October 2006, Asheville North Carolina.

Student Supervision

Post-doctoral Supervision

Alexandra Blair	
Erika Braithwaite (Precision Analytics, Montreal, Canada)	2019 – Present
Vered Kaufman-Shriqui (Senior Lecturer, Ariel University, Ariel, Israel)	2016 – 2017
	2012 – 2014

Principal PhD Supervision

Michelle Amri	
Nakia Lee-Foon	2017 – Present
Mariana Duarte	2014 – Present
Faraz Shahidi (Post-doctoral Fellow, Institute for Work and Health)	2014 – Present
Chantel Ramraj, Post-doctoral Fellow, University of Chicago	2013 – 2019
Stephanie Baker (Discontinued when I moved to University of Toronto)	2013 – 2018
	2009 – 2010

AS

PhD Thesis Committee Membership

Ingrid Geisinger	2020 – Present
Emmanuelle Arpin	2019 – Present
Matt J Parbst	2018 – Present
Jennifer Jairam	2017 – Present
Andree-Anne Fafard St-Germain	2015 – Present
Patricia Louie	2015 – Present
Noha AE Gomaa	2014 – 2017
Kevin Black	2011 – 2014
Sarah Brennenstuhl	2011 – 2013
Rachel Loopstra	2011 – 2013
Melissa Pirrie	2011 – 2013
Anjum Hajat	2008 – 2010
Kelly Quinn	2008 – 2010
Jessica Jones-Smith	2008 – 2010
Liana Richardson	2008 – 2009
Caryl Fledacker	2008 – 2009

PhD Internal Examiner

Jon Koltai	2018
Nadia Akseer	2017
Sarah Edwards	2017
Diana Withrow	2015
Karen-Lee Miller	2015
Kevin Brown	2014
Sonica Singhal	2013
Edwin Ng	2013
Anthony Chum	2012
Kristy Hackett	2012
Laura Corna	2011

PhD Qualifying Examination Committee Membership

Kevin Clark	2016
Mariana Duarte	2014
Goldameir L. Oneka	2014

PhD Qualifying Examination Appraiser

Renée Monchalin	2017
Kinnon McKinnon	2016
Victoria Blackwell-Hardie	2012
Sarai Racey	2012
Allison Amin	2011

MSc to PhD Examination

Andree-Anne Fafard St-Germain	2015

MSc Thesis Committee Membership

Julie Farmer, Faculty of Dentistry	2015
Elsie Amoako, Institute of Health Policy Management and Evaluation	2015

Practicum Supervisor

Kayla Daneal (MPP)	2020
Padmaja Sreeram (MD/MSc in System Leadership and Innovation)	2019
Victoria Tan (BSc Honours in Global Health)	2019
Katrina Hueniken (MPH-Health Promotion)	2018
Abtin Parnia (MPH-Epidemiology)	2016
Neha Ahmed (MPH-Epidemiology)	2015

MPH Student Advisor

AS

Amal Osman	2012 – 2014
Michelle Olding	2012 – 2014
Rebecca Cheff	2012 – 2014
Linda Chan	2012 – 2013
Talia Bronstein	2011 – 2013
Joel Pidutti	2011 – 2013
Julie Kang	2011 – 2013
Garima Talwar	2011 – 2013
Alanna Fennell	2011 – 2013
Alexandra Terrana	2011 – 2013
Michelle Green	2011 – 2013
Rachel MacLean	2011 – 2013
Priya Nadarajan	2011 – 2013
Tanzina Islam	2010 – 2013
Sarah Elliott	2010 – 2013
Rachel Page	2008 – 2010
Lindsay Herenden	2008 – 2010
Ebun Odneye	2008 – 2009
Lindsay Moriarty	2008 – 2009

UNIVERSITY SERVICE

University of Toronto, University Wide

- CIHR Canada Graduate Scholarships Review Committee (2021 – Present)
- Vanier Canada Graduate Scholarships Review Committee (2021 – Present)
- Constituency Representative, Health Policy, Management and Evaluation, Public Health Sciences, University of Toronto Faculty Association Council (2020 – Present)
- Scientific Leadership Council, Edwin S.H. Leong Centre for Healthy Children (2020 – Present)
- Committee on Equity, Diversity, and Inclusion in Research and Innovation (2019 – Present)
- President's International Council on the United States (2018 – Present)
- Black Health Advisory Committee, Faculty of Medicine (2018 – Present)
- Person-Centred Care Advisory Committee, Faculty of Medicine (2017 – Present)
- Black Faculty Group (2016 – Present)
- Diversity Advisory Council (DAC) Member, Faculty of Medicine (2017 – 2020)
- Search Committee, Murphy Family Foundation Chair in Early Life Interventions, St. Michael's Hospital and Faculty of Medicine, University of Toronto (2019)
- Selection Committee, Executive Director for the Edwin S.H. Leong Centre for Healthy Children (2019)
- University of Toronto Internal Review College, Innovation Fund Competition, Canada Foundation for Innovation (2019)
- Distinguished Invitee – Recognized for significant contributions to the University of Toronto community, Massey College Black History Month High Table Dinner (2019)

AS

- Chair of Raising University of Toronto's Research Profile in the US Working Group, President's International Council on the United States (2018 – 2019)
- Faculty Advisor, Black Policy Conference, Munk School of Public Policy and Global Affairs & Harvard Kennedy School (2018 – 2019)
- Chair of the Connaught Life Sciences (Social, Cultural, Environmental and Population Health Research) Review Panel (2018 – 2019)
- Connaught Life Sciences (Epidemiology & Health Outcomes) Review Panel Committee (2016 – 2018)
- Judge for Case Competition on Comparative Public Policy and Inequality, School of Public Policy (2018)
- Chair of the Connaught Life Sciences (Epidemiology & Health Outcomes) Review Panel (2016 – 2017)
- 3rd Year Reviewer for Physician-Scientist, Hospital for Sick Children (2017)

University of Toronto, Dalla Lana School of Public Health

- Head, Division of Epidemiology (2020 – Present)
- Program Director, Black Post-Doctoral Program (2020 – Present)
- Organizer, Equity Speaker Series, Institute for Pandemics (2020 – Present)
- Black Post-Doctoral Program Search Committee (2020 – Present)
- MPH Admissions Committee (2020 – Present)
- Graduate Curriculum Committee (2020 – Present)
- Dean's Strategic Planning Committee (2020 – Present)
- Lecuturer, Outreach and Access Program (2019 – Present)
- Teaching Assistant Hiring Committee (2018 – Present)
- Promotions and Tenure Review Committees (2017, 2019 – Present)
- PhD Epidemiology Admissions Committee (2016 – Present)
- Black Health Lead Search Committee (2021)
- CIHR Tier 2 Canada Research Chair Internal Review Committee (2021)
- Graduate Department of Public Health Sciences Appointment Committee (2020)
- Faculty Liaison, Diversity Climate Survey (2019 – 2020)
- Provost's Postdoctoral Fellowship Admissions Committee (2020)
- Chair in Addiction Policy Search Committee, DLSPH & Centre for Addiction and Mental Health (2020)
- Faculty Search Committee, Division of Biostatistics (2020)
- Director Selection Committee, Institute of Health Policy, Management, and Evaluation (2019 – 2020)

- Banting Postdoctoral Fellowship Panel (2019)
- Faculty Group, High School Bridging Program (2019)
- Judge for Case Competition on Global Public Health (2019)
- Faculty Hiring Committee, Institute for Health Policy, Management, and Evaluation (2018 – 2019)
- Faculty Advisor, Black Students Association (2017 – 2019)
- Big Data Committee (2015 – 2019)
- Consultant, High School Bridging Program and Summer Institute (2018)
- Banting Postdoctoral Fellowship Committee (2018)
- Hosted visiting scholar Dr. Dario Novak from the Department of General and Applied Kinesiology, University of Zagreb, Zagreb, Croatia (2017)
- Co-Director of Diversity Committee (2016 – 2017)
- Graduate Curriculum Committee, Social and Behavioural Health Sciences (2013 – 2017)
- Reviewer for the Global Health Masters Travel Award (2017)
- PhD Program Directors Committee (2016 – 2017)
- Graduate Council Committee (2016 – 2017)
- PhD Program Director, Social and Behavioural Health Science (2015 – 2016)
- Division of Social and Behavioural Sciences Qualifying Examination Working Group (2015 – 2016)
- Division of Social and Behavioural Sciences Faculty Search Committee (2013 – 2014)
- Education Committee of the Dalla Lana School of Public Health Council (2013 – 2014)
- Division of Social and Behavioural Sciences Ph.D. Admissions Committee (2011 – 2016)
- Division of Social and Behavioural Sciences MPH Admissions Committee (2011 – 2012)
- Planning Committee for "Introduction to Public Health" Course (2011 – 2013)
- L'Anson Scholarship Award Committee (2010 – 2011)
- Faculty Engagement Committee (2010 – 2011)

Other University Service

- *University of North Carolina – Chapel Hill,* Co-leader of Toronto Club (2017 – Present)
- *Harvard University* , Member of Harvard Club of Toronto (2011 – Present)
- *University of North Carolina – Chapel Hill,* Faculty Advisor, Social Epidemiology Journal Club (2009 – 2010)

AS

- *University of North Carolina – Chapel Hill,* Faculty Advisor, Black Graduate and Professional Students' Association (2009 – 2010)
- *University of North Carolina – Chapel Hill,* Department of Health Behavior and Health Education, Doctoral Program Committee (2009 – 2010)
- *University of North Carolina – Chapel Hill,* Department of Health Behavior and Health Education, Master's Comprehensive Exam Committee (2009 – 2010)
- *University of North Carolina – Chapel Hill,* Carolina Population Center, Training Evaluation Committee (2008 – 2010)
- *University of North Carolina – Chapel Hill,* Department of Health Behavior and Health Education, Admissions Committee (2008 – 2009)
- *University of North Carolina – Chapel Hill,* Department of Health Behavior and Health Education, awards committee (2008)
- *University of Tennessee,* MPH admissions committee (2006 – 2007)
- *University of Tennessee*, Faculty search committee (2006 – 2007)
- *University of Tennessee*, Public health program committee (2006 – 2007)
- *Boston University,* Committee on minority faculty recruitment (1999)

AS

This is Exhibit **2** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 12 AK. day of March, 2021.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

A3

Court File No.223/21

FORM 53
Courts of Justice Act
ACKNOWLEDGMENT OF EXPERT'S DUTY

ONTARIO
SUPERIOR COURT OF JUSTICE
(Divisional Court)

BETWEEN:

DAVID DANESHVAR

Applicant

- and -

HER MAJESTY THE QUEEN IN RIGHT OF ONTARIO AS REPRESENTED BY THE MINISTER OF HEALTH, and the HONOURABLE CHRISTINE ELLIOTT, MINISTER OF HEALTH for the PROVINCE OF ONTARIO

Respondents

ACKNOWLEDGMENT OF EXPERT'S DUTY

1. My name is Dr. Arjumand Siddiqi. I live in the City of Toronto, in the Province of Ontario.

2. I have been engaged by or on behalf of David Daneshvar to provide evidence in relation to the above-noted court proceeding.

3. I acknowledge that it is my duty to provide evidence in relation to this proceeding as follows:

    a. To provide opinion evidence that is fair, objective and non-partisan;

    b. To provide opinion evidence that is related only to matters that are within my area of expertise; and

    c. To provide such additional assistance as the court may reasonably require, to determine a matter in issue.

4. I acknowledge that the duty referred to above prevails over any obligation which I may owe to any party by whom or on whose behalf I am engaged.

Date: MARCH 16, 2021

Signature

AS

This is Exhibit **3** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 15 AF. day of March, 2021.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

AS

: Stay at home ot for essential travel and follow the **restrictions and public health measures**

Safe and effective vaccines will help protect us against COVID-19. Learn about them and when they will be available in Ontario for you and your family.

This page will be updated regularly. Last updated March 15, 2021.

Booking a vaccination

Ontario's vaccine booking system is now available.

How to book a vaccine

On this page

When you can get the vaccine

Ontario has a three-phase plan that prioritizes vaccines for those at greatest risk of severe illness and those who care for them. We are currently completing Phase 1 of the plan.

Phase 1

High-risk populations
(approximately 1.8 million people)

December 2020 – March 2021

- Congregate living for seniors
- Health care workers
- Adults in First Nations, Métis and Inuit populations
- Adult chronic home care recipients
- Adults over 80 years old

Distribution through:
hospital site clinics, mobile teams, site-specific clinics, mass vaccination clinics (late March)

Phase 2

Mass deliveries of vaccines
(approximately 9 million people)

April 2021 – July 2021

- Adults aged 60 to 79, in 5-year increments
- High-risk congregate settings (such as shelters, community living)
- Individuals with high-risk chronic conditions and their caregivers

AS

- Those who cannot work from home
- At-risk populations

Distribution through:
mass vaccination clinics, pharmacies, primary care, site-specific clinics, mobile teams, mobile sites, public health units

Phase 3

Steady state

July 2021 onwards

- Adults 59 years and younger

Distribution through:
mass vaccination clinics, pharmacies, primary care, site-specific clinics, mobile teams, mobile sites, public health units

If there is limited supply, we will vaccinate people in the order in which they are listed. Learn how the priorities are determined.

All timelines are subject to change depending on vaccine supply.

Check with your public health unit

Each public health unit is developing a vaccine plan tailored to their own community's needs. Local plans will align with Ontario's vaccine distribution plan and ethical framework. Find your public health unit and check their website for details about vaccination in your area.

Find your public health unit

AS

Our three-phased vaccination plan

Phase 1: high-risk populations (current phase)

Phase 2: mass deliveries of vaccines

Phase 3: steady state

How we are prioritizing vaccinations

Ontario's plan prioritizes vaccines for those at greatest risk of severe illness and those who care for them.

Our strategy to vaccinate the population is based on:

- age
- risk due to:
  - health conditions
  - congregate settings
  - hot spots (areas with higher rates of death, hospitalization and transmission)
  - not being able to work from home

This is because evidence shows that vaccinating primarily based on age, with some adjustment for high risk groups, will prevent more:

- deaths
- hospitalizations
- ICU admissions
- cases of COVID-19

AS

To make sure Ontario's vaccine program is equitable and fair, decisions about priority are guided by:

- an ethical framework for COVID-19 vaccine distribution
- guidance from the:
  - Ontario COVID-19 Vaccine Distribution Task Force
  - National Advisory Committee on Immunization
- Ontario's guidance for prioritizing health care workers for COVID-19 vaccination
- engagement with health and community partners working with communities at greater risk
- evidence from clinical trials and Health Canada approvals

Collecting sociodemographic data

As part of our commitment to building safe and healthy communities, Ontario is collecting sociodemographic data on a voluntary basis from individuals who get the COVID-19 vaccine. We are collecting this data to:

- get a more complete picture of who is being vaccinated across the province
- make sure vaccines are provided in a way that is equitable
- show us where we need to provide more information to address any gaps
- help ensure that we are reaching everyone who wants to be vaccinated

When you get the vaccine, you may be asked to share information about your:

- race
- ethnicity
- language
- income
- household size

Providing this information will be completely voluntary, and safeguards will be in place to protect your privacy.

You will be able to receive the vaccine whether you provide the information or not.

If you change your mind about allowing your information to be used, you can contact the Ministry of Health at heia@ontario.ca. If you withdraw your consent, we will stop using your AS

sociodemographic data in the future.

Why get vaccinated

Safe and reliable vaccines can help protect you and your family from COVID-19. They are an important tool to help stop the spread of the virus, build immunity in Ontario and allow us to safely resume normal life.

When a large percentage of the population becomes immune to COVID-19, the spread of the virus will slow down or stop.

The vaccines approved for use in Canada:

- require two doses for your body to develop infection-fighting response
- will help prevent death and serious illness due to COVID-19
- are anticipated to be effective against the original strain of the virus and the identified variants

Until vaccines are widely available and enough people have been fully vaccinated to stop the spread of the virus, we all must:

- continue to follow local public health advice and restrictions
- practise physical distancing
- use masks or face coverings
- stay home as much as possible and only go out for necessities

COVID-19 Vaccine Distribution Task Force

The COVID-19 Vaccine Distribution Task Force is advising Ontario as it plans the immunization program and delivers vaccines.

The task force is advising and providing recommendations on:

- how to deliver, store and distribute vaccines
- support for partners in the health care system to deliver vaccinations in phases, beginning with vulnerable populations

AS

- clinical guidance to administer the vaccine and track vaccine uptake
- reporting data and technology to provide timely, relevant and accurate information to health care providers, decision-makers and the public
- public education and community outreach efforts to encourage people to get the vaccine

Members

- General (retired) Rick Hillier, former Chief of Defence Staff for the Canadian Forces (chair)
- Mario Di Tommaso, Deputy Solicitor General, Community Safety, Commissioner of Emergency Management (vice-chair)
- Helen Angus, Deputy Minister of Health (vice-chair)
- Ontario Regional Chief RoseAnne Archibald of Taykwa Tagamou Nation
- Dr. Isaac Bogoch, infectious diseases consultant and internist, Toronto General Hospital
- Dr. Dirk Huyer, Ontario's Chief Coroner and Coordinator of Provincial Outbreak Response
- Angela Mondou, President and CEO, TECHNATION
- Mark Saunders, former Toronto Police Chief
- Dr. Maxwell Smith, bioethicist and assistant professor, Western University
- Dr. Homer Tien, trauma surgeon and President and CEO, Ornge
- Dr. Regis Vaillancourt, Director of Pharmacy, Children's Hospital of Eastern Ontario
- Dr. Kieran Moore, Medical Officer of Health, Kingston, Frontenac, Lennox & Addington

Ex-officio members

- Dr. David Williams, Chief Medical Officer of Health, Public Health
- Matt Anderson, President and CEO, Ontario Health
- Shawn Batise, Deputy Minister, Indigenous Affairs Ontario
- Lynn Betzner, Deputy Minister, Intergovernmental Affairs & Associate Secretary of the Cabinet
- Laurie LeBlanc, Deputy Minister, Ministry of Transportation
- Giles Gherson, Deputy Minister, Ministry of Economic Development, Job Creation and Trade
- Karen Hughes, Deputy Minister, Ministry of Government and Consumer Affairs AS

- Richard Steele, Deputy Minister, Ministry of Long-Term Care
- Denise Cole, Deputy Minister for Seniors and Accessibility

Related

- The latest announcements about COVID-19 vaccines
- COVID-19 vaccine safety
- What you need to know about the COVID-19 vaccine for Canada
- COVID-19 in Ontario
- General information about vaccines and immunizations
- COVID Alert mobile app

AS

This is Exhibit **4** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 12 day of March, 2021.

AK.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

AS

SCIENCE BRIEFS

A Strategy for the Mass Distribution of COVID-19 Vaccines in Ontario Based on Age and Neighbourhood

Kevin A. Brown, Nathan M. Stall, Eugene Joh, Upton Allen, Isaac I. Bogoch, Sarah A. Buchan, Nick Daneman, Gerald A. Evans, David N. Fisman, Jennifer L. Gibson, Jessica Hopkins, Trevor Van Ingen, Antonina Maltsev, Allison McGeer, Sharmistha Mishra, Fahad Razak, Beate Sander, Brian Schwartz, Kevin Schwartz, Arjumand Siddiqi, Janet Smylie, Peter Jüni on behalf of the Ontario COVID-19 Science Advisory Table

Version 1.1

Published: February 26, 2021

Updated on March 1, 2021. Version 1.0 is available under Additional Resources at https://doi.org/10.47326/ocsat.2021.02.10.1.0

Citation: Brown KA, Stall NM, Joh E, et al. A Strategy for the Mass Distribution of COVID-19 Vaccines in Ontario Based on Age and Neighbourhood. Science Briefs of the Ontario COVID-19 Science Advisory Table. 2021;2(10).https://doi.org/10.47326/ocsat.2021.02.10.1.0

Author Affiliations: The affiliations of the members of the Ontario COVID-19 Science Advisory Table can be found at https://covid19-sciencetable.ca/.

Declarations of Interest: The declarations of interest of the members of the Ontario COVID-19 Science Advisory Table can be found at https://covid19-sciencetable.ca/.

About Us: The Ontario COVID-19 Science Advisory Table is a group of scientific experts and health system leaders who evaluate and report on emerging evidence relevant to the COVID-19 pandemic, to inform Ontario's response. Our mandate is to provide weekly summaries of relevant scientific evidence for the COVID-19 Health Coordination Table of the Province of Ontario, integrating information from existing scientific tables, Ontario's universities and agencies, and the best global evidence. The Science Table summarizes its findings for the Health Coordination Table and the public in Science Briefs.

Correspondence to: Secretariat of the Ontario COVID-19 Science Advisory Table (info@covid19-sciencetable.ca)

Key Message

SARS-CoV-2 infection has taken a disproportionate toll on Ontario older adults, and on residents of disadvantaged and racialized urban neighbourhoods throughout the province.

Prioritizing and implementing vaccine distribution for Ontarians based on both age and neighbourhood of residence could ensure that those at the highest risk of SARS-CoV-2 infection, and hospitalization, ICU admission or death from COVID-19 will be among the first to receive vaccines.

This vaccine strategy will maximize the prevention of deaths and long-term morbidity, and best maintain health care system capacity by reducing hospitalizations and ICU admissions due to COVID-19 as compared with a strategy that prioritizes vaccination based on age alone (Figure 1).

The strategy would not interfere with the ongoing and future vaccination of any specific high-risk population, as it is intended to guide the mass distribution of vaccines to the general Ontario population.

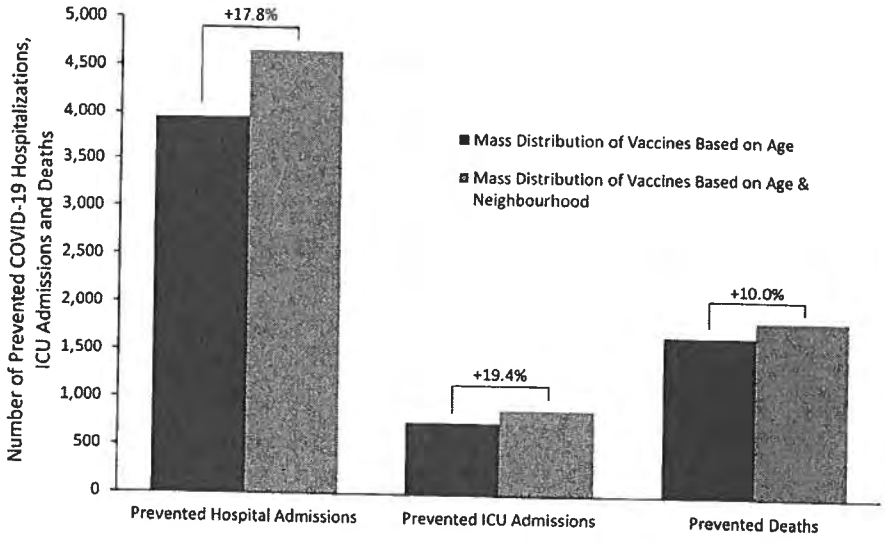


Figure 1. Projected Number of Prevented COVID-19 Hospitalizations, ICU Admissions and Deaths by Two Strategies for Mass Distribution of Vaccines in Ontario, March 1 to May 31, 2021

Bar graph presenting the projected number of prevented hospitalizations, ICU admissions and deaths due to COVID-19 in Ontario from March 1-May 31, 2021 under two strategies for mass distribution of vaccines: 1) prioritization based on age alone (blue bars) and 2) prioritization based on age and neighbourhood of residence (orange bars). The brackets above the bar graphs report the relative difference (%) in prevented outcomes between the two strategies for mass distribution of vaccines. See Table 1 below for the number of projected events associated with the different distribution strategies.

Advisory Table, its Working Groups, and its partners.

Summary

Background

Ontario is currently in the initial stages of its COVID-19 vaccine distribution plan, which involves the vaccination of 1.5-million high-risk individuals. Rapidly immunizing those at the greatest risk of acquiring SARS-CoV-2 infection and experiencing hospitalization, ICU admission and death from COVID-19 outside of specific high-risk groups will continue to be important in the Ontario's subsequent mass distribution stages of vaccine, especially in the face of limited vaccine supply and with the emergence of variants of concern.

Questions

Which Ontario age groups and neighbourhoods have experienced the highest incidence of SARS-CoV-2 infection and hospitalizations, ICU admissions and deaths due to COVID-19?

What is the potential impact of an Ontario mass distribution strategy for COVID-19 vaccines that explicitly takes both age and neighbourhood of residence into account?

Findings

COVID-19 deaths and hospitalizations are strongly associated with individuals' age and neighbourhood of residence. As of January 16, 2021, 50% of Ontario COVID-19 deaths, outside of LTC and retirement homes, have occurred in just 4% of the population aged 16 years or above. Similarly, 50% of hospitalizations were concentrated in just 11% of the population aged 16 years or above. The highest risk populations can be reliably identified using information on individuals' age and neighbourhood of residence.

Projections indicate that a vaccine strategy prioritizing both age and neighbourhood would prevent an additional 3,767 cases of SARS-CoV-2 infection, and 702 hospital admissions, 145 ICU admissions, and 168 deaths from COVID-19 as compared to a strategy that prioritizes based on age alone.

Interpretation

A mass vaccine distribution strategy that prioritizes individuals based on both their age and neighbourhood of residence can reduce cases of SARS-CoV-2 infection, and hospitalizations, ICU admissions, and deaths due to COVID-19, and will also directly address the inequitable impact of COVID-19 on disadvantaged populations in Ontario.

The number of events prevented by this strategy will further increase in the context of vaccine scarcity, with increasing duration of the vaccine rollout, if the daily incidence of SARS-CoV-2 cases increases, if vaccination not only protects against symptomatic COVID-19, but also against asymptomatic infection and transmission, and if an age-based strategy is inequitable, resulting in higher vaccination rates in wealthier neighbourhoods, as currently observed in the United States.

AS

Background

COVID-19 has taken a disproportionate toll on older adults and residents of disadvantaged urban neighbourhoods in Ontario. More than 95% of Ontario's COVID-19 deaths have occurred among individuals aged 60 years and older, and the COVID-19 case fatality rate is more than 100 times higher in individuals aged 80 years and older, as compared to individuals under 40 years of age.[1] The incidence of SARS-CoV-2 infection is also disproportionately higher in urban neighbourhoods, especially in those with higher concentrations of essential workers, crowded housing, multigenerational family households, visible minorities and individuals with lower socioeconomic status.[2] Recent evidence from the United States suggests that the mass distribution of the COVID-19 vaccine—which has largely used an age-based prioritization framework—has been inequitable, with higher vaccination rates in wealthier neighbourhoods, which also have lower incidences of SARS-CoV-2 infections and COVID-19 deaths.[3,4] This has led to calls to consider prioritizing vaccine distribution based on both age *and* residence in neighbourhoods most severely affected by COVID-19.[5,6]

Ontario is currently in the initial stages of its COVID-19 vaccine distribution plan, which involves the vaccination of 1.5-million high-risk individuals, including residents, staff and caregivers of residents in congregate care settings; frontline healthcare workers; adults in First Nations, Métis, and Inuit populations; adult chronic home care recipients; and people aged 80 years or older. Rapidly immunizing those at the greatest risk of acquiring SARS-CoV-2 infection and experiencing hospitalization, ICU admission and death from COVID-19 outside of specific high-risk groups will continue to be important in the subsequent mass distribution stages, especially in the face of limited vaccine supply and the emergence of variants of concern.[7] This approach will minimize deaths and long-term morbidity, and maintain health care system capacity.

Questions

Which Ontario age groups and neighbourhoods have experienced the highest incidence of SARS-CoV-2 infection and hospitalizations, ICU admissions and deaths due to COVID-19?

What is the potential impact of a mass distribution strategy for COVID-19 vaccines that explicitly takes both age and neighbourhood of residence into account?

Findings

Retrospective Analysis

To date, Ontario neighbourhoods with the highest cumulative incidence of SARS-CoV-2 infections are in Toronto, Peel, York, and Windsor-Essex regions (Figures 2 and 3).

AS

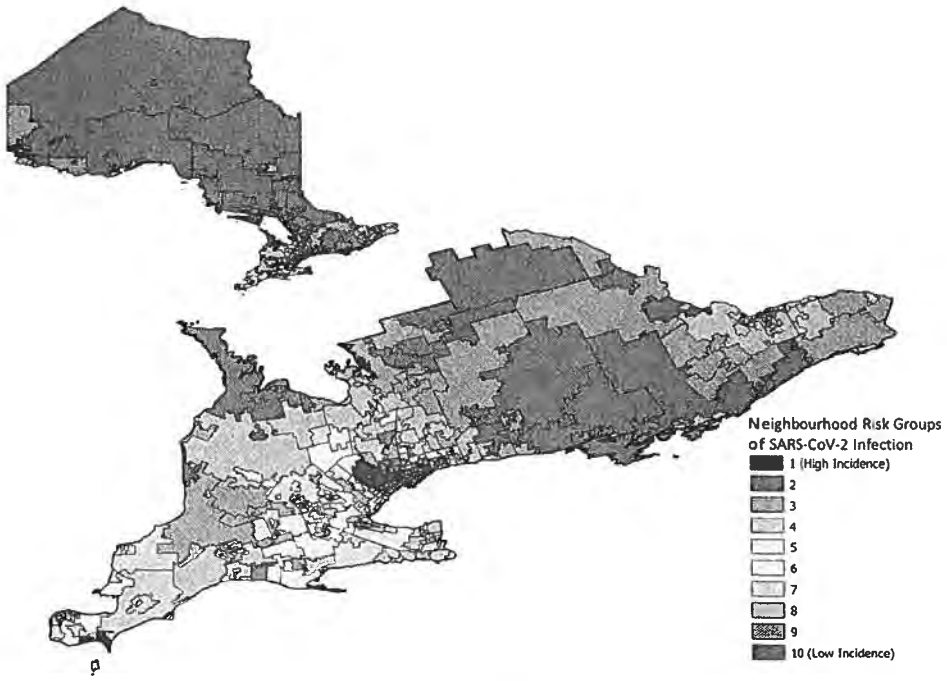


Figure 2. Incidence of SARS-CoV-2 Infections in 516 Ontario Neighbourhoods, January 23, 2020 to January 16, 2021
Neighbourhoods ranked in 10% increments by cumulative incidence of SARS-CoV-2 infection between Jan 23, 2020 and Jan 16, 2021. Each group represents 10% of the Ontario population (~1.5 million inhabitants). Neighbourhoods are defined by the first three digits of a resident's postal code (also known as "forward sortation area"). A total of 509 neighbourhoods were analyzed. Group 1 includes neighbourhoods with the highest cumulative incidence of SARS -CoV-2 infection, whereas group 10 includes neighbourhoods with the lowest cumulative incidence of SARS-CoV-2 infection. Data sourced from the Public Health Case and Contact Management Solution and other case management systems (CCM plus), extracted on January 16, 2021.

As of January 16, 2021, 1,758 Ontarians have died of COVID-19 outside of long-term care (LTC) and retirement homes. Of these deaths, 21% occurred in Ontario neighbourhoods ranked in the top 10% of SARS-CoV-2 infection rates, while 49% of deaths occurred in individuals aged 80 years and older.

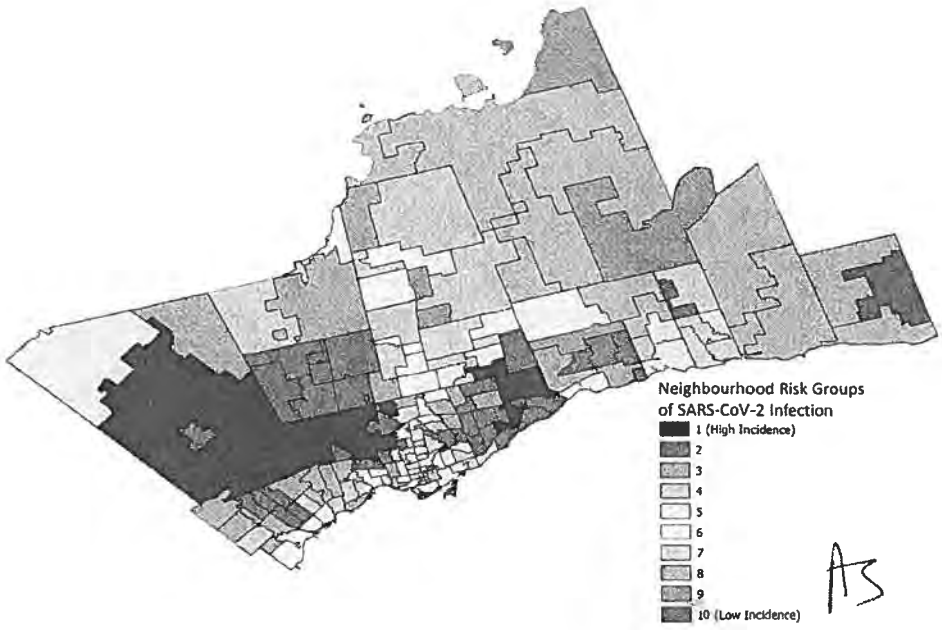


Figure 3. Incidence of SARS-CoV-2 Infection in 180 Greater Toronto Area Neighbourhoods, January 23, 2020 to January 16, 2021
Neighbourhoods ranked in 10% increments by cumulative incidence of SARS-CoV-2 infection between Jan 23, 2020 and Jan 16, 2021. Neighbourhoods are defined by the first three digits of a resident's postal code (also known as forward sortation area). A total of 180 neighbourhoods are presented. Group 1 includes neighbourhoods with the

highest incidence of SARS-CoV-2 infections, whereas group 10 includes neighbourhoods with the lowest incidence of SARS-CoV-2 infections. Data sourced from the Public Health Case and Contact Management Solution and other case management systems (CCM plus), extracted on January 16, 2021.

COVID-19 deaths are strongly associated with an individual's age and neighbourhood of residence. As of January 16, 2021, 50% of Ontario COVID-19 deaths, outside of LTC and retirement homes, have occurred in just 4% of the population aged 16 years or above. These are represented by the 10 lighter coloured cells in the upper left corner of Figure 4 with an incidence of more than 85 deaths per 100,000 residents.

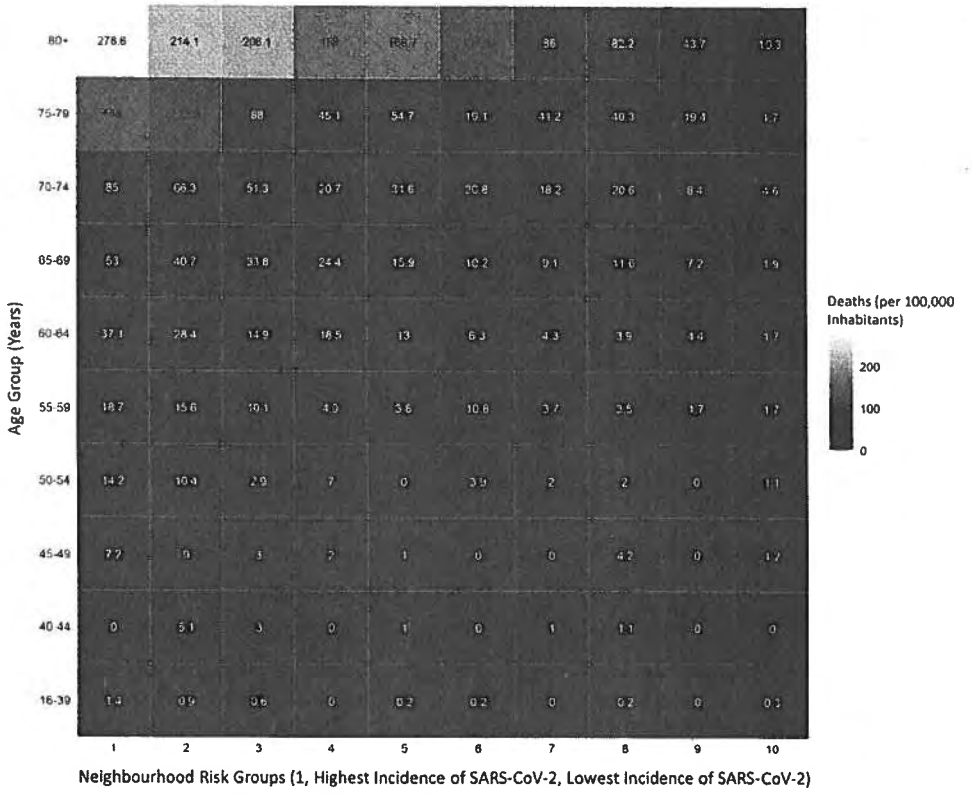


Figure 4. Incidence of COVID-19 Deaths by Age and Neighbourhood in Ontario, January 23, 2020 to January 16, 2021
COVID-19 deaths by age and neighbourhood in Ontarians living outside of LTC and retirement homes from January 23, 2020 to January 16, 2021. COVID-19 deaths occurred predominantly in older adults residing in neighbourhoods with the highest cumulative incidence of SARS-CoV-2 infection. Over 50% of deaths occurred in 4% of the population, presented in the 10 cells in the upper left corner of the figure with incidence of more than 85 deaths per 100,000 inhabitants. Data sourced from the Public Health Case and Contact Management Solution and other case management systems (CCM plus), extracted on January 16, 2021; neighbourhood population from the Registered Persons Database (RPDB).

COVID-19 hospitalizations are also strongly associated with an individual's age and neighbourhood of residence, with 50% of hospitalizations concentrated in 11% of the population aged 16 years or above. These are represented by the 22 lighter coloured cells with more than 160 hospitalizations per 100,000 inhabitants at the top left corner of Figure 5.

AS

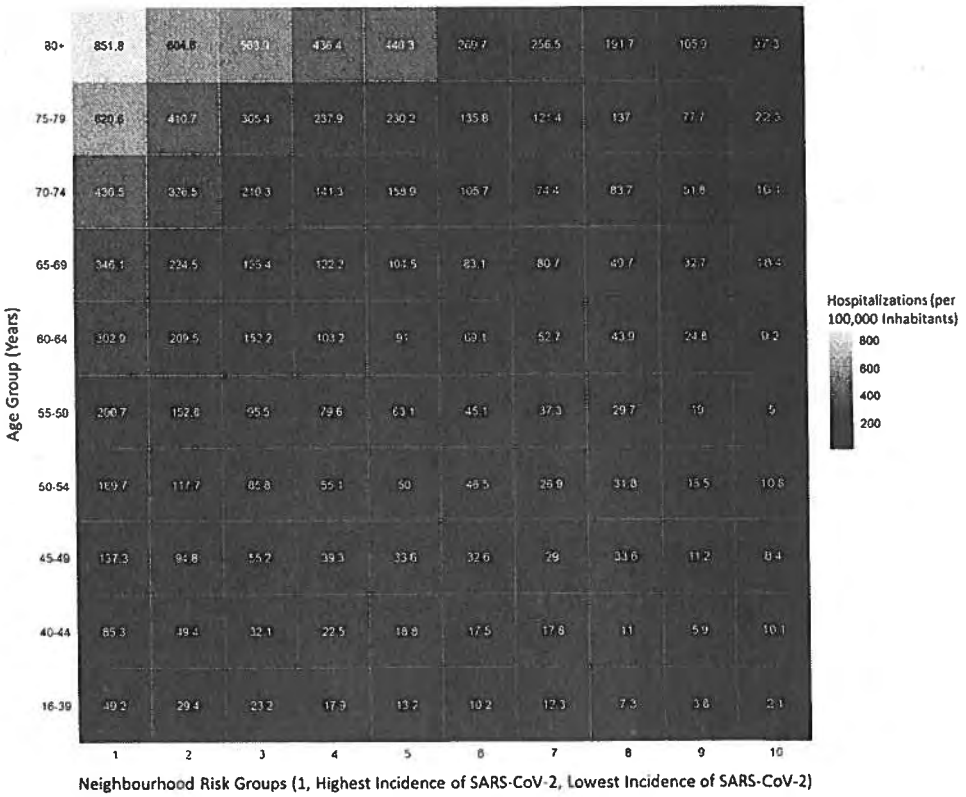


Figure 5. Incidence of Hospitalizations for COVID-19 by Age and Neighbourhood of Residence in Ontario, from January 23, 2020 to January 16, 2021

Incidence of COVID-19 hospitalizations by age and neighbourhood in Ontarians living outside of LTC and retirement homes from January 23, 2020 to January 16, 2021. COVID-19 hospitalizations occurred predominantly in older adults residing in neighbourhoods with the highest cumulative incidence of SARS-CoV-2 infection. Over 50% of hospitalizations occurred in approximately 11% of the population, represented by the 22 cells in the upper left corner of the figure with an incidence more than 160 hospitalizations per 100,000 inhabitants. Data sourced from the Public Health Case and Contact Management Solution and other case management systems (CCM plus), extracted on January 16, 2021; neighbourhood population from the Registered Persons Database (RPDB).

Vaccination Strategy Using Age and Neighbourhood-Based Prioritization

In view of the retrospective analysis above, an effective mass vaccine distribution strategy for Ontario should identify people with the highest priority for COVID-19 vaccination based on their age and the neighbourhood they reside in. This will prevent the largest number of deaths and hospitalizations due to COVID-19.

Figure 6 shows the number of deaths or hospitalizations due to COVID-19 that have occurred in Ontarians living outside of LTC and retirement homes between January 23, 2020 and January 16, 2021, which could be used as a blueprint to identify the highest priority individuals for vaccine distribution. There is a 380-fold difference in the frequency of COVID-19 deaths or hospitalizations between the oldest individuals living in neighbourhoods with the highest incidence of SARS-CoV-2 (top left cell of Figure 6), and the youngest individuals living in neighbourhoods with lowest incidence of SARS-CoV-2 (bottom right cell of Figure 6). Additional analyses indicates that the past occurrence of events shown in Figure 6 is highly predictive of the risk of future events in the same neighbourhoods (data available upon request).

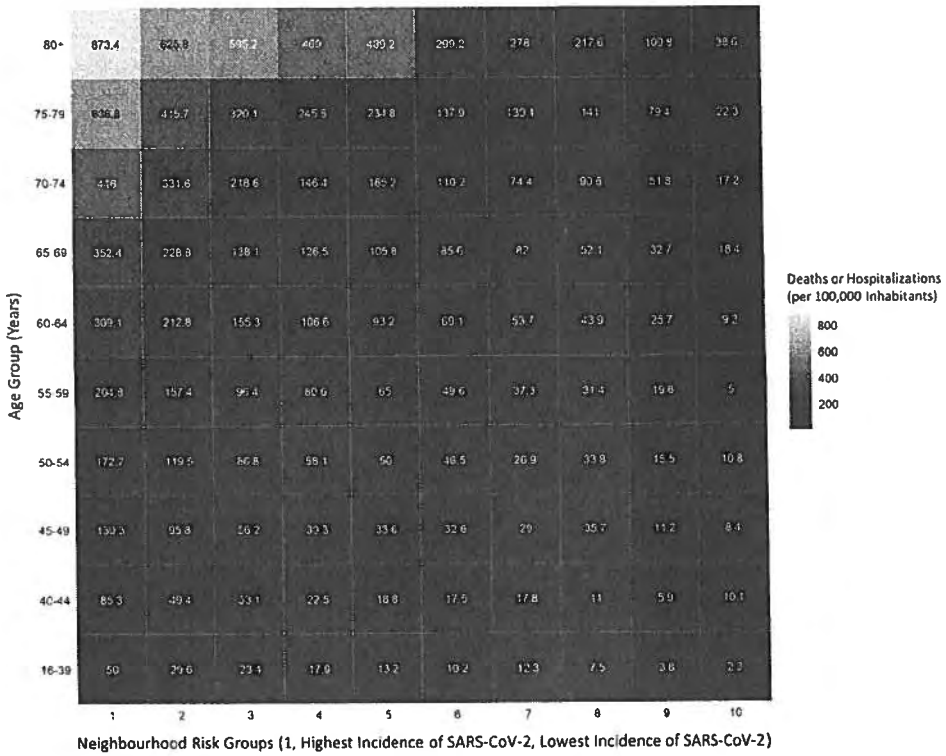


Figure 6. Incidence of COVID-19 Deaths or Hospitalizations by Age and Neighbourhood of Residence in Ontario, from January 23, 2020 to January 16, 2021

Incidence of COVID-19 deaths or hospitalizations by age and neighbourhood in Ontarians living outside of LTC and retirement homes. COVID-19 deaths or hospitalizations occurred predominantly in older adults residing in neighbourhoods with the highest cumulative incidence of SARS-CoV-2 infection. There is a 380-fold difference in the frequency of COVID-19 deaths or hospitalizations between the population 80 years of age and above living in the highest incidence neighbourhoods (top left cell) and the population between 16 and 39 years of age living in the lowest incidence neighbourhoods (bottom right cell). Data sourced from the Public Health Case and Contact Management Solution and other case management systems (CCM plus), extracted on January 16, 2021; neighbourhood population from the Registered Persons Database (RPDB).

Prioritizing mass vaccine distribution based on both age and neighbourhood of residence will ensure that Ontarians at the highest risk of SARS-CoV-2 infection, hospitalization, or death due to COVID-19 will be the first to receive vaccines. Within each neighbourhood risk group, the age cut-offs for priority of vaccination can be selected depending on the observed risk of death or hospitalization due to COVID-19. Cut-offs of 400, 300, 200 and 100 deaths or hospitalizations per 100,000 inhabitants can be used in descending order to sequentially identify age cut-offs for priority vaccination. Figure 7 is a 3-dimensional representation of the differences in the risk of COVID-19 deaths or hospitalizations observed across age bands and neighbourhood risk groups.

AS

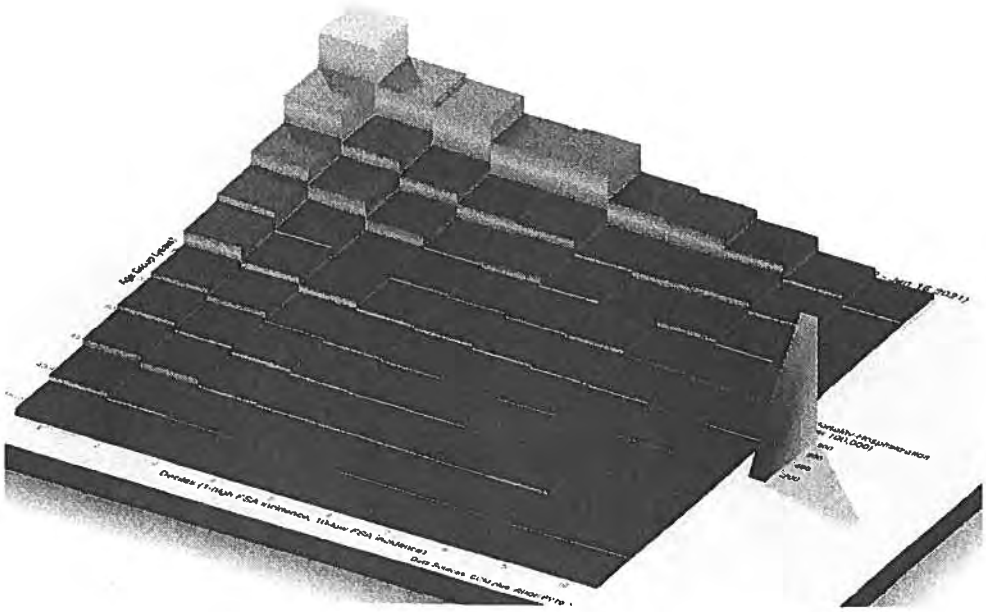


Figure 7. 3-Dimensional Representation of the Differences in the Risk of COVID-19 Deaths or Hospitalizations by Age and Neighbourhood of Residence in Ontario, from January 23, 2020 to January 16, 2021

Risk of COVID-19 deaths or hospitalizations by age and neighbourhood in Ontarians living outside of LTC and retirement homes. COVID-19 deaths or hospitalizations occurred predominantly in older adults, especially those residing in neighbourhoods with the highest cumulative incidence of SARS-CoV-2 infection. Data sourced from the Public Health Case and Contact Management Solution and other case management systems (CCM plus), extracted on January 16, 2021; neighbourhood population from the Registered Persons Database (RPDB). See Figure 6 for explanations.

Figure 8 presents projections after most of Ontario moved back to the colour coded COVID-19 response framework for public health measures.[8] The scenario takes into account that all Ontario regions had schools return to in-class learning, and all except for Toronto, Peel and North Bay-Parry Sound lifted some of their public health restrictions by February 22, 2021, in accordance with the framework.[8] It assumes that the current effective reproduction number (R_t) for the traditional variants originally identified in Wuhan, China, is 1.00 (estimate on February 24, 2021), and that it will gradually increase over 3 weeks to 1.09 (the average R_t found for traditional variants during the first 3 weeks of December 2020). The scenario also assumes that Ontario will return to a province-wide lockdown with a stay-at-home order on March 10, 2021, due to early signs of surging SARS-CoV-2 infections as the more transmissible B.1.1.7 variant, which was first identified in the United Kingdom, becomes the dominant variant in the province.[9]

AS

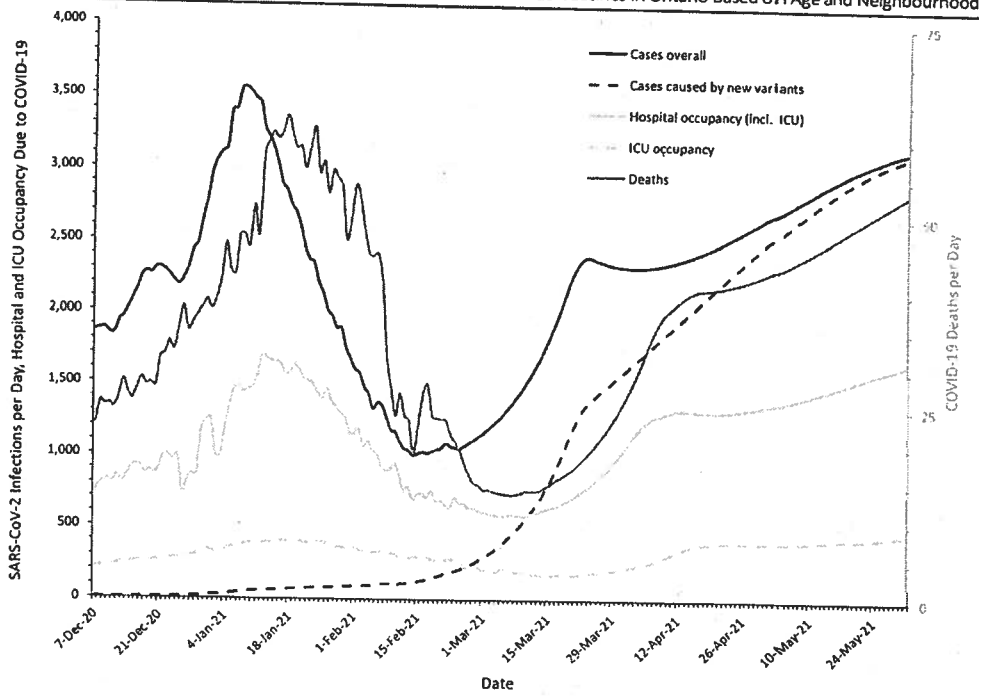


Figure 8. Actual and Projected SARS-CoV-2 Infections Overall and from the B.1.1.7 Variant, Hospital Occupancy, ICU Occupancy, and Deaths from COVID-19 in Ontario, from December 7, 2020, to May 31, 2021, assuming that a province-wide lockdown with a stay-at-home order will be re-introduced on March 10, 2021

Line graphs presenting the actual and projected rolling 7-day average of SARS-CoV-2 infections overall and due to the B.1.1.7 variant, and COVID-19 hospital occupancy, ICU occupancy, and deaths in Ontario, from December 7, 2020, to May 31, 2021. Note that the scales for SARS-CoV-2 infections, and COVID-19 hospital and ICU occupancy (left) and for COVID-19 deaths per day (right) are different. Outcomes are projected for the period between February 25 and May 31, 2021 under the assumption that no additional vaccination will be administered to Ontarians, except for those administered by February 24, 2021 to residents, staff and caregivers of congregate care settings, frontline healthcare workers, adults in First Nations, Métis, and Inuit populations, and adult chronic home care recipients, and that there will be a province-wide lockdown with a stay-at-home order re-introduced on March 10, 2021. See results section above and methods section below for full assumptions used for the projections.

Figure 9 shows the projected cumulative number of hospitalizations (Panel A), ICU admissions (Panel B) and deaths (Panel C) between March 1 and May 31, 2021 in Ontario under 3 scenarios. In Scenario 1, no additional vaccines are administered to Ontarians, except for those high-risk individuals vaccinated by February 24, 2021.[8,10] In Scenario 2, 1.3 million Ontarians are vaccinated between March 1 and May 20, 2021, using a prioritization framework based on age alone; this scenario assumes equal administration of vaccines across all Ontario neighbourhoods. In Scenario 3, 1.3 million Ontarians being vaccinated between March 1 and May 20, 2021, using a prioritization framework based on both age and neighbourhood.

Table 1 presents estimates of the projected outcomes for all 3 scenarios. The cumulative projected number of events between March 1 and May 31, 2021 is consistently lower with a strategy for the mass distribution of vaccines that prioritizes based on both age and neighbourhood of residence as compared to either a scenario of no additional vaccination beyond February 24, 2021 or a vaccination strategy that prioritizes based on age alone. A vaccine strategy prioritizing both age and neighbourhood will prevent a projected additional 3,767 cases of SARS-CoV-2 infection, 702 hospitalizations, 145 ICU admissions, and 168 deaths from COVID-19 as compared to a strategy that prioritizes based on age alone (Table 1).

A3

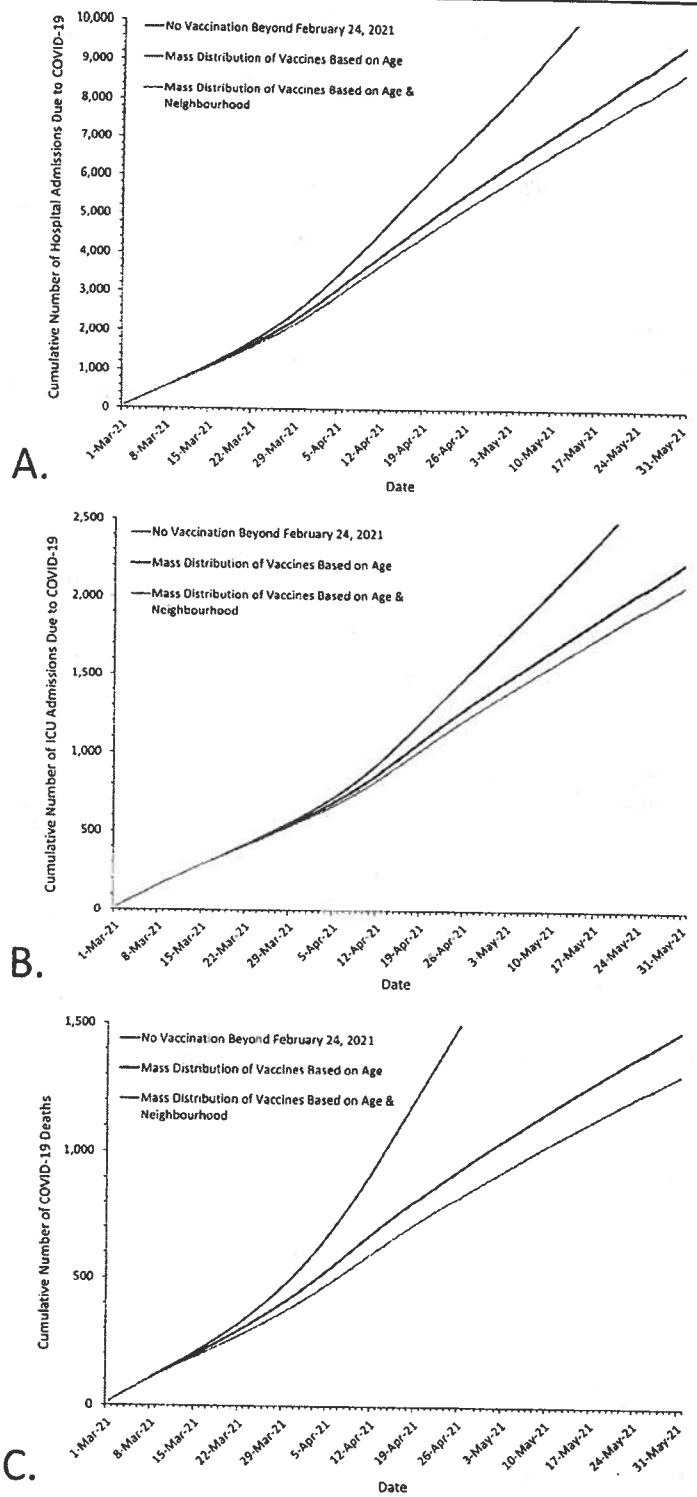


Figure 9. Cumulative Number of Hospitalizations, ICU Admissions and Deaths occurring between March 1 and May 31, 2021 under 3 Vaccine Mass Distribution Scenarios

Projected cumulative number of hospitalizations (Panel A), ICU admissions (Panel B) and deaths (Panel C) occurring between March 1 and May 31, 2021, under 3 vaccine mass distribution scenarios. No vaccination refers to the control scenario of no additional vaccines being administered to Ontarians, except for those high-risk individuals vaccinated by February 24, 2021 (residents, staff and caregivers of congregate care settings for older adults, frontline healthcare workers, adults in First Nations, Métis, and Inuit populations, and adult chronic home care recipients). Mass distribution of vaccines based on age refers to a scenario of 1.3 million Ontarians being vaccinated between March 1 and May 20, 2021, using a prioritization framework for mass immunization based on age alone; this scenario assumes equal administration of vaccines across all Ontario neighbourhoods. Mass distribution of vaccines based on age & neighbourhood refers to a scenario of 1.3 million Ontarians being vaccinated between March 1 and May 20, 2021, using a prioritization framework based on both age and neighbourhood. See Figure 7 for base scenario.

	No additional vaccination beyond February 24, 2021	Vaccine distribution based on age alone	Vaccine distribution based on age and neighbourhood
SARS-CoV-2 infections	221,729	214,717	210,950
COVID-19 hospitalizations	13,414	9,460	8,758
COVID-19 ICU admissions	2,981	2,232	2,087
COVID-19 deaths	3,152	1,474	1,306

Table 1. Cumulative projected SARS-CoV-2 cases, COVID-19 hospitalizations, ICU admissions and deaths in Ontario between February 17-May 31, 2021 under three scenarios: 1) no additional vaccination beyond February 24, 2021, 2) vaccine distribution prioritizing age alone, and 3) vaccine distribution prioritizing age and neighbourhood.
Note that the estimates for the vaccine distribution strategy based on age alone assume equal administration of vaccines across all Ontario neighbourhoods. This assumption will likely underestimate the number of events, as experience in the United States suggests, that residents of socioeconomically deprived neighbourhoods at high risk of COVID-19 are less likely than residents of socioeconomically advantaged neighbourhoods at low risk of COVID-19 to receive the vaccine.[3–6]

Interpretation

As of January 16, 2021, 50% of Ontario COVID-19 deaths, outside of LTC and retirement homes, have occurred in just 4% of the population aged 16 years or above. These are represented by the 10 lighter coloured cells in the upper left corner of Figure 4 above. In addition, 50% of hospitalizations have occurred in 11% of the population aged 16 years or above. These are represented by the 22 lighter coloured cells in the top left corner of Figure 5 above. These high risk populations are defined by a combination of an individual's age and neighbourhood of residence.

A strategy for the mass distribution of COVID-19 vaccines that prioritizes people based on both their age and neighbourhood of residence can reduce cases of SARS-CoV-2 infection, COVID-19 hospitalizations, ICU admissions, and deaths, and will also directly address the inequitable impact of COVID-19 on disadvantaged populations in Ontario.

The age and neighbourhood prioritization strategy is intended to guide the mass distribution of COVID-19 vaccines to the general population.[7] The prioritization strategy needs to be combined with efforts to promote equitable administration of COVID-19 vaccines. This includes partnering with trusted community organizations and leaders to promote vaccine awareness and uptake. Simple registration procedures are essential, including options that do not require the internet or digital platforms, such as phone-based or in-person registration. Registration also needs to be accessible to those with limited English or French language proficiency, poor literacy, and those with cognitive or sensory impairments. Additional options that do not require pre-registration or government-issued identification are important. Vaccination centres should be located in local community centers, schools, houses of worship, or other highly frequented and trusted sites in the community. Centres should be accessible and located near public transportation. Hours of operation should extend beyond standard business hours. Mobile outreach options are required for individuals who cannot access vaccination centres due to mobility, transportation or other barriers.[3–6]

Importantly, the suggested mass distribution strategy would not interfere with the ongoing vaccination of any specific high-risk population prioritized for initial receipt of COVID-19 vaccines,[11] including residents, staff and caregivers in congregate care settings; frontline healthcare workers; adults in First Nations, Métis, and Inuit populations; adult chronic home care recipients; and people aged 80 years or older irrespective of their neighbourhood of residence.

The strategy will also not interfere with Ontario's planned vaccination of high-risk populations prioritized for subsequent receipt of COVID-19 vaccines, including people who live and work in high-risk congregate settings (e.g., shelters, community

living), individuals with high-risk chronic conditions and their caregivers, other specific populations and communities beyond those identified in this strategy facing barriers related to the social determinants of health who are at greater risk of COVID-19, and frontline essential workers, including first responders, teachers and other education staff and the food processing industry.[11–13] Age cut-offs could be used for the prioritization of high-risk essential workers who have similar risk of exposure to residents of high incidence neighbourhoods, regardless of their neighbourhood of residence, but based on their place of work (Figure 6).

Differences between a mass vaccine distribution strategy that prioritizes people based on both their age and neighbourhood of residence and a strategy based on age alone will become larger in the context of vaccine scarcity, with increasing duration of the vaccine rollout beyond May 31, 2021, if the daily incidence of SARS-CoV-2 cases increases, if vaccination also protects against asymptomatic infection and transmission,[14] and if an age-based strategy is inequitable, resulting in higher vaccination rates in wealthier neighbourhoods, as currently observed in the United States.[3,4]

Methods Used for This Science Brief

We conducted a population-level retrospective cohort study and developed a data-driven predictive model of the potential impacts of different strategies for the mass distribution of COVID-19 vaccines in Ontario. All analyses were based on SARS-CoV-2 cases, COVID-19 hospitalizations, and COVID-19 death data retrieved from the Public Health Case and Contact Management Solution and other case management systems (CCM plus) reported between January 23, 2020 and January 16, 2021. Cases in LTC and retirement homes were excluded. Neighbourhood of residence was defined by 526 unique forward sortation areas (FSAs), the first 3 digits of a resident's postal code. FSAs with less than 1,000 residents were merged with adjacent neighbourhoods to ensure accurate prediction of SARS-CoV-2 incidence, yielding 509 unique neighbourhoods. Age-specific population data by FSA were obtained from the Registered Persons Database (RPDB) Fiscal Year 2019/2020.

Age was classified into 10 age bands (16-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, and ≥80 years of age). Neighbourhood cumulative SARS-CoV-2 incidence was classified into 10 neighbourhood risk groups with equal populations based on the observed cumulative incidence of SARS-CoV-2 infection from the beginning of the COVID-19 pandemic (January 23, 2020) until January 16, 2021. The combination of the 10 age bands and 10 neighbourhood risk groups resulted in a matrix of 100 cells. For each cell, we calculated the rate of COVID-19 deaths, the rate of COVID-19 hospitalizations and the rate of the composite of COVID-19 hospitalizations or deaths due to COVID-19 per 100,000 inhabitants using the Public Health Case and Contact Management Solution and other case management systems (CCM plus). This data has demonstrated accuracy in identifying deaths and hospitalizations among COVID-19 cases in Ontario.[15]

We evaluated three scenarios: (1) an assumption that no additional vaccines would be administered to Ontarians, except for those administered by February 24, 2021 to residents, staff and caregivers in congregate care settings for older adults, frontline healthcare workers, adults in First Nations, Métis, and Inuit populations, and adult chronic home care recipients (control scenario); (2) an assumption that 2.2 million vaccine doses would be administered to 1.3 million Ontarians over a 13-week period between March 1 and May 31, 2021 with vaccination of 100,000 people per week, prioritizing by age based on the above 10 age bands; (3) an assumption that 2.2 million vaccine doses would be administered to 1.3 million

Ontarians over a 13-week period between March 1 and May 31, with vaccination of 100,000 people per week, prioritizing by both age and neighbourhood of residence based on the 100 cells shown in Figure 6. For the third scenario, vaccination priority was based on the ranked incidence rate per 100,000 inhabitants of the composite outcome of hospitalization or death due to COVID-19.

We assumed that all Ontarians received mRNA-based vaccines, which as of February 25, 2021, are the only COVID-19 vaccines currently approved by Health Canada. Based on trial data, we defined COVID-19 vaccine efficacy to be 0% in the week after the first dose, 70% in week 2 post-vaccination, 85% in weeks 3-4 post vaccination, 90% in week 5 post-vaccination, and 95% thereafter.[16] We assumed that all vaccinated individuals received the second vaccine dose within approved schedules,[17] and that there were no indirect vaccine effects (i.e. we assumed no herd immunity effects).[16,18]

We modelled the effectiveness of prioritization strategies in scenarios 2 and 3 as compared with control scenario 1 using public health surveillance data limited to the second wave of the COVID-19 pandemic, from September 1, 2020 to January 16, 2021. These analyses yielded daily projections for the entire 13-week vaccination period, from March 1 to May 31, 2021, and allowed us to estimate daily rate ratios comparing scenarios 2 and 3 with control scenario 1. The modelling process had five steps and was based on regression models that were fit using the gamm4 package in R.

First, a regression model of predicted baseline incidence of SARS-CoV-2 infections was developed. The prospective model estimated the predicted SARS-CoV-2 incidence in all Ontario neighbourhoods as a function of cumulative incidence from the onset of the pandemic (January 23, 2020) until January 9, 2021. The prediction model was based on a dataset of weekly neighbourhood SARS-CoV-2 incidence, using a logistic count regression model. The model had a random intercept to account for variation between neighbourhoods, and a penalized spline for time. Based on this model, we estimated SARS-CoV-2 incidence deciles. Second, we predicted the incidence of SARS-CoV-2 infections across the 100 cells defined by neighbourhood risk and age band, using a tensor spline for the interaction of neighbourhood risk and age.[19] Third, we developed logistic count regression models for the risk of COVID-19 hospitalization and death, among SARS-CoV-2 cases, which yielded the probability of an event given case status. Fourth, we sorted cells defined by age bands and neighbourhood risk groups from most to least likely to experience the composite outcome of COVID-19 hospitalization or death. Based on this ranking we sequentially determined, from March 1, 2021 onwards, the Ontarians prioritized to receive the first dose of the COVID-19 vaccine each week, followed by the second dose within approved schedules. Fifth, we projected the incidence forward based on baseline SARS-CoV-2 incidence in risk group x age bands, and age band specific vaccination levels and estimated daily rate ratios for scenario 2 as compared with control scenario 1, and for scenario 3 as compared with control scenario 1.

Then, we used a deterministic, non-mechanistic model to project daily updated plausible estimates of the incidence of COVID-19 cases and deaths, and of hospital and ICU occupancy due to COVID-19 between February 25 and May 31, 2021, using the following assumptions: First, there would be a linear increase in the log of the effective reproduction number R_t for the traditional variant, originally identified in Wuhan, China, associated with school openings and opening of the province from log(1.00) as estimated on February 24, 2021, to log(1.09) three weeks later, with 1.09 reflecting the geometric mean R_t observed in Ontario for traditional variants during the 3 weeks between December 1 and December 21, 2020. Second, the province would go back into a lockdown with a province-wide stay-at-home order

starting on March 10, 2021, which would result in a decrease of R_t for the traditional variants to 0.82 starting on March 20, 2021, 10 days after the lockdown. An R_t of 0.82 reflects the geometric mean found for the traditional variants during the 3 weeks between January 15 and February 4, 2021. Fourth, the B.1.1.7 variant would be 40% more transmissible than traditional variants and would continue to follow a logarithmic growth curve with a doubling time for the odds of 11.3 days, as observed between January 21 and February 24, 2021. We conservatively assumed that this doubling time would remain constant over time and would not be shortened by school openings and the opening of the province. Fifth, daily hospital occupancy (including ICU) from COVID-19 would be 5.7% of daily active cases, with 5.7% reflecting the mean percentage observed between December 24, 2020, and February 24, 2021, with an assumed time lag of 10 days between daily active cases and daily hospital occupancy, and a mean duration of 10 days for cases to be considered active. Sixth, daily ICU occupancy would be at 30.5% of hospital occupancy due to COVID-19, the mean percentage observed between December 8, 2020, and February 24, 2021, with a time lag of 10 days between daily hospital occupancy and daily ICU occupancy. Seventh, daily deaths caused by the traditional variants would be at 0.14% of daily active cases, which reflects the mean percentage observed during the three weeks between February 1 and February 21, 2021, after the vaccine distribution in LTC and retirement homes became partially effective, and the assumption that deaths would be further reduced by 10% once the vaccine distribution in LTC and retirement homes became fully effective. Seventh, there would be a relative increase in mortality of 30% associated with the B.1.1.7 variant as compared with the traditional variants. Eighth, R_t would be modified by seasonal changes in accordance with the inverse pattern observed in Ontario between August 1 and December 31, 2020, resulting in a progressive reduction of $\log(R_t)$ between March 1 and May 31, 2021.[20]

We multiplied the daily estimates of incidence of SARS-CoV-2 infections, hospital occupancy and deaths from COVID-19 with the daily rate ratios derived for scenarios 2 and 3 for vaccine distribution, and derived cumulative incidence curves of deaths, hospitalizations and ICU admissions, and the cumulative numbers of SARS-CoV-2 cases, and COVID-19 hospitalizations, ICU admissions, and deaths between March 1 and May 31, 2021.

Author Contributions

KAB and PJ conceived of the Science Brief. KAB, NMS, and PJ wrote the first draft. EJ, TVI, SB, PJ, and KAB conducted the analysis. All authors contributed to the interpretation of analyses, revised the Science Brief critically for important intellectual content and approved the final version.

The authors would like to thank Carmen Kong for creating the maps presented in this Science Brief.

References

1. Bonanad C, García-Blas S, Tarazona-Santabalbina F, et al. The Effect of Age on Mortality in Patients With COVID-19: A Meta-Analysis With 611,583 Subjects. *J Am Med Dir Assoc.* 2020;21(7):915-918. https://doi.org/10.1016/j.jamda.2020.05.045

2. van Ingen T, Brown KA, Buchan SA, Akingbola S, Daneman N, Smith BT. *Neighbourhood-Level Risk Factors of COVID-19 Incidence and Mortality.* Epidemiology; 2021. https://doi.org/10.1101/2021.01.27.21250618

3. Salmon D, Opel DJ, Dudley MZ, Brewer J, Breiman R. Reflections On Governance, Communication, And Equity: Challenges And Opportunities In COVID-19 Vaccination: Article examines the engagement and communication steps necessary to strengthen the COVID-19 vaccine roll out by federal, state, and local governments. *Health Aff (Millwood)*. Published online February 4, 2021:10.1377/hlthaff. https://doi.org/10.1377/hlthaff.2020.02254
4. Bachireddy C, Dar M, Chen C. Medicaid and COVID-19 Vaccination—Translating Equitable Allocation Into Equitable Administration. *JAMA Health Forum*. 2021;2 (2):e210114. https://doi.org/10.1001/jamahealthforum.2021.0114
5. Jean-Jacques M, Bauchner H. Vaccine Distribution—Equity Left Behind? *JAMA*. Published online January 29, 2021. https://doi.org/10.1001/jama.2021.1205
6. Bibbins-Domingo K, Petersen M, Havlir D. Taking Vaccine to Where the Virus Is—Equity and Effectiveness in Coronavirus Vaccinations. *JAMA Health Forum*. 2021;2(2):e210213. https://doi.org/10.1001/jamahealthforum.2021.0213
7. Government of Ontario. COVID-19 vaccination update. Technical Briefing presented at the: January 13, 2021; Ontario. Accessed January 19, 2020. https://files.ontario.ca/moh-covid-19-vaccine-technical-briefing-en-january-13-2021-2021-01-13.pdf
8. Government of Ontario. COVID-19 response framework: keeping Ontario safe and open. Ontario.ca. Published January 14, 2021. Accessed December 6, 2020. https://www.ontario.ca/page/covid-19-response-framework-keeping-ontario-safe-and-open
9. Brown KA, Gubbay J, Hopkins J, et al. Rapid Rise of S-Gene Target Failure and the UK variant B.1.1.7 among COVID-19 isolates in the Greater Toronto Area, Canada. *medRxiv*. Published online February 12, 2021:2021.02.09.21251225. https://doi.org/10.1101/2021.02.09.21251225
10. Stall NM, McGeer A, Maltsev A, et al. The impact of the speed of vaccine rollout on COVID-19 cases and deaths in Ontario long-term care homes. *Sci Briefs Ont COVID-19 Sci Advis Table*. 2021;2(8). https://doi.org/10.47326/ocsat.2021.02.08.1.0
11. Government of Ontario. Getting a COVID-19 vaccine in Ontario. COVID-19 (coronavirus) in Ontario. Published 2021. Accessed February 17, 2021. https://covid-19.ontario.ca/getting-covid-19-vaccine-ontario
12. 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 October 2020. *medRxiv*. Published online January 22, 2021:2021.01.21.21250266. https://doi.org/10.1101/2021.01.21.21250266
13. Murti M, Achonu C, Smith BT, et al. COVID-19 Workplace Outbreaks by Industry Sector and their Associated Household Transmission, Ontario, Canada, January – June, 2020. *medRxiv*. Published online November 30, 2020:2020.11.25.20239038. https://doi.org/10.1101/2020.11.25.20239038
14. Amit S, Regev-Yochay G, Afek A, Kreiss Y, Leshem E. Early rate reductions of SARS-CoV-2 infection and COVID-19 in BNT162b2 vaccine recipients. *The Lancet*. 2021;0(0). https://doi.org/10.1016/S0140-6736(21)00448-7
15. Chung H. Validation of COVID-19 Outcomes in Public Health Surveillance Data using Health Administrative Databases. Published online October 21, 2020.
16. Jüni P, Tuite AR, Bogoch II, et al. Rollout strategy for the Pfizer-BioNTech COVID-19 vaccine in Ontario. *Sci Briefs Ont COVID-19 Sci Advis Table*. 2021;2(6). https://

doi.org/10.47326/ocsat.2021.02.06.1.0

17. Public Health Agency of Canada. Recommendations on the use of COVID-19 vaccines. Published December 14, 2020. Accessed February 11, 2021. https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines.html
18. Polack FP, Thomas SJ, Kitchin N, et al. Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. *N Engl J Med*. 2020;383(27):2603-2615. https://doi.org/10.1056/NEJMoa2034577
19. Pedersen EJ, Miller DL, Simpson GL, Ross N. Hierarchical generalized additive models in ecology: an introduction with mgcv. *PeerJ*. 2019;7:e6876. https://doi.org/10.7717/peerj.6876
20. Brown KA, Soucy J-PR, Buchan SA, et al. The mobility gap: estimating mobility levels required to control Canada's winter COVID-19 surge. *medRxiv*. Published online February 1, 2021:2021.01.28.21250622. https://doi.org/10.1101/2021.01.28.21250622

This is Exhibit **5** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 12 AK. day of March, 2021.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

AS

GLOSSARY

A glossary for health inequalities

I Kawachi, S V Subramanian, N Almeida-Filho

J Epidemiol Community Health 2002;56:647–652

In this glossary, the authors address eight key questions pertinent to health inequalities: (1) What is the distinction between health inequality and health inequity?; (2) Should we assess health inequalities themselves, or social group inequalities in health?; (3) Do health inequalities mainly reflect the effects of poverty, or are they generated by the socioeconomic gradient?; (4) Are health inequalities mediated by material deprivation or by psychosocial mechanisms?; (5) Is there an effect of relative income on health, separate from the effects of absolute income?; (6) Do health inequalities between places simply reflect health inequalities between social groups or, more significantly, do they suggest a contextual effect of place?; (7) What is the contribution of the lifecourse to health inequalities?; (8) What kinds of inequality should we study?

The burgeoning field of health inequalities research has given rise to many questions and debates about definitions of concepts, analytical strategies, interpretation of findings, and explanatory models.[1–10] Any glossary for health inequalities therefore must go further than simply defining terms and concepts—it must also acknowledge and discuss controversies in the field. The following glossary is neither intended to be a comprehensive treatment of this subject, nor an exhaustive list of textbook definitions. Rather than adopting a purely definitional approach to health inequalities, we have chosen to highlight some major debates in contemporary research as a way of introducing key concepts and terminology in the field. Many of the issues we have selected to discuss are controversial simply because there are still large gaps in the scientific understanding of the determinants of health. Readers may take different views and disagree about the issues, partly because the science has not yet gone far enough and we are left to make informed guesses.

We focus on eight key questions pertinent to health inequalities:

1 What is the distinction between health inequality and health inequity?

2 Should we measure health inequalities (that is, describing the distribution of health across individuals), or should we measure social group differences in health (for example, inequalities in health by social class)?

3 Do health inequalities mainly reflect the effects of poverty or are they generated by the socioeconomic gradient?

4 Are health inequalities mediated by material deprivation or by psychosocial mechanisms?

5 Is there an effect of relative income on health, separate from the effects of absolute income?

6 Do health inequalities between places simply reflect health inequalities between social groups or, more significantly, do they suggest a contextual effect of place in shaping inequalities in health?

7 What is the contribution of the life course to health inequalities?

8 What other kinds of inequality should we study?

THE DISTINCTION BETWEEN HEALTH INEQUALITY AND HEALTH INEQUITY

Inequality and equality are dimensional concepts, simply referring to measurable quantities. Inequity and equity, on the other hand, are political concepts, expressing a moral commitment to social justice.

Health inequality is the generic term used to designate differences, variations, and disparities in the health achievements of individuals and groups. A straightforward example of health inequality is higher incidence of disease X in group A as compared with group B of population P. If disease X is randomly or equally distributed among all groups of population P, then there is no presence of health inequality in that population. In other words, health inequality is a descriptive term that need not imply moral judgment. To further illustrate this point, imagine individual A who dies at age 40 during a sky diving accident. His identical twin, B, who does not enjoy this hobby, lives to age 80. In this case, the unequal life spans of A and B (and for that matter, the unequal life expectancies of recreational sky divers and non-divers) reflects a personal choice that would not necessarily evoke moral concern. Besides such voluntarily assumed risks, other examples of health inequality that we would not normally consider unjust include pure chance (for example, a random genetic mutation—unlucky but not unjust) and life stage differences (for example, a 20 year old having better health than a 60 year old, but expected to succumb to the same slings and arrows of infirmity 40 years on). That said, many forms of health inequalities are also undoubtedly inequitable.

Health inequity refers to those inequalities in health that are deemed to be unfair or stemming from some form of injustice. Whitehead and Dahlgren [11] proposed additional considerations

See end of article for authors' affiliations

Correspondence to: Professor I Kawachi, Department of Health and Social Behavior, Harvard School of Public Health, 677 Huntington Avenue, Boston MA 02115, USA; Ichiro.Kawachi@channing.harvard.edu

such as whether the inequalities are avoidable or unnecessary. There are some difficulties in adopting preventability and necessity as criteria for the definition of health inequity. In principle, even risk taking behaviour such as sky diving is avoidable or preventable. However, this does not make its tragic outcome more or less inequitable. As for necessity, a functionalist's defence of social stratification would view health inequalities as a "necessary" and inevitable consequence of maintaining a market economy.[12]

The crux of the distinction between equality and equity is that the identification of health inequities entails normative judgment premised upon (a) one's theories of justice; (b) one's theories of society; and (c) one's reasoning underlying the genesis of health inequalities. Because identifying health inequities involves normative judgment, science alone cannot determine which inequalities are also inequitable, nor what proportion of an observed inequality is unjust or unfair.

On one account, *most* of the health inequalities across social groups (such as class and race) are unjust because they reflect an unfair distribution of the underlying social determinants of health (for example, access to educational opportunities, safe jobs, health care, and the social bases of self respect).[13 14] On the other hand, some extreme views would deny any role of social injustice in the creation of health inequalities. Much of this debate revolves around the issues of free will and individual responsibility for self care. Those who emphasise individual responsibility tend to view health inequalities as the outcome of differences in how people make choices (for example, the decision to start smoking, or to adhere to a risk taking hobby), whereas social determinists view the same choices as arising out of constrained and unfair circumstances (for example, targeting of tobacco advertising to low income children).

The existence of a social gradient in health behaviours itself demands an explanation. The weight of the empirical evidence in the health inequalities literature supports the social determinist's position. That is, the decision to invest in personal health is not freely chosen to the extent that (a) there are *early life course* influences on adult health (when, presumably, most individuals are not competent to make informed choices); and (b) to the extent that one's life chances depend upon *contextual factors* (that is, ambient risks that are imposed on individuals through their micro and macro environment or the behaviour of others). The conditions that need to be met for regarding health inequalities as fair are, in fact, extremely stringent. Thus, many genetic differences, exposure to different childhood conditions, differences in most health behaviours, as well as most environmental exposures are unfair.

MEASURING AND ASSESSING HEALTH INEQUALITIES

Two distinct approaches have been described for evaluating health inequalities. *Measuring social group differences in health* represents the more common approach to assessment, characterised by defining certain social groups a priori (for example, social class, race) and then examining the health differentials between them. This approach assumes the existence of meaningful social groupings that reflect the unequal (and often unjust) distribution of resources and life opportunities across segments of society.

Alternatively, some researchers have sought to measure health inequalities by measuring the distribution of *health status across individuals in a population*, analogous to measures of income distribution in a population.[15] It is argued that by restricting health inequality measurements to the value-free description of the distribution of health across individuals, one can bypass the dilemmas of selecting the variables used to measure social groups, like class, and thereby steer clear of normative positions regarding the origins of health inequalities across social groups. These two lines of reasoning—essentially reflecting the distinction between "inequity" and "inequality", respectively, have been intensely debated.

According to Murray *et al* [15]: "the argument that social group differences are the best approach to measuring health inequalities confounds a positive issue, the extent of inequality across individuals, and a normative question: which inequalities are unjust?"[15] (page 539). In response, Braveman *et al*[16] have countered that one needs to be clear about the nature of one's research question. If a researcher is concerned about equity, then it is essential to study inequalities across social groups, and therefore normative judgments cannot—indeed ought not—be shirked. A fundamental argument against purely descriptive approaches is that it does not make sense to consider individuals stripped of their social relations. Any approach that lumps together members of a given population because they share a health profile runs the risk of: (a) disregarding meaningful groupings of political relevance; and (b) preventing inquiries into the causes of health inequalities in society.

On the other hand, it is true that the descriptive approach of measuring health distributions allows for more flexible comparisons of inequalities across time and place.

There are concerns about the comparability of groups across countries, or changes in social composition over time. International comparisons of health inequalities defined by social groups are potentially problematic, because: "(e)ven if occupation-based social group health differences are larger in France than in the United Kingdom, there may always be some new variable that can be used to define other social groupings in which differences are greater in the United Kingdom than in France" [15] (page 540).

In summary, the two approaches yield complementary, not contradictory, information. Complementarity does not, however, imply equal priority of each approach in the construction of scientific knowledge geared towards overcoming health inequities. Measuring and monitoring health inequities can never be devoid of normative content, and accordingly priority must be given to analysing inequalities between groups constituted under social and historical criteria.[2]

SOCIOECONOMIC GRADIENT OR POVERTY: WHAT DRIVES HEALTH INEQUALITIES?

This question relates to the nature and shape of the relation between socioeconomic position and health. Research on health inequalities indicates that poor health is not simply confined to those at the bottom of the socioeconomic hierarchy. What, then, is the role of poverty in producing health inequalities? The answer to that question depends on one's definition of "poverty".

Poverty has been defined in both absolute and relative terms. *Absolute poverty* is defined as the inability to meet basic human needs, such as food, shelter and, avoidance of disease. It is typically operationalised in terms of a monetary threshold—a poverty line—deemed necessary to meet minimal human needs. The problem with this approach, as pointed out by Gordon and Spicker,[17] is that the "absolute" requirement to meet needs such as food and shelter is relative to the rest of society. Thus:

> "Nutritional requirements are dependent on the work roles of people at different points of history and in different cultures. Avoidable disease is dependent upon the level of medical technology. The idea of shelter is relative not just to climate, but also to what society uses shelter for" (Townsend,[18] quoted in Gordon and Spicker,[17] page 7).

The official poverty threshold in the United States is based on an absolute definition of poverty. Except for adjustment for

inflation, the US poverty definition has remained constant and invariant over time since it was introduced in 1964, based on the income needed to purchase a basic meal plan. Currently, about 11.3% of American household live below the official poverty threshold. However, the socioeconomic gradient in health (see below) clearly extends beyond individuals living below this official threshold.

Relative poverty, by contrast, defines poverty in terms of its relation to the standards that exist elsewhere in society.[17] For example, Townsend [18] refers to poverty as a form of relative deprivation, or "the absence or inadequacy of those diets, amenities, standards, services and activities which are common or customary in society". The poverty line in this case is defined as some proportion of a society's average per capita income or expenditure, for example, less than one half the country's average per capita income. Adopting a relative poverty definition, a much greater proportion of the US population could be said to be impoverished, because of the wide disparities in income and wealth in that society. The socioeconomic gradient in health (below) is partly a reflection and consequence of the prevalence of relative poverty in society.

The socioeconomic gradient in health refers to the worse health of those who are at a lower level of socioeconomic position—whether measured by income, occupational grade, or educational attainment—even those who are already in relatively high socioeconomic groups.[19 20] It is therefore not just the conditions associated with severe disadvantage (such as lack of access to food, housing, and medical care) that explain socioeconomic inequalities in health among those who have attained relatively high levels of socioeconomic position. That said, House and Williams [21] emphasise that: "(I)t is most important to understand what accounts for socioeconomic inequalities in health across the broader lower range (e.g., lower 40–60%) of socioeconomic position, rather than focusing mainly or only on factors that might explain this relationship across the gradient or at higher levels" (page 89).

MATERIAL DEPRIVATION OR PSYCHOSOCIAL MECHANISMS: WHAT EXPLAINS HEALTH INEQUALITIES?

Different scholars have emphasised different explanations for the existence of health inequalities. *The material interpretation* of health inequalities emphasises the graded relation between socioeconomic position and access to tangible material conditions, from basics such as food, shelter, and access to services and amenities, as well as car and home ownership, access to telephones and the internet, and the like.[22]

The psychosocial interpretation, by contrast, ascribes the existence of health inequalities to the direct or indirect effects of stress stemming from either being lower on the socioeconomic hierarchy, or living under conditions of relative socioeconomic disadvantage. Models of the direct effects of stress on physiological systems include *allostatic load*, which describes the wear and tear on the organism caused by exposure to daily adverse life circumstances.[23] Stress may also affect health indirectly by leading to a more adverse profile of behaviours such as smoking and excess drinking.

Occasionally, the material and psychosocial interpretations have been cast as if they were competing accounts of the mechanisms underlying health inequalities.[24] In reality, these explanations are not mutually exclusive, nor is it usually possible to disentangle their effects from one another. A common source of misunderstanding stems from the use of labels according to whether researchers are referring to initial causes or underlying pathways. The predominant usage of the "material" and "psychosocial" labels seems to be according to the underlying pathways by which different factors produce health inequalities. Thus, low social status/prestige and lack of control are often labelled as psychosocial determinants of health, even though they may be triggered by material factors (such as lack of income or bad housing).

In principle, all material resources of some relevance to daily life have some psychosocial meaning attached to it. For example, home or car ownership has both a material interpretation as well as a psychosocial one (as in the symbolic sense of security that home or car ownership affords).[25] An internet or telephone connection enables a subscriber to find jobs or keep their jobs (calling in sick), as well as fulfill their sense of social connectedness. Even employment or money fosters a sense of control. Asking which of these mechanisms is more important for explaining health inequalities may not be revealing or helpful, especially if the solution in both instances is to improve people's access to tangible resources.

THE ABSOLUTE AND RELATIVE INCOME HYPOTHESIS IN HEALTH INEQUALITIES

A distinct field of research on health inequality has begun to focus on the potential health effects of relative income, as separate from the effects of absolute income.[26]

The *absolute income hypothesis* states that an individual's health depends on their own (and only their own) level of income. In other words, the health status of an individual with a given level of income (say, 50% of the average income) is hypothesised to be the same regardless of what everybody else makes around him. But if everybody else's incomes suddenly doubled, our hypothetical individual would be twice as poor as before—if one happens to subscribe to the relative concept of poverty discussed earlier. It is difficult to imagine that the poor person's health would remain unaffected by the change, especially given that the standards of consumption necessary to function under the new arrangement are also likely to change. That is, changes in how the average members of society live will often force changes in how poor people live. Many material goods that are essential for functioning in advanced societies today—such as automobiles, telephones, access to the internet—started out as luxuries and later turned into necessities.[27 28] The inability to attain the normative level of consumption may, in turn, cause psychosocial distress.

The *relative income hypothesis* asserts that health depends not just on one's own level of income, but also on the incomes of others in society. At any given level of income, the hypothesis states that an individual's health status depends on the *rank* within the income distribution that is bestowed upon the individual by her level of income, and/or the *distance* between her income and the average income (or some other benchmark of social comparison). It has proved difficult to directly test the relative income hypothesis, because of the lack of agreement about the appropriate reference group for social comparison—do individuals compare themselves to other below or above them? Do they compare themselves to others like them, or to celebrities and moguls portrayed in the mass media? Most likely, people compare themselves simultaneously in several directions.

An indirect test of the relative income hypothesis is provided by examining the association between *income distribution* and individual health. If relative income matters for health in addition to absolute income, then a low income person would fare worse in a more unequal society than in a more egalitarian society. The association between income inequality and individual health has been tested in a number of studies using the Gini coefficient or its close variants.[29 30]

The *Gini coefficient* is a summary measure of income distribution. Algebraically, the Gini coefficient is defined as half of the arithmetic average of the absolute differences between all pairs of incomes in a population, the total then being normalised on mean income. If incomes in a population are distributed completely equally, it will be zero; and if one

AS

person has all the income, it will be 1.0. A graphical interpretation of the Gini coefficient, as well as other common measures of income inequality, is described in Kawachi and Kennedy.[29]

To date, studies of income inequality and health outcomes have yielded mixed results, with some studies indicating a modest effect of income inequality on individual mortality,[31] self rated health,[32 33] depressive symptoms,[34] and health behaviours.[35] Other studies have found no such effects after controlling for individual income,[36–38] while some have revealed a differential effect of income inequality on different income groups.[39] In all of the aforementioned studies, the effect of income inequality on health was examined after controlling for individual income. It needs to be pointed out that the practice of adjusting for individual income when looking for an effect of income inequality has its own problems, as eloquently stated by Diez-Roux and colleagues [35]:

> "The analytical separation of these two mechanisms (i.e., the effects of absolute and relative differences) may be theoretically interesting but is also artificial, because both are inextricably linked. In reality adjusting inequality effects for individual-level income necessarily leads to an underestimation of the *total* inequality effect on health" (page 685).

Researchers have emphasised different mechanisms underlying the postulated link between income inequality and health. Some have focused on the psychosocial harm (for example, the shame, loss of self respect) produced by invidious social comparisons in an unequal society.[40] Others have focused on the patterns of social investment (for example, lower state effort on education and welfare spending) that often accompanies a growing distance between the rich and poor.[41] Erosion of social cohesion and social capital has been cited as an additional mechanism underlying the relation between income inequality and health.[42 43]

Social capital is defined as the resources available to individuals and to society through social relationships. Social capital has sometimes been erroneously identified as a purely psychosocial variable.[24] It should be obvious, however, that the resources available through social relationships can sometimes take the form of tangible factors (such as cash loans, labour in kind, access to information), in addition to psychosocial resources (such as trust, norms of reciprocity, and emotional support).

"UNHEALTHY" PEOPLE OR "UNHEALTHY PLACES": THE SOURCE OF INEQUALITIES IN HEALTH

There is growing interest in documenting the role of place or context (defined as neighbourhoods, workplaces, regions, states) in (re)producing health inequalities.[44–46] *Area or place effects* refers to the health effects of variables that tell us something about the places or contexts, and not simply the people who inhabit them. Macintyre [47] provides a useful distinction between types of place effects, referred to as collective and contextual place effects.

A collective effect refers to aggregated group properties that exert an influence on health over and above individual characteristics. For example, living in areas with a high proportion of people who have certain individual characteristics (for example, based on age, social class, income or race).

A contextual effect, meanwhile relates to the broader political, cultural, or institutional context, for example the presence or absence of features that are intrinsic to places, such as infrastructural resources, economic policies of states, social and public support programmes. Contextual effects can also include influences of cultural background, such as the ethnic, religious, and linguistic make up of communities, as well as certain ecological or environmental influences.

Place effects can be further unpacked in three different steps, in ascending order of complexity.[48] At the simplest level, the task is to distinguish compositional explanations from contextual explanations of spatial variations in health outcomes.

A *compositional explanation* for area differences ascribes the variations in health outcomes to the characteristics of individuals who reside in them. For example, higher mortality rates in high poverty areas may simply reflect the worse health status of poor individuals who make up a poor area. Similar types of people will experience similar health outcomes no matter where they live. If, however, contextual effects matter, then similar types of people can be expected to achieve very different levels of health depending upon where they live.

A second level of analytical complexity involves the unpacking of *contextual heterogeneity*. For instance, places vary differentially: places with high rates of poor health for one social group may have lower rates for the other groups and vice versa.

The third level of analytical complexity is unpacking *individual-contextual interactions*. Contextual factors (such as social capital or income inequality—both are examples of group characteristics)—may differentially affect different population groups. Thus, for instance contextual factors may have a greater impact on poor population groups as compared with non-poor groups, or vice versa. In summary, the notion of contextual analysis is that it matters not simply "who you are in relation to where you are", but rather the question of "who you are *depends* upon where you are".

Multilevel analytical approach provides a useful way of addressing the issues outlined above.[48 49] As the name suggests, this approach anticipates that determinants of health inequalities occur simultaneously at several levels, from the individual, to neighbourhoods, regions, and states. Consequently, multilevel regression techniques are essentially about modelling heterogeneity at each of the desired levels of the conceptual model through a range of variables that tell us something about each of the levels. Importantly, these methodological and substantive perspectives [50] are supported by a robust technical estimation process.[51 52] Indeed, any research on health inequalities that takes context and place seriously is intrinsically multilevel and cannot be otherwise. Multilevel methods consider most data structures within a nested framework and such nesting could be hierarchic and/or non-hierarchic. Seen this way, repeated/longitudinal analysis (whether it is people who are repeatedly measured or places), multivariate analysis (when there are more than one inter-related outcomes) or a cross classified analysis (when we do not have neat hierarchic nesting) are simply special cases of a multilevel regression framework.[48] Most existing multilevel applications have, however, failed to capitalise on the full potential offered by these frameworks and in particular the ability to model contextual heterogeneity (as defined here) and the idea of nested and correlated data structures.

LIFE COURSE PERSPECTIVES TO HEALTH INEQUALITY

Parallel with the growing interest in the dimension of place, researchers have increasingly sought to understand the emergence of health inequality across the dimension of time. *Life course effects* refers to how health status at any given age, for a given birth cohort, reflects not only contemporary conditions but embodiment of prior living circumstances, in utero onwards.[53] Detailed presentations of this perspective have been articulated elsewhere.[54 55]

Three distinct pathways are hypothesised to be relevant to life course effects: firstly, *latent effects* by which the early life environment affects adult health independent of intervening experience; secondly, *pathway effects*, through which the early

life environment sets individuals onto life trajectories that in turn affect health status over time; and thirdly, *cumulative effects* whereby the intensity and duration of exposure to unfavourable environments adversely affects health status, according to a dose-response relation.[55] Regardless of the mechanisms leading to their expression, life course effects are fundamental to an understanding of the origins of health inequality.[56 57] To the extent that health inequalities in adult life are partly determined by early life circumstances, their elimination cannot be left to individual choice alone.

WHAT OTHER KINDS OF INEQUALITY SHOULD WE STUDY?

Although we have emphasised health inequalities across socioeconomic groups, an analysis of inequalities would be incomplete without consideration of ascriptive characteristics. *Ascriptive* characteristics refer to traits present at birth (such as gender and race). Such characteristics may themselves influence the subsequent social position of individuals. Limitations of space do not allow us to extend this glossary to cover the concepts used in the analysis of gender and racial inequalities in health. Beyond gender and race, there are many other dimensions along which health inequalities could be described, including: political power (household authority, work place control, legislative authority), cultural assets (privileged lifestyles, high status consumption practices), social assets (access to social networks, ties, associations), honorific status (prestige, respect), and human resources (skills, expertise, training).[58] The empirical inquiry into health inequalities has only begun to scratch this surface.

Authors' affiliations

I Kawachi, S V Subramanian, N Almeida-Filho, Center for Society and Health, Harvard School of Public Health, Boston, USA

Funding: Dr Almeida-Filho is supported in part by a Pan-American Health Organization/Harvard Center for Society and Health Fellowship on Health Inequalities.

Conflicts of interest: none.

REFERENCES

1 **Hexel PC**, Wintersberger H. Inequalities in health: strategies. *Soc Sci Med* 1986;**22**:151–60.
2 **Breilh J**, Granda E. Epidemiología y Contrahegemonía. *Soc Sci Med* 1989;**28**:1121–7.
3 **Whitehead M**. *The concept and principles of equity and health*. Washington DC: Pan American Health Organization (CID/HSP/PAHO), 1991.
4 **Castellanos PL**. *Health status and social class in Latin America: implications for research and policy*. Washington: Pan American Health Organization/World Health Organization (PAHO-WHO), 1992.
5 **Montoya C**. La equidad: Usos del concepto como criterio de progreso. *Cuadernos Médicos Sociales* 1997;**38**:6–12.
6 **Wilkinson RG**. Socioeconomic determinants of health. Health inequalities: relative or absolute material standards? *BMJ* 1997;**314**:591–5.
7 **Whitehead M**. Diffusion of ideas on social inequalities in health: a European perspective. *Milbank Q* 1998;**76**:469–92, 306.
8 **Bartley M**, Sacker A, Firth D, *et al*. Towards explaining health inequalities. *BMJ* 2000;**320**:1303–7.
9 **Oliver A**, Cookson R.Towards multidisciplinary research into health inequalities. *Health Econ* 2000;**9**:565–6.
10 **Gwatkin DR**.Health inequalities and the health of the poor: what do we know? What can we do? *Bull World Health Organ* 2000;**78**:75–85.
11 **Dahlgren G**, Whitehead M. *Policies and strategies to promote social equality in health*. Stockholm: Institute of Future Studies, 1991.
12 **Davis K**, Moore WE. Some principles of stratification. *Am Sociol Review* 1945;**10**:242–9.
13 **Daniels N**, Kennedy B, Kawachi I. *Is inequality bad for our health?* Boston: Beacon Press, 2000.
14 **Woodward A**, Kawachi I. Why reduce health inequalities? *J Epidemiol Community Health* 2000;**54**:923–9.
15 **Murray CJL**, Gakidou EE, Frenk J. Health inequalities and social group differences: what should we measure? *Bull World Health Organ* 1999;**77**:537–43.
16 **Braveman P**, Krieger N, Lynch J. Health inequalities and social inequalities in health. *Bull World Health Organ* 2000;**78**:232–4.
17 **Gordon D**, Spicker P, eds. *The international glossary on poverty*. London: CROP Publications, 1999.
18 **Townsend P**. *Poverty in the United Kingdom*. London: Penguin, 1979.
19 **Marmot MG**, Davey Smith G, Stansfeld S, *et al*. Health inequalities among British civil servants. The Whitehall II study. *Lancet* 1991;**337**:1387–93.
20 **Adler NE**, Ostrove JM. Socioeconomic status and health: What we know and what we don't. *Ann NY Acad Sci* 1999;**896**:3–15.
21 **House JS**, Williams DR. Understanding and reducing socioeconomic and racial/ethnic disparities in health. In: Smedley BD, Syme SL, eds. *Promoting health. Intervention strategies from social and behavioral research*. Washington DC: National Academy Press, 2000:81–124.
22 **Lynch J**, Kaplan G. Socioeconomic position. In: Berkman LF, Kawachi I, eds. *Social epidemiology*. New York: Oxford University Press, 2000:13–35.
23 **McEwen BS**, Seeman T. Protective and damaging effects of mediators of stress. Elaborating and testing the concepts of allostasis and allostatic load. *Ann NY Acad Sci* 1999;**896**:30–47.
24 **Lynch JW**, Davey Smith G, Kaplan GA, *et al*. Income inequality and health: importance to health of individual income, psychosocial environment, or material conditions. *BMJ* 2000;**320**:1200–4.
25 **Macintyre S**, Ellaway A, Der G, *et al*. Do housing tenure and car access predict health because they are simply markers of income or self esteem? A Scottish study. *J Epidemiol Community Health* 1998;**52**:657–64.
26 **Kawachi I**, Kennedy BP, Wilkinson RG, eds. *Income inequality and health. A reader*. New York: The New Press, 1999.
27 **Jencks C**. *Rethinking social policy. Race, poverty, and the underclass*. Cambridge, MA: Harvard University Press, 1992.
28 **Frank RH**. *Luxury fever. Why money fails to satisfy in an era of excess*. New York: The Free Press, 1999.
29 **Kawachi I**, Kennedy BP. The relationship of income inequality to mortality—Does the choice of indicator matter? *Soc Sci Med* 1997;**45**:1121–7.
30 **Wagstaff A**, van Doorslaer E. Income inequality and health: What does the literature tell us? *Annu Rev Public Health* 2000;**21**:543–67.
31 **Lochner K**, Pamuk ER, Makuc D, *et al*. State-level income inequality and individual mortality risk: a prospective, multi-level study. *Am J Public Health* 2001;**91**:385–91.
32 **Kennedy BP**, Kawachi I, Glass R, *et al*. Income distribution, socioeconomic status, and self-rated health: a US multi-level analysis. *BMJ* 1998;**317**:917–21.
33 **Soobader M-J**, LeClere F. Aggregation and the measurement of income inequality: effects on morbidity. *Soc Sci Med* 1999;**48**:733–44.
34 **Kahn RS**, Wise PH, Kennedy BP, *et al*. State income enequality, household income, and maternal mental and physical health: cross-sectional national survey. *BMJ* 2000;**321**:1311–15.
35 **Diez-Roux AV**, Link BG, Northridge ME. A multilevel analysis of income inequality and cardiovascular disease risk factors. *Soc Sci Med* 2000;**50**:673–87.
36 **Fiscella K**, Franks P. Poverty or income inequality as predictors of mortality: longitudinal cohort study. *BMJ* 1997;**314**:1724–8.
37 **Daly M**, Duncan GJ, Kaplan GA, *et al*. Macro-to-micro links in the relation between income inequality and mortality. *Milbank Q* 1998;**76**:315–39.
38 **Mellor JM**, Milyo J. Reexamining the evidence of an ecological association between income inequality and health. *J Health Polit Policy Law* 2001;**26**:487–522.
39 **Subramanian SV**, Kawachi I, Kennedy BP. Does the state you live in make a difference? Multilevel analysis of self-rated health in the U.S. *Soc Sci Med* 2001;**53**:9–19.
40 **Wilkinson RG**. The culture of inequality. In: Kawachi I, Kennedy BP, Wilkinson RG, eds. *Income inequality and health. A reader*. New York: The New Press, 1999:492–8.
41 **Kawachi I**, Kennedy BP. Health and social cohesion: why care about income inequality? *BMJ* 1997;**314**:1037–40.
42 **Kawachi I**, Kennedy BP, Lochner K, *et al*. Social capital, income inequality, and mortality. *Am J Public Health* 1997;**87**:1491–8.
43 **Kawachi I**, Berkman LF. Social cohesion, social capital, and health. In: Berkman LF, Kawachi I, eds. *Social epidemiology*. New York: Oxford University Press, 2000:174–90.
44 **Jones K**, Moon G. Medical geography: taking space seriously. *Progress in Human Geography* 1993;**17**:515–24.
45 **Macintyre S**, Maciver S, Sooman A. Area, class and health: should we be focusing on places or people? *Journal of Social Policy* 1993;**22**:213–34.
46 **Macintyre S**, Ellaway A. Ecological approaches: rediscovering the role of the physical and social environment. In: Berkman LF, Kawachi I, eds. *Social epidemiology*. New York: Oxford University Press, 2000:332–48.
47 **Macintyre S**. What are the spatial effects and how can we measure them? In: Dale A, ed. *Exploiting national surveys and census data: The role of locality and spatial effects*. OP 12. Manchester: Centre for Census and Survey Research, University of Manchester, 1997:1–28.
48 **Subramanian SV**, Jones K, Duncan C. Towards a multilevel geography of health. In: Kawachi I, Berkman LF, eds. *Neighborhoods and health*. New York: Oxford University Press (in press).
49 **Pickett KE**, Pearl M. Multilevel analyses of neighborhood socioeconomic context and health outcomes: a critical review. *J Epidemiol Community Health* 2001;**55**:111–22.
50 **Leyland AH**, Goldstein H, eds. *Multilevel modeling of health statistics*. Chichester: Wiley, 2001.

51 **Goldstein H.** *Multilevel statistical models.* 2nd edn. London: Arnold, 1995.
52 **Jones K,** Bullen N. Contextual models of urban house prices: a comparison of fixed- and random-coefficients model developed by expansion. *Economic Geography* 1994;**70**:252–72.
53 **Krieger N.** A glossary for social epidemiology. *J Epidemiol Community Health* 2001;**55**:693–700.
54 **Kuh DL,** Ben Shlomo Y, eds. *A life course approach to chronic disease epidemiology. Tracing the origins of ill health from early to adult life.* Oxford: Oxford University Press, 1997.
55 **Hertzman C.** The biological embedding of early experience and its effects on health in adulthood. *Ann NY Acad Sci* 1999;**896**:85–95.
56 **Marmot M.** Aetiology of coronary heart disease. *BMJ* 2001;**323**:1261–2.
57 **Barker DJP,** Forsen T, Uutela A, *et al.* Size at birth and resilience to effects of poor living conditions in adult life: longitudinal study. *BMJ* 2001;**323**:1273–6.
58 **Grusky DB,** ed. *Social stratification in sociological perspective.* Boulder, CO: Westview Press, 1994.

This is Exhibit **6** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 16 AK. day of March, 2021.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

AS

New ICES report shows immigrants, refugees and other newcomers account for nearly 44% of all COVID-19 cases in Ontario

SEPTEMBER 9, 2020 TORONTO

COVID-19 infections have taken a disproportionate toll on racialized communities, immigrants and low-income populations in many countries, including Canada. **ICES**, a non-profit research institute that uses population-based health information to produce knowledge on a broad range of health care issues, has released a report that focuses on patterns of COVID-19 testing and test results among immigrants and refugees in Ontario during the initial phase of testing between January 15 and June 13, 2020.

This is the first report of its kind in Canada to compare COVID-19 testing rates among immigrants and refugees with those of their Canadian-born counterparts.

In Ontario, higher rates of positive COVID-19 tests have been found among people living in neighbourhoods with high rates of ethnic diversity, including more recent immigrants.

"What we found particularly striking was that overall testing rates were lower in most immigrant, refugee and newcomer populations, but the rate of positive cases is significantly higher than Canadian-born or long-term residents," says Dr. Astrid Guttmann, chief science officer at ICES and lead author on the report.

The report looked at who was tested from among all Ontario residents eligible for OHIP, apart from those living in long-term care homes. The researchers used data from Immigration, Refugees and Citizenship Canada (IRCC) that allowed the linkage of the permanent resident file for immigrants landed in Ontario from 1985 to 2017 with ICES health administrative data.

The report found that:

- While immigrants, refugees and other newcomers make up just over 25 per cent of the Ontario population, they accounted for 43.5 per cent of all COVID-19 cases.
- Rates of testing were lower for most immigrants and refugees compared with Canadian-born and long-term residents.
- Rates of positive results in those tested and per capita were higher across all immigration categories compared with Canadian-born and long-term residents.
- Employment as a health care worker, especially among women, accounted for a disproportionate number of cases in immigrants and refugees, with those from the Philippines, Jamaica and Nigeria being particularly affected.
- Among all female adults who tested positive for COVID-19, 36 per cent employed as health care workers; immigrants and refugees make up 45 per cent of these health care workers.
- While the number of positive COVID-19 tests peaked at the beginning of April in Canadian-born and long-term residents, there were two pronounced peaks of positivity in April and May in immigrants, refugees and other newcomers.
- Of those tested for COVID-19, refugees had the highest percent positivity: in those tested (10.4 per cent vs 7.6 per cent in other immigrants and 2.9 per cent in Canadian-born and long-term residents.
- The highest rates of positivity by world region were in immigrants and refugees from Central, Western and East Africa; South America; the Caribbean; South East Asia and South Asia.

"Our report adds to the emerging evidence of the inequities of COVID-19 infection rates in Ontario. We document disproportionately higher rates of infection among those who landed in Ontario as economic caregivers, refugees, those with lower levels of education and language fluency, those who currently live in lower income neighbourhoods and with more crowded housing," adds Guttmann. "Apart from addressing many of root causes of higher risk of infections, very high test positivity in certain groups of immigrants also suggests that there may be important barriers to testing that will be important to address if there is a second wave in Ontario this fall."

ICES has been providing information about COVID-19 testing and test recipient characteristics, as well as testing by long-term care facilities and retirement homes, to Public Health Ontario and the Ministry of Health daily since April 17, 2020.

Through partnerships at the provincial level, ICES has rapidly added near-real-time COVID-19-relevant data sets to its collection of linked health data. ICES' securely held database de-identifies personal health information from the health system data, which can then be accessed for research and analytics by health-system knowledge users and researchers.

ICES is a primary partner in the Ministry of Health's recently launched Ontario Health Data Platform (OHDP). The OHDP website will provide researchers with secure access to Ontario health data for COVID-19-related research projects. OHDP-approved researchers will initially be accessing data on the ICES platform; eventually a second high-performance computing platform will be accessible through Queen's University.

ICES is an independent, non-profit research institute that uses population-based health information to produce knowledge on a broad range of health care issues. Our unbiased evidence provides measures of health system performance, a clearer understanding of the shifting health care needs of Ontarians, and a stimulus for discussion of practical solutions to optimize scarce resources. ICES knowledge is highly regarded in Canada and abroad, and is widely used by government, hospitals, planners, and practitioners to make decisions about care delivery and to develop policy. In October 2018, the institute formerly known as the Institute for Clinical Evaluative Sciences formally adopted the initialism ICES as its official name. For the latest ICES news, follow us on Twitter: @ICESOntario

FOR FURTHER INFORMATION PLEASE CONTACT:

Deborah Creatura
Media Advisor, ICES
deborah.creatura@ices.on.ca
647-406-5996

RELATED PRODUCTS

REPORT

COVID-19 in Immigrants, Refugees and Other Newcomers in Ontario: Characteristics of Those Tested and Those Confirmed Positive, as of June 13, 2020

ICES IN THE NEWS

'They're at risk': How COVID-19 is affecting health-care workers of colour

2/1/2021 | tvo | Article

COVID-19 disproportionately impacted immigrants and refugees in Ontario, new report finds

9/9/2020 | CTV News | Article

COVID-19 disproportionately impacted immigrants and refugees in Ontario, new report finds

9/9/2020 | Newstalk 1010 | Article

AS

This is Exhibit **7** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 12 AK. day of March, 2021.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

AS

BREAKING

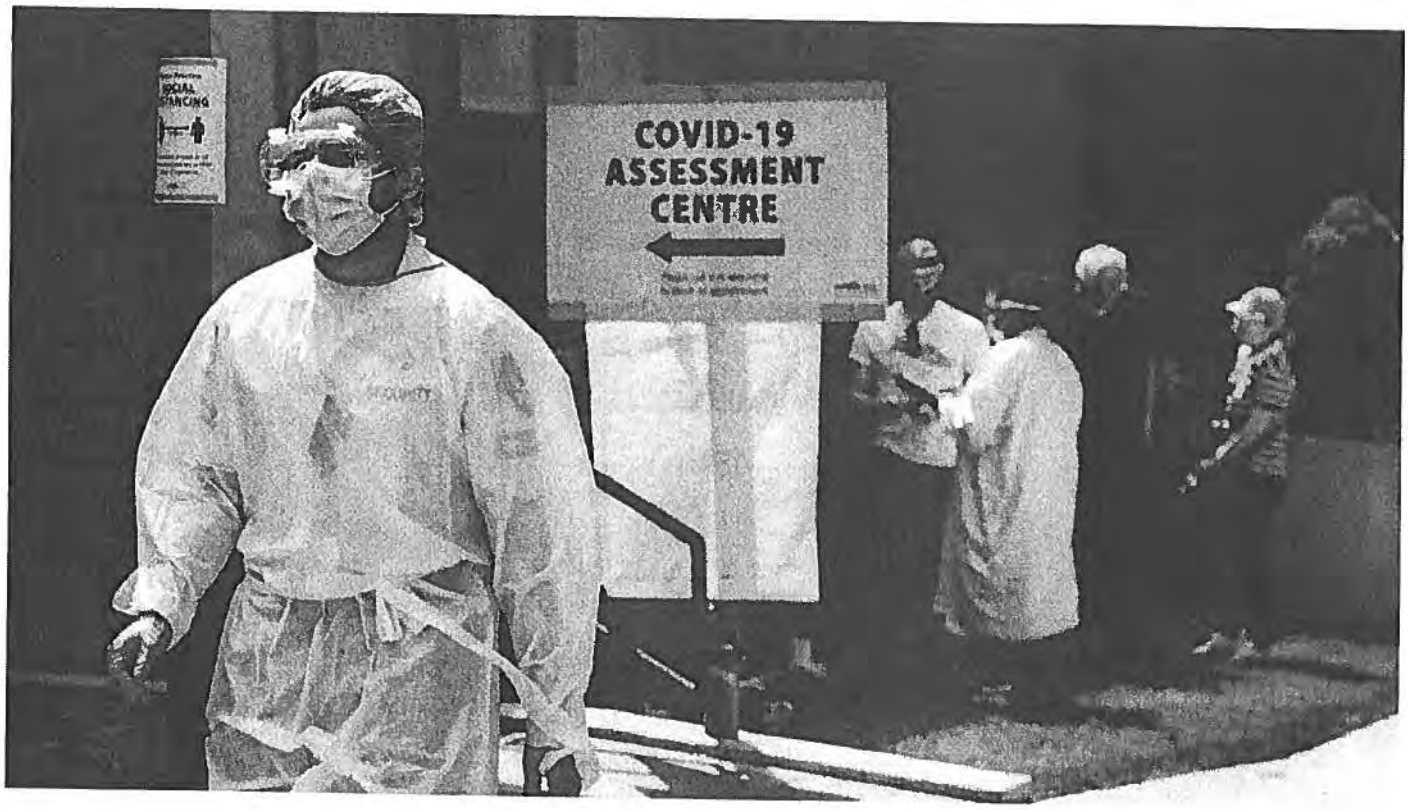
Ontario logs fewer than 1,100 new COVID-19 cases, positivity rate jumps past 4 per cent

TORONTO | NEWS

Nearly 80% of COVID-19 cases in Toronto were among racialized groups in November

Kerrisa Wilson
Web Content Writer, CP24
@kerrisawilson | Contact

Published Thursday, January 21, 2021 5:09PM EST



People line up to be tested at a COVID-19 assessment centre in Toronto on Tuesday, May 26, 2020. Health officials and the government have asked that people stay inside to help curb the spread of COVID-19. THE CANADIAN PRESS/Nathan Denette

AS

TORONTO -- Nearly 80 per cent of COVID-19 cases in Toronto identified with a racialized group in November, according to the city.

On Thursday, Toronto's Chief Medical Officer of Health Dr. Eileen de Villa discussed new data on ethno-racialized groups affected by the virus during a city media briefing.

The data shows that racialized groups continue to make up a disproportionate share of COVID-19 cases, as they have throughout the pandemic.

- **Full coverage at CTVNews.ca/Coronavirus**
- **Coronavirus vaccine tracker: How many people in Canada have received shots?**
- **Ontario now in third wave of COVID-19, province's hospital association says**
- **Here's what you need to know about getting the COVID-19 vaccine in the Toronto area**
- **Here's what can reopen as Toronto and Peel Region enter the grey zone**
- **This is the full list of people eligible for COVID-19 vaccines in Phase 2**
- **COVID-19 cases in Ontario schools and child-care centres as of March 15**

In November, 79 per cent of reported cases of the novel coronavirus in Toronto were among those who identified with a racialized group. This is higher than the proportion of the city's population who identify as belonging to a racialized group (52 per cent.)

Meanwhile, 21 per cent of cases were among people who identified as white, while 48 per cent of Toronto's population identifies as white.

In addition, 71 per cent of people who were hospitalized for the virus in November identified as coming from a racialized group.

"This overrepresentation is consistent with the higher overall case rates in these groups. It does not suggest racialized groups are more likely to become hospitalized if infected," de Villa said.

The city gathered population data from the 2016 census.

The ethno-racialized groups over-represented in COVID-19 cases and hospitalizations include Arab, Middle Eastern or West Asian, Black, East Asian, Latin American, South Asian or Indo-Carribbean and Southeast Asian.

Whereas, East Asian and white people are under-represented in cases and hospitalizations, according to the city's data.

AS

"South Asian and Indo-Caribbean people now make up the highest proportion of cases amongst ethno-racial groups overall at 27 per cent of cases while comprising 13 per cent of the population," de Villa said.

In November, the COVID-19 infection rate among people in Toronto was higher for those identifying with racialized groups (1,372 per 100,000 people), compared to white people (397 per 100,000 people_. The city's overall infection rate was 905.

The novel coronavirus also disproportionately affects households with a lower income.

Nearly half of COVID-19 cases in November were among those living in households that could be considered lower income, compared to 30 per cent of the population that met the same definition.

Meanwhile, 54 per cent of people who were hospitalized with the virus were living in low income households.

A household earning less than $30,000 roughly aligns with low income measures for one person households, while households with two to four people earning less than $50,000 also meet those measures, according to the city.

"While COVID-19 is a threat to everyone, it is plainly imposing real and disproportionate burdens on racialized communities and lower income groups. It is important to acknowledge how people's living and working conditions are contributing to these inequities" de Villa said.

In November, the infection rate was higher among people who are considered low income (808 per 100,000 people), than it was among those living in higher income households (356 per 100,000 people). The city's overall rate was 492.

De Villa noted that racialized communities are more likely to work on the frontlines putting them at more risk of getting infected.

"Many workers and lower wage frontline jobs do not get paid if they call in sick. This is a significant barrier to our pandemic management efforts and reinforces the need for effective income supports for working people suffering from COVID-19, in particular paid sick days," she said.

While discussing the city's latest COVID-19 numbers, de Villa noted that the city's effective reproductive number, which represents the expected number of cases generated from one case, dipped below one to 0.86, marking a trend in the right direction that hasn't been witnessed for a few months.

"This means that overall each new case of COVID-19 is resulting in less than one additional new infection. Practically speaking, it means that we have a slight advantage over the virus rather

than the virus having the advantage over us," she said.

The seven-day rolling average of new cases also dropped to 730 compared to 772 a week ago.

But de Villa warned that "a consistent pattern" needs to be witnessed before the decline in numbers can be called a trend.

On Thursday, the city reported 986 new cases and 10 more deaths. But Toronto Public Health said 102 cases were added to today's numbers due to a data backlog that has now been resolved.

TORONTO TOP STORIES

Ontario logs fewer than 1,100 new COVID-19 cases, positivity rate jumps above 4 per cent

This is Exhibit **8** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 18 AK. day of March, 2021.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

Six areas of Ontario to begin using province's online booking system for COVID-19 shots: source

A health-care worker prepares a dose of the Pfizer-BioNTech COVID-19 vaccine at a UHN COVID-19 vaccine clinic in Toronto on Thursday, January 7, 2021 THE CANADIAN PRESS/Nathan Denette

Nicole Thompson, The Canadian Press
Published Monday, March 1, 2021 5:18AM EST

TORONTO -- Ontario's website for booking COVID-19 vaccination appointments will begin a "soft launch" in six public health units this week, two weeks before it becomes available across the province, The Canadian Press has learned.

But the website will not be available to the general population in those regions, said a senior government source not authorized to speak publicly about the plan.

Instead, public health officials will reach out to a small number of individuals who are 80 or older, as well as some eligible health-care workers, starting Monday.

The source said the plan will help the province test components of the system before the full launch, determine whether any changes need to be made to the system and organize the vaccination of larger populations.

The site is a "public-facing extension" of the COVaxON system the province has been using since the start of the vaccine rollout, the source said, and will also serve to keep track of inoculation data.

The regions participating in the soft launch are Kingston, Frontenac, and Lennox and Addington; Peterborough County-City; Hastings and Prince Edward Counties; Leeds, Grenville, and Lanark; Grey Bruce; and Lambton.

RELATED STORIES

Ontario's online vaccine appointment portal to open on March 15; people ages 80+ will start receiving shots during 3rd week of March

Ontario testing online COVID-19 vaccine portal to avoid crash when it opens: Elliott

The source noted the site will not be available to other regions before March 15, even those that have already begun vaccinating members of the 80-and-over age group such as York and Peel.

Those regions must use "existing relationships with residents" to book the vaccinations until the online platform launches on March 15, when they're expected to switch to the provincial system.

The source said the website will focus at first on appointments at mass vaccination sites, but the province will work with public health units in the coming weeks to make sure it's compatible with other facilities such as hospital sites and mobile clinics.

The government has faced criticism for what some describe as the slow rollout of its vaccine booking portal, which is expected to launch the same day the head of the vaccine task force said people aged 80 and over would start getting the shots.

Retired general Rick Hillier said his team was "furiously working" to test and refine the site so it would be up-and-running on time.

Health Minister Christine Elliott defended the timeline, saying the government was still testing the site and wanted to ensure it won't crash when it goes live.

"We don't want to rush to failure," she said last week.

This is Exhibit **9** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 12 AK. day of March, 2021.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

AS

< Home

CTV NEWS

BREAKING

Ontario logs fewer than 1,100 new COVID-19 cases, positivity rate jumps past 4 per cent

TORONTO | News

Toronto will wait for Ontario COVID-19 booking portal to come online before vaccinating seniors

Chris Herhalt
Web Content Writer, CP24
@_Herhalt | Contact

Published Wednesday, March 3, 2021 8:10AM EST

AS

TORONTO -- Toronto will not begin a mass registration of its seniors for COVID-19 vaccination for at least another 12 days because it is waiting for a centrally-run registration program set up by the province to come online, Mayor John Tory said Wednesday.

"We have chosen I think wisely to be part of provincial registration and scheduling system which isn't up and running until March 15," Tory told CP24 on Wednesday.

Unlike its smaller neighbouring public health regions such as York, Peel and Halton which all began registering those 80 and up for shots and administering them this week, Tory says the sheer size of the city's elderly population, coupled with the concentration of healthcare workers that live in the city, dictate that Toronto will be slower than the rest of the GTA in reaching its seniors for vaccination.

- **Full coverage at CTVNews.ca/Coronavirus**
- **Coronavirus vaccine tracker: How many people in Canada have received shots?**
- **Ontario now in third wave of COVID-19, province's hospital association says**
- **Here's what you need to know about getting the COVID-19 vaccine in the Toronto area**
- **Here's what can reopen as Toronto and Peel Region enter the grey zone**
- **This is the full list of people eligible for COVID-19 vaccines in Phase 2**
- **COVID-19 cases in Ontario schools and child-care centres as of March 15**

"Half of all doctors in Ontario reside in Toronto, and they're on the priority list together with first responders and so on," Tory told CP24 on Wednesday. "We don't get any extra vaccine to account for that."

AB

He said that other public health regions that had smaller pools of healthcare workers to vaccinate got a head start on vaccinating elderly people in the community.

"What's happened in some of the other places is they finished doing the healthcare workers because they have fewer of them, so they can move on to do some of the other people."

Some hospitals including Michael Garron Hospital in East York, are pre-registering seniors age 80 and above for vaccination, but have not yet given them any shots.

Earlier this week, the City of Toronto released its official vaccination plan, which calls for a mix of 350 different sites and mobile teams to administer coronavirus vaccines to residents.

As noted by Tory, the provincial registration portal for COVID-19 vaccination does not go live across Ontario until March 15, but other public health units have simply set up their own portals in conjunction with hospitals.

Tory said the sheer size of Toronto dictates that it won't be able to move as quickly as other public health units to vaccinate seniors.

"We have as many people aged 80+ in Toronto as the entire population of Guelph. The scale of everything done in the City of Toronto is just massive and you want to make sure you get it right."

He said the provincial registrations program will include a call centre for seniors without internet access to register over the phone.

In the current first phase of Ontario's vaccination program, only frontline healthcare workers, residents of congregate care settings such as long-term care homes and retirement residences, the homeless, first responders, Indigenous adults and people aged 80 and above in the community can be immunized up until March 31.

Ontario Vaccine Task Force leader Ret. Gen. Rick Hillier said the province expects to begin vaccinating those over the age of 75 starting on April 15 and people over 70 one month later. The target date for vaccinating people 65 and over is June 1, and July 1 for people 60 and over.

RELATED IMAGES

AS

FILE - In this Thursday, Feb. 11, 2021 file photo, pharmacy technician Sochi Evans fills a syringe with a Pfizer-BioNTech COVID-19 vaccine at Texas Southern University in Houston. (Brett Coomer/Houston Chronicle via AP, File)

This is Exhibit **10** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 12 AK. day of March, 2021.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

AS

Black Doctors Call On Government To Fight Bias

For Immediate Release
March 12, 2021, Toronto---More than two-thirds of Black Canadians are reluctant to get vaccinated because they don't fully trust the health care system, so a coalition of Black medical scientists and community organizers is calling on government to make the system more fair.

"These disparities are rooted in systemic anti-Black racism," says Dr. Onye Nnorom, President of the Black Physicians Association of Ontario (BPAO), citing a Statistics Canada report showing only 34% of our Black population has no hesitation to take a Covid19 vaccine.

At a time when the pandemic is hitting Black and racialized communities hardest, the BPAO and the Black Health Alliance, along with the Black Opportunity Fund, BlackNorth Initiative and the Black Scientists' Task Force on Vaccine Equity are especially alarmed about this vaccine hesitancy.

"Too many Black Canadians are vaccine-hesitant because for generations our community has experienced discrimination in public health systems," Dr. Nnorom says.

"If the goal is to increase the Covid19 vaccine acceptance rate amongst Black Canadians, the government needs to make significant changes to the system," says Dr. Ato Sekyi-Otu of Black Opportunity Fund.

According to the coalition, the distrust of the medical system is primarily a result of systemic conditions that have also led to disproportionate negative impacts of the COVID-19 pandemic on Black communities.

Black Canadian public health, medical and community health organizations are coming together to issue a joint position statement calling on the government, public health authorities, healthcare institutions, and pharmaceutical companies to deal with this community health crisis once and for all. The group is asking to:

- **Develop plans that prioritize Black communities and neighbourhoods for vaccine distribution, testing sites, and other COVID-19 mitigation efforts.**
- Implement effective social policies which will also improve outcomes. For example, paid sick leave, better housing, and enhanced worker protection. These are contributing factors that have put Black Canadians and other marginalized lower-income Canadians at increased risk of COVID-19.

- **Allocate adequate resources to support community-led health promotion efforts including awareness campaigns, peer educator, and health ambassador programs to support COVID-19 vaccine uptake within Black communities**
- Partner with and resource community organizations from affected communities to support vaccine uptake
- Take swift and immediate steps to eliminate anti-Black racism in health and public health and address its impacts on health in Black communities
- Ensure governments and pharmaceutical companies are more proactive in building vaccine confidence and demonstrating the safety of the COVID-19 vaccine
- **Ensure race-based data is collected in collaboration with Black communities to identify, address and evaluate best practices to meet Black population health needs**
- Increase Black representation at decision-making tables, particularly on hospital and advisory boards
- Establish partnerships with Black health organizations to improve health outcomes.
- Ensure that policy- and decision-makers are firmly committed to rebuilding communities and populations that have been hardest hit by COVID-19.

A holistic community approach is crucial to building vaccine confidence and increasing vaccine uptake. Black populations will be best protected against COVID-19 through a combination of more equitable public health responses.

-30-

For more information and interviews contact:
Charmain Emerson
Black Opportunity Fund
charmain.emerson@gmail.com
416-857-9401

AS

POSITION STATEMENT

BLACK HEALTH AND THE COVID-19 VACCINES

BLACK HEALTH ALLIANCE

BPAO Black Physicians' Association of Ontario

BLACKNORTH INITIATIVE

Black Opportunity Fund

MARCH 12, 2021

POSITION STATEMENT: BLACK HEALTH AND THE COVID-19 VACCINES

Executive Summary

This joint position statement from Black- Canadian health and Black-Canadian medical organizations highlights the issue of COVID-19 vaccine distrust within Black communities.

As demonstrated by a recent report by Statistics Canada, "Black people in particular have been far more likely to succumb to the virus than members of other groups." Furthermore, according to a report by the Public Health Agency of Canada, "Vaccine Hesitancy is highest amongst the Black population" with only 34% of Black Canadians stating they would be willing to take the COVID-19 vaccine, in November 2020.

This distrust is primarily a result of systemic conditions that have also led to disproportionate negative impacts of the COVID-19 pandemic on Black communities. These disparities are rooted in systemic anti-Black policies, along with inequitable and inadequate public health and social policy responses.

As a result of anti-Black racism, our communities' pleas to address the social determinants of health, collect race-based health data and improve health-care funding in racialized communities go largely ignored. The need for quick and appropriate public health response to this community health crisis is clear therefore **we call upon public health authorities, government, healthcare institutions, pharmaceutical companies to:**

- Develop plans that prioritize Black communities and neighbourhoods for vaccine distribution, testing sites, and other COVID-19 mitigation efforts.
- Implement effective social policies that will also improve outcomes. For example, (e.g., paid sick leave, better housing and enhanced worker protection). These are contributing factors that have put Black Canadians and other marginalized lower-income Canadians at increased risk of COVID-19.
- Allocate adequate resources to support community-led health promotion efforts including awareness campaigns, peer educator and health ambassador programs to support COVID-19 vaccine uptake within Black communities
- Partner with and resource community organizations from affected communities to support vaccine uptake
- Take swift and immediate steps to eliminate anti-Black racism in health and public health and address its impacts on health in Black communities
- Ensure governments and pharmaceutical companies are more proactive in building vaccine confidence and demonstrating the safety of the COVID-19 vaccine
- Ensure race-based data is collected in collaboration with Black communities to identify, address and evaluate best practices to meet Black population health needs
- Increase Black representation at decision-making tables, particularly on hospital and advisory boards
- Establish partnerships with Black health organizations to improve health outcomes.
- Ensure that policy- and decision-makers are firmly committed to rebuilding communities and populations that have been hardest hit by COVID-19.

A holistic community approach is crucial to building vaccine confidence and increasing vaccine uptake. Black populations will be best protected against COVID-19 through a combination of more equitable public health responses.

Table of Contents

AS

SUMMARY

This joint position statement from Black health and Black medical organizations highlights the issue of COVID-19 vaccine distrust within Black communities. This distrust is a result of systemic conditions that have also led to disproportionate negative impacts of the COVID-19 pandemic on Black communities.

This statement examines the impact of COVID-19 on Black communities, the roots of vaccine distrust and how to build vaccine confidence. It recommends concrete solutions for improving health outcomes for Black populations and encourages Black Canadians to get the vaccine to protect themselves and their loved ones.

The intended audiences are health policy leaders, public health officials, health-care leaders and Black community health leaders.

COVID-19'S IMPACT ON RACIAL AND ENTHIC MINORITY GROUPS

The COVID-19 pandemic has had a disproportionate impact on racial and ethnic minority groups, due to long-standing systemic health and social inequities. As demonstrated by a recent report by Statistics Canada, "Black people in particular have been far more likely to succumb to the virus than members of other groups."[1] These inequities include but are not limited to a number of factors associated with systemic racism, including:

- Occupation (e.g., working in high-exposure environments as essential front-line workers)
- Increased risk of chronic illness
- Barriers to health-care access and utilization
- Education, income and wealth gaps
- Housing and living conditions

BLACK COMMUNITIES ARE AMONG THOSE HARDEST HIT BY COVID-19

As a result of the inequities referenced above, Black communities have been among those hardest hit by COVID-19. Although race-based data is not readily available across the country, where such data has been collected it has demonstrated a disproportionate burden on Black people, families and communities. For example:

- The case rates of COVID-19 are three times higher in Toronto's Black population than in its white population.[2]
- The rate of COVID-19 hospitalization is three times greater in Toronto's Black population than in its white population.[2]

---

[1] Tasker, JP. More racially diverse areas reported much higher numbers of COVID-19 deaths: StatsCan [Internet]. CBC.ca. 2021 Mar 11 [cited 11 March 2021]. Available from: https://www.cbc.ca/news/politics/racial-minorities-covid-19-hard-hit-1.5943878.

[2] City of Toronto. COVID-19: Status of cases in Toronto [Internet]. Toronto; City of Toronto; 2021. Ethno-racial group, income, & infection; 2020 Dec 31 [cited 2021 Mar 2]; [6th tab]. Available from: https://www.toronto.ca/home/covid-19/covid-19-latest-city-of-toronto-news/covid-19-status-of-cases-in-toronto/

AS

- National surveys have shown higher rates of job loss and earning loss in the Black population during the pandemic[3] and rates of food insecurity are rising.
- A recent study has shown a looming risk of evictions in Toronto's Black population.[4]

These disparities are rooted in systemic anti-Black policies, along with inequitable and inadequate public health and social policy responses.

INADEQUATE PUBLIC HEALTH RESPONSE

According to a report by the Public Health Agency of Canada, "Vaccine Hesitancy highest amongst the Black population," 34% of Black Canadians stated they would be willing to take the COVID-19 vaccine in November 2020.[5] Disparities in COVID-19's impact and the Black community's distrust of the COVID-19 vaccine share the same root cause: anti-Black racism, which has resulted in a systemic inequity of power, resources and opportunities that discriminates against people of African descent.[6] As a result of anti-Black racism, our communities' cries to address the social determinants of health, collect race-based health data and improve health-care funding in racialized communities go largely ignored. A recent Wellesley Institute survey demonstrated the low levels of trust in public services by the Toronto Black community. This is likely a consequence of the fact that services have not been made accessible to them in an equitable fashion.[7]

An appropriate public health response must consider the issues referenced above, while employing an equity framework (e.g., the Health Equity Approach to COVID-19 proposed by the Public Health Agency of Canada[8]) or a racial equity impact analysis.[9] This would enable affected communities to get the support they need to address prevention and the socioeconomic and medical consequences of COVID-19. Our recommendations for an appropriate public health response are detailed below.

---

[3] African-Canadian Civic Engagement Council (CA). Impact of COVID-19: Black Canadian perspectives [Internet]. Toronto: African-Canadian Civic Engagement Council, Innovative Research Group; 2020 Sep [cited 2021 Mar 3]. 30 p. Available from: https://innovativeresearch.ca/wp-content/uploads/2020/09/ACCEC01-Release-Deck.pdf

[4] Leon S, Iveniuk J. Forced out: evictions, race, and poverty in Toronto [Internet]. Toronto: Wellesley Institute; 2020 Aug [cited 2021 Mar 03]. 23 p. Available from: https://www.wellesleyinstitute.com/wp-content/uploads/2020/08/Forced-Out-Evictions-Race-and-Poverty-in-Toronto-.pdf

[5] Public Health Agency of Canada. Building COVID-19 vaccine confidence in Canadians: local medical officers [unpublished report]. Virtual presentation given 2020 Dec 18.

[6] Abdillahi I, Shaw A. Social determinants and inequities in health for Black Canadians: a Snapshot [Internet]. Public Health Agency of Canada; 2020 Sep [cited 2021 Mar 03]. 14 p. Available from: https://www.canada.ca/content/dam/phac-aspc/documents/services/health-promotion/population-health/what-determines-health/social-determinants-inequities-black-canadians-snapshot/health-inequities-black-canadians.pdf

[7] Iveniuk J, Gunaseelan V. Race and social capital: examining trust and connection in Toronto [Internet]. Toronto: Wellesley Institute; 2021 Jan [cited 2021 Mar 03]. 11 p. Available from: https://www.wellesleyinstitute.com/wp-content/uploads/2021/02/Race-and-Social-Capital.pdf

[8] Public Health Agency of Canada. From risk to resilience: an equity approach to COVID-19 [Internet]. Public Health Agency of Canada; 2020 Oct [cited 2021 Mar 03]. 86 p. Available from: https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/from-risk-resilience-equity-approach-covid-19.html#about

[9] Keleher T. Racial equity impact assessment [Internet]. Race Forward: The Center for Racial Justice Innovation; 2009 p. 1-2. Available from: https://www.raceforward.org/sites/default/files/RacialJusticeImpactAssessment_v5.pdf

AS

ROOTS OF VACCINE DISTRUST

Distrust of medical institutions is a response to the trauma of institutionalized and systemic violence and racism against the Black community. Generations of exclusion, marginalization, criminalization and discrimination have created an overall distrust of Canadian institutions of power, including the medical system. These lived experiences of underinvestment and systemic violence — combined with readily available misinformation — deepen distrust among Black communities in Western countries across the globe.[10,11]

The Black Canadian experience is rife with health and social inequities. This is a legacy of anti-Black racism that is uniquely rooted in European colonization in Africa and the Caribbean, as well as slavery in North America, South America and the Caribbean. The United Nations has reported that "The cumulative impact of anti-Black racism and discrimination faced by African Canadians in the enjoyment of their rights to education, health, housing and employment, among other economic, social and cultural rights, has had serious consequences for their overall well-being."[12]

It is critical that all levels of governments — including public health authorities and pharmaceutical companies — understand their obligation to build and increase trust in their institutions, particularly in Black communities that have been historically and systematically neglected when it comes to investing in social, community and health programs.

BUILDING VACCINE CONFIDENCE AND INCREASING UPTAKE

Black communities are using many channels to acknowledge concerns and rebuild trust, including virtual town halls, culturally adapted messaging in media and social media, community outreach initiatives and collaboration with mainstream government, health-care and research organizations.

A holistic community approach is needed to build vaccine confidence and increase vaccine uptake. Black populations will be best protected against COVID-19 through a combination of more equitable public health responses, such as:

- Partnering with the leadership from affected communities
- Providing adequate COVID-19 testing in neighbourhoods that are disproportionately affected
- Distributing adequate personal protective equipment for essential workers
- Combining vaccine availability with education and awareness campaigns, and

[10] Bajaj S, Stanford F. Beyond Tuskegee - vaccine distrust and everyday racism. N Engl J Med [Internet]. 2021 Feb [cited 2021 March 03];384(5):e12. Available from: https://www.nejm.org/doi/full/10.1056/NEJMpv2035827 doi: 10.1056/NEJMpv2035827

[11] Geddes L. Covid vaccine: 72% of black people unlikely to have jab, UK survey finds. The Guardian [Internet]. 2021 Jan 16 [cited 2021 March 03]. Available from: https://www.theguardian.com/world/2021/jan/16/covid-vaccine-black-people-unlikely-covid-jab-uk

[12] UN Human Rights Council. Report of the working group of experts on people of African descent on its mission to Canada [Internet]. United Nations General Assembly; 2017 Aug [cited 2021 Mar 03]. 20 p. Report no.: A/HRC/36/60/Add.1. Available from: https://www.refworld.org/docid/59c3a5ff4.html

- Implementing effective social policies (e.g., paid sick leave, better housing and enhanced worker protection) that has put Black and other lower-income Canadians at increased risk of COVID-19 could also improve outcomes

We strongly agree with the approach of the National Advisory Committee on Immunization,[13] which has recommended that:

> "Efforts should be made to increase access to immunization services to reduce health inequities without further stigmatization or discrimination, and to engage systemically marginalized populations and racialized populations in immunization program planning."[14]

OUR MESSAGE TO BLACK COMMUNITIES

We know there is a strong desire for things to go back to normal — to return to school, social events and religious gatherings, or to reconnect with the vulnerable members of our society. To achieve this, we need an all-hands-on-deck approach, including physical distancing, wearing a mask, getting vaccinated and following other public health recommendations.

The rigorous safety measures required for the COVID-19 vaccines to reach the market give us confidence to recommend the use of these vaccines when they are available. See Appendix 1 for more information on the development and testing of these vaccines.

OUR RECOMMENDATIONS

Health-care and public health institutions should:

- Designate Black communities as a priority population for COVID-19 vaccinations, based on demographic data demonstrating that Black communities are disproportionately affected by the virus
- Combine vaccine prioritization with an appropriately targeted communication strategy, including community engagement.

---

[13] The National Advisory Committee on Immunization is a national advisory committee of experts in the fields of pediatrics, infectious diseases, immunology, pharmacy, nursing, epidemiology, pharmacoeconomics, social science and public health. The Committee reports to the Vice-President of the Infectious Disease Prevention and Control Branch, and works with staff of the Centre for Immunization and Respiratory Infectious Diseases of the Public Health Agency of Canada to provide ongoing and timely medical, scientific and public health advice.
National Advisory Committee on Immunization (CA). National Advisory Committee on Immunization (NACI): membership and representation [Internet]. Canada.ca. 2021 Feb [cited 2021 Mar 03]. Available from: https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/naci-membership-representation.html

[14] National Advisory Committee on Immunization (CA). Recommendations on the use of COVID-19 vaccines [Internet]. Canada.ca. 2021 Mar [cited 2021 Mar 03]. Available from: https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines.html

Government, researchers and hospitals should demonstrate a sustained commitment to health equity for Black communities by:

- Ensuring race-based data is collected in collaboration with Black communities to identify, address and evaluate best practices to meet Black population health priorities
- Increasing Black representation at decision-making tables, particularly on hospital and advisory boards
- Establishing partnerships with Black health organizations
- Ensuring health leaders, clinical and public health staff and researchers receive cultural competency training in decolonization, anti-Black racism and its impacts on health in Black communities
- Ensuring governments and pharmaceutical companies are more proactive in building vaccine confidence and demonstrating the safety of the COVID-19 vaccine
- Ensuring that policy- and decision-makers are firmly committed to rebuilding communities and populations that have been hardest hit by COVID-19.

For Black communities, we recommend that:

- Black health-care providers strongly consider getting vaccinated
- Black health-care providers support communities to ensure there is representation at vaccine clinics, health committees and advocacy for Black community health issues
- Black Canadians consider getting the vaccine when it becomes available to protect themselves, their loved ones and their communities. Getting vaccinated will also help protect vulnerable members of the community who cannot receive the vaccine (e.g., young children and the immuno-compromised).

APPENDIX 1: VACCINATIONS APPROVED IN CANADA ARE RIGOROUSLY TESTED

We currently have no long-term studies to confirm the long-term effectiveness of the various COVID vaccines or their long-term effects.

However, the rigorous safety measures required to reach the market give us confidence to recommend the use of these vaccines when they do become available.

Black scientists around the world have been involved in the development of the COVID-19 mRNA vaccines. Dr. Kizzmekia Corbett, a Black virologist and immunologist, was a key developer of the Moderna mRNA COVID vaccine. Its development was also supported by the National Medical Association, a professional society of African American doctors and a respected authority on Black health in the United States. Many Black Canadian clinicians and scientists are at the forefront of the fight against COVID-19 and recommend COVID-19 vaccines for Black Canadians.

The development of these mRNA vaccines are a result of decades of research, which started shortly after SARS-1 in 2003-04. Research has been done on mRNA vaccines for cancers for many years. The stabilization of mRNA had been the limiting factor for the creation of vaccines. With the focus of research energy and funding during this pandemic, this obstacle was finally overcome with the development of a stable lipid envelope that allows the mRNA to reach its proper destination. It is important to note the mRNA does not affect our DNA. Also, once the mRNA has helped to trigger the process to generate an immune response, it breaks down and leaves the body. Similarly, non-mRNA vaccines do not alter someone's DNA.

The COVID-19 vaccines are going through the same phases of clinical research as all other vaccines. Phase I looks at whether the treatment is safe. Phase II involves more people and assesses whether the treatment works. Phase III assesses the best dose in a large, randomized trial with a more diverse population. The combined Phase III studies of the Pfizer and Moderna vaccines included about 10 per cent of people who identified as being Black or African American. Once vaccines have been administered to populations, a fourth phase of evaluation occurs. This is called the vaccine surveillance (post-marketing) phase, which allows for rare side-effects to be detected.

In addition to the mRNA vaccines, other types of vaccines have been developed and will likely be approved for use in Canada. These vaccines will have gone through the same phases of research and safety checks as the mRNA vaccines.

AS

APPENDIX 2: ABOUT THE AUTHORS

This joint position statement was written by the following organizations.

The Black Health Alliance is a community-led charity working to improve the health and well-being of Black communities in Canada. The Black Health Alliance is focused on supporting COVID-19-related health promotion tailored to the unique needs, lived realities and cultural specificities of diverse Black communities. This includes COVID-19 prevention, testing, vaccination and available community supports for Black communities. The objective of these activities will be to help reduce the COVID-19 related health inequities.

The Black Physicians' Association of Ontario (BPAO) has a mandate to address racialized health disparities affecting Black communities in Ontario and the inequitable representation of Black people in the field of medicine. The BPAO has established a Black Health Vaccine Initiative to address Black health inequities related to COVID-19 and advance Black-led community education related to the COVID-19 vaccine.

Black Opportunity Fund (BOF) Healthcare Task Force. The BOF has a mandate to address anti-Black racism by offering sustainable funding to organizations across Canada. The BOF Healthcare Task Force consists of Black health-care providers, researchers and community activists across the country and seeks to support Black-led organizations that address the inequities in health and health-care access in Black communities.

The BlackNorth Initiative (BNI) Health Committee. The BNI's mission is to end anti-Black systemic racism throughout all aspects of our lives by utilizing a business-first mindset. The BNI Health Committee was created to remove barriers to opportunities for Black people and dismantle anti-Black systemic racism. It will establish an action-oriented mandate, a set of key performance indicators and clearly defined deliverables to achieve its goal.

APPENDIX 3: LIST OF CANADIAN BLACK HEALTH ORGANIZATIONS THAT SUPPORT THIS STATEMENT

Signed in solidarity with Black health organizations and Black medical organizations across Canada.

Black Physicians of Canada
Parkdale Queen West Community Health Centre
Wharton Medical Clinic
Women's Health Alliance
Black Physiotherapists Association (BPTA)
Black Physicians of the Health Association of African Canadians
Carea Community Health Centres
Vibrant Healthcare Alliance
Canadian Association of Nigerian Physicians and Dentists
Black Creek Community Health Centre
Black Physicians of British Columbia
Quebec Black Medical Association / Association Médicale des Personnes de Race Noire du Québec
Black Physicians of British Columbia
TAIBU Community Health Centre
Black Scientists' Taskforce on Vaccine Equity
Black Physicians' Association of Alberta
Network for the Advancement of Black Communities

ACKNOWLEDGEMENTS

Student contributors:

Jordyn Gibson & Lucina Rakotovao

APPENDIX 4: ADDITIONAL READINGS

Health Equity Reports & Recommendations by Black Health Organizations in 2020:

- Black Health Alliance, Health Commons Solutions Lab, Sinai Health. Black Experience in Healthcare 2020 Report. [cited 2021 Mar 03]. Available from: https://static1.squarespace.com/static/5a0d40298dd041f9a60bb3a7/t/5ea9a317983eca78fd95ee6d/1588175652047/Full+Report-+Black+Experiences+in+Health+Care+Symposium+2020.pdf
- Statement from Black Health Leaders on COVID-19's impact on Black Communities in Ontario; 2020 April [cited 2021 Mar 03] Available from: https://www.allianceon.org/news/Statement-Black-Health-Leaders-COVID-19s-impact-Black-Communities-Ontario

Additional information on Black populations in Canada:

- Maheux H, Do D. Diversity of the Black population in Canada: an overview [Internet]. Ottawa: Statistics Canada; 2019 Feb [cited 2021 Mar 03]. 22 p. Cat no.: 89-657-X2019002 Available from: https://www150.statcan.gc.ca/n1/pub/89-657-x/89-657-x2019002-eng.htm
- Statistics Canada. A socioeconomic portrait of Canada's Black population. The Daily [Internet]. 2020 Feb 25 [cited 2021 Mar 03]. Available from: https://www150.statcan.gc.ca/n1/daily-quotidien/200225/dq200225b-eng.htm#search01
- Houle R. Changes in the socioeconomic situation of Canada's Black population, 2001 to 2016 [Internet]. Ottawa: Statistics Canada; 2020 Aug [cited 2021 Mar 03]. 42 p. Cat no.: 89-657-X2020001. Available from: https://www150.statcan.gc.ca/n1/pub/89-657-x/89-657-x2020001-eng.htm
- Abdillahi I, Shaw A. Social determinants and inequities in health for Black Canadians: a Snapshot [Internet]. Public Health Agency of Canada; 2020 Sep [cited 2021 Mar 03]. 14 p. Available from: https://www.canada.ca/content/dam/phac-aspc/documents/services/health-promotion/population-health/what-determines-health/social-determinants-inequities-black-canadians-snapshot/health-inequities-black-canadians.pdf

Additional references on racism in medicine:

- Wall LL. The medical ethics of Dr J Marion Sims: a fresh look at the historical record. J Med Ethics [Internet]. 2006 Jun [cited 2021 Mar 03];32(6):346-350. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2563360/ doi:10.1136/jme.2005.012559
- Advisory Committee on Human Radiation Experiments. The human radiation experiments: the final report of the President's Advisory Committee. New York: Oxford Univ. Press; 1996. Chapter 8, Total-body irradiation: Problems when research and treatment are intertwined; p. 239-240.

- Alsan M, Wanamaker M. Tuskegee and the health of Black men. Q J Econ [Internet]. 2017 Aug [cited 2021 Mar 03];133(1):407-455. Available from: https://pubmed.ncbi.nlm.nih.gov/30505005/ doi: 10.1093/qje/qjx029
- Dryden O, Nnorom O. Time to dismantle systemic anti-Black racism in medicine in Canada. Can. Med. Assoc. J. [Internet]. 2021 Jan [cited 3 March 2021];193(2):E55-E57. Available from: https://www.cmaj.ca/content/cmaj/193/2/E55.full.pdf doi: 10.1503/cmaj.201579
- National Advisory Committee on Immunization (CA). Recommendations on the use of COVID-19 vaccines [Internet]. Canada.ca. 2021 Mar [cited 2021 Mar 03]. Available from: https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines.html
- UN Human Rights Council. Report of the working group of experts on people of African descent on its mission to Canada [Internet]. United Nations General Assembly; 2017 Aug [cited 2021 Mar 03]. 20 p. Report no.: A/HRC/36/60/Add.1. Available from: https://www.refworld.org/docid/59c3a5ff4.html
- Ismail S, Hardy K, Tunis M, Young K, Sicard N, Quach C. A framework for the systematic consideration of ethics, equity, feasibility, and acceptability in vaccine program recommendations. Vaccine [Internet]. 2020 Jun [cited 3 March 2021];38(36):5861-5876. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7283073/ doi: 10.1016/j.vaccine.2020.05.051
- Ontario Agency for Health Protection and Promotion (Public Health Ontario). Introducing race, income, household size, and language data collection: a resource for case managers [Internet]. Toronto: Queen's Printer for Ontario; 2020. 8 p. Available from: https://www.publichealthontario.ca/-/media/documents/ncov/main/2020/06/introducing-race-income-household-size-language-data-collection.pdf?la=en
- Centers for Disease Control and Prevention. [LR8] Health equity considerations and racial and ethnic minority groups [Internet]. Cdc.gov. 2021 Feb [cited 3 March 2021]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/race-ethnicity.html

This is Exhibit **11** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 12 AK. day of March, 2021.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

By Daniel Salmon, Douglas J. Opel, Matthew Z. Dudley, Janesse Brewer, and Robert Breiman

DOI: 10.1377/hlthaff.2020.02254
HEALTH AFFAIRS 40, NO. 3 (2021): 419–425

ANALYSIS

Reflections On Governance, Communication, And Equity: Challenges And Opportunities In COVID-19 Vaccination

ABSTRACT **The US response to coronavirus disease 2019 (COVID-19) has been plagued with politics driving public health and messaging. As a result, COVID-19 vaccine rollout is occurring in an environment ill equipped to achieve broad acceptance of the vaccine. Addressing public concerns unlocks the potential for high vaccine coverage; this is best achieved when science and values, not politics, inform public health. A multifaceted and thorough engagement and communication plan that is responsive to the concerns and values of different groups must be swiftly yet carefully implemented in a coordinated manner by federal, state, and local governments. Effective communication will require rapid and rigorous science to promptly differentiate between adverse events following immunization that are causally related versus simply coincidental. Health care providers, in particular, will need support to process the otherwise potentially overwhelming amount of relevant information and effectively integrate it into discussions with their patients to support their decision making. An equitable COVID-19 immunization program could substantively reduce the disproportionate risks associated with this pandemic.**

Daniel Salmon (dsalmon1@jhu.edu) is a professor in the Departments of International Health and Health, Behavior, and Society and director of the Institute for Vaccine Safety, Johns Hopkins Bloomberg School of Public Health, in Baltimore, Maryland.

Douglas J. Opel is an associate professor in the Department of Pediatrics, University of Washington School of Medicine, in Seattle, Washington.

Matthew Z. Dudley is an assistant scientist in the Department of International Health and codirector of epidemiology in the Institute for Vaccine Safety, Johns Hopkins Bloomberg School of Public Health.

Janesse Brewer is an associate in the Department of International Health and codirector of stakeholder and community engagement in the Institute for Vaccine Safety, Johns Hopkins Bloomberg School of Public Health.

Robert Breiman is chief scientific officer of the Global Health Crisis Communication Center, in Atlanta, Georgia.

Developing and producing vaccines within a year of the discovery of a viral pathogen is an achievement beyond previous imagination. Molecular, genomic, immunologic, and technical advances have overcome what would have been an impossible consideration just a few years ago. Unparalleled investments and collaborations included an advance market commitment, enabling millions of doses to be produced for each vaccine candidate in anticipation that the vaccine would be safe and effective and enabling distribution of the vaccine for use immediately following regulatory review and authorization. These hopes have already come to fruition: Two vaccine products to protect against coronavirus disease 2019 (COVID-19) received Emergency Use Authorization (EUA) by the Food and Drug Administration (FDA) in December 2020 based on evidence of their safety profile and efficacy of greater than 90 percent.[1,2] Several other candidates are on the horizon.

Operation Warp Speed may be successful in its principal purpose and objective: "ensuring that every American who wants to receive a COVID-19 vaccine can receive one, by delivering safe and effective vaccine doses to the American people beginning January 2021."[3] However, COVID-19 vaccines may have a limited impact on controlling the pandemic and returning to normal social and economic life because vaccination, not vaccines themselves, saves lives. An estimated

70 percent of the population or more must have immunity to COVID-19 to effectively control disease through herd or community immunity.[4] These estimates assume homogeneous uptake of the vaccine, however; there is ample evidence that clustering of unvaccinated people can lead to disease outbreaks such as recently seen with measles, even when vaccine coverage at the state or national level is very high.[5] Disease-induced immunity comes at a heavy price and likely wanes over time. Vaccine-induced immunity is very straightforward to calculate: vaccine effectiveness multiplied by vaccine uptake. Operation Warp Speed seems to be based on the principle that if we build it, they will come. In this article we characterize public perceptions during the rollout of the vaccine and the impact on vaccine-informed decision making, the potential for vaccine equity to help address underlying health disparities, vulnerabilities of the vaccine program, and the role of health care providers and science to impact vaccine decision making and communications.

Vaccine Rollout Environment

Public polling data demonstrate that COVID-19 vaccine rollout will occur in an environment that is not prepared to widely accept the vaccine. We may build it, but many might not come.

US adults may underestimate COVID-19. Polls from early in the pandemic found that nearly two-thirds underestimated the overall risk of death from COVID-19 and that more than half severely underestimated their own susceptibility to death.[6] The percentage of US adults intending to vaccinate against COVID-19 decreased substantially from more than 70 percent in late spring to only about half in September, before rebounding to above 60 percent by late fall. Although the exact starting and ending points varied, this U-shaped pattern was generally seen regardless of race/ethnicity, political affiliation, gender, age, and education. Common concerns among those not intending to vaccinate were safety, efficacy, and the perceived rushed timeline for development.[7–10] Factors consistently associated with lower intention to vaccinate include Black race, younger age (less than age sixty), lower education, and conservative political ideology.[6–11] Having more fear of COVID-19 and receiving a provider recommendation were both associated with greater intention to vaccinate.[11]

The immense investments in and achievements of the development of these vaccines will result in suboptimal public health benefit without a systematic approach to providing interpretable, context- and culture-specific, accurate, and trusted information about the vaccines that promotes vaccine confidence. A one-size-fits-all vaccine information and "demand creation" effort will not succeed, given the size of the US and the wide range of cultural beliefs, political leanings, scientific understanding, levels of trust in government leaders and agencies, and perceived motives of pharmaceutical companies. There is also the influence of antivaccine campaigns and the rapid spread of misinformation through a variety of electronic media to contend with. As described by the World Health Organization (WHO) in the context of vaccine messaging broadly, "Messages need to be tailored for the specific target group, because messaging that too strongly advocates vaccination may be counterproductive, reinforcing the hesitancy of those already hesitant."[12] The importance of tailored messaging is especially important in the COVID-19 context given wide variability in perceptions of disease susceptibility and severity, range of vaccine safety concerns, and underlying distrust of the vaccine program and government response to the pandemic.

Informed Decision Making And Vaccine Acceptance

As a first step, there must be recognition that decision making in a crisis is different and complicated by the fact that the pandemic's "waves" create heightened moments of crisis. The US population is not uniformly experiencing the pandemic: Some communities are disproportionately affected through increased exposure or severity of outcomes. Having the option to telework, living in households with multiple generations, relying on public transportation, having savings, and many other factors affect how the pandemic may affect people's interest in being and eagerness to be vaccinated. Layer on historical and cultural experience with experimental medical research for some communities (for example, Black, Native American, and Latinx), either in the US[13] or in countries they've recently migrated from,[14] and the result is a complex set of lenses through which a pandemic and vaccination may be considered.

Building, implementing, and adapting effective community engagement for bidirectional communication and dialogue are essential to the success of a COVID-19 vaccination program. Partnering with community-based organizations that serve different geographic, racial/ethnic, age, religious/faith, and political belief groups can ultimately help reduce the disproportionate burden of illness from COVID-19 on particular communities and increase vaccine acceptance. Community engagement activities need to be ongoing and responsive to the evolution of

Misperceptions around the severity of illness from COVID-19 must be addressed to create an environment receptive to vaccination.

knowledge regarding COVID-19 and advances in vaccine development and vaccine rollout.

In particular, misperceptions around the severity of illness from COVID-19 must be addressed to create an environment receptive to vaccination. Although there are indeed treatment options that are effective at reducing COVID-19 morbidity and mortality, a substantial proportion of the population believes that COVID-19 is not a serious disease.[6] Frequent (and inaccurate) statements such as "the flu is worse than COVID-19," "increasing incidence is a result of improved testing," and "mortality data are inflated to increase the profits of clinicians" can contribute to people's misperceptions of the severity of COVID-19 disease and hinder vaccine demand. Narratives that prioritize personal autonomy without considering community benefit as well as inconsistent messaging around mask wearing and social distancing further complicate receptivity to vaccination. Correcting misperceptions is important to inform people's views as they develop instead of changing people's minds, especially with regard to vaccines.[15] Public health must change the perception of COVID-19 severity to facilitate the acceptance of vaccines as well as other disease control efforts.

The name "Operation Warp Speed" reflects the endeavor's mission and focus; however, many perceived that the rush led to shortcuts around vaccine safety. To date, this is not the case. Phase III clinical trials have been adequately powered for determining whether the benefits outweigh the risks in the populations studied. The EUA process, though requiring less safety and efficacy data than are required for formal approval of vaccines through the standard Biological License Application process, included the Vaccine Related Biological Product Advisory Committee (VRBPAC) in its authorization process to share detailed clinical trial data; allow public review of all data; and include independent, nongovernmental experts in determinations of whether the available evidence of COVID-19 vaccine safety and efficacy justified its emergency use. The Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC), comprising independent, nongovernmental experts, also provided vaccine recommendations regarding who should get which vaccines through public deliberations. The transparency of these processes may assist in overcoming perceptions that the vaccine has been rushed to market. However, transparency might not be enough. There should be focused efforts to engage the public regarding the rigorous approach to vaccine development, evaluation, authorization for use, and post-rollout safety surveillance and how it provides assurance that the benefits of the vaccine outweigh the risks, and, if adverse reactions result from the vaccine, how people will be compensated. Engagement and messaging need to be developed and evaluated for subpopulations that likely vary in information needs and credible sources for such information.

Assurance of safety goes beyond clinical trials and authorization for use. Adverse reactions that are uncommon, have delayed onset, or occur in subpopulations excluded from clinical trials or subpopulations included in inadequately powered trials require study after vaccines are deployed. Postauthorization safety evaluation to detect real adverse reactions is particularly important for COVID-19 vaccines, given that many are using novel technologies. Examples of real adverse reactions caused by vaccines but not identified until widely used in the population include Guillain-Barré Syndrome following the 1976 swine flu vaccine,[16] narcolepsy following AS03 adjuvanted pandemic 2009 H1N1 vaccine (Pandemrix),[17] and enhanced disease following Dengue vaccine.[18]

Additionally, vaccination of large numbers of people will be coincidentally related to health outcomes (for example, heart attacks, strokes, and illness from COVID-19) that would have happened anyway. Mass vaccination programs that rapidly vaccinate large numbers of people are at high risk of being undermined by coincidental adverse events following immunization, such as recently occurred in South Korea, where several deaths following a mass influenza vaccination campaign largely brought the program to a halt.[19] Rapid and rigorous science is needed to determine whether adverse events following immunization are causally related to vaccination, are more likely in some individuals or subpopulations, or are simply coincidental. The process for separating real adverse reactions from coin-

cidental events must be credible, and communication programs must be prepared to respond to real or coincidental vaccine safety scares that arise domestically or are imported from other countries.

Vaccine Equity

There are disproportionate risks for COVID-19-associated illness, hospitalization, and death among people whose exposure to the virus is increased because of their living and working environments and transportation requirements. The increased risks of COVID-19 are linked to systemic social injustices and underlying medical conditions. An equitable COVID-19 immunization program prioritizes these populations to receive a vaccine in order to mitigate health inequities.

It must be acknowledged, however, that many communities at disproportionate risk for COVID-19 might also not accept immunization. Some individuals within these communities are unlikely to trust an immunization program brought along at warp speed by the government and large corporations. To realize the goal of a COVID-19 immunization program to mitigate health inequities, it is essential for it to include engagement that facilitates trust, provides accurate and interpretable information, and honors and incorporates their values and lived experience. Failure to gain acceptance of vaccines and achieve equitable access and use will represent a tragic public health failure.

Mounting an effective vaccine program will require understanding and responding to the concerns and values of different groups. We can anticipate that the communication challenges will become more complex as additional vaccines are authorized. Health communication principles shown to improve trust should be emphasized, such as transparency, tailoring, and trusted messengers.[20,21]

The Role Of Health Care Providers

Health care providers will play a critical role in any COVID-19 vaccination strategy. Health care providers have been consistently cited by parents and patients as a trusted source of vaccine information.[12,22] This mirrors recent national survey data in which over 90 percent of US adults reported "some" or "a lot" of trust in doctors and other health care professionals,[23] a trustworthiness that has persisted during the COVID-19 pandemic.[24,25] One of the most consistent predictors of acceptance among patients and parents of routine vaccinations is a health care provider recommendation.[26–28] Similarly, parents who have their vaccine concerns addressed or are given reassurance by their child's health care provider have accepted vaccines after initially being hesitant.[29]

Failure to gain acceptance of vaccines and achieve equitable access and use will represent a tragic public health failure.

Health care provider communication practices regarding a COVID-19 vaccine, however, will be contingent upon health care providers themselves being confident in the safety and effectiveness of any approved vaccine. Historically, this confidence has been achieved through trust in the processes and systems to develop, approve, and monitor the safety of vaccines. For COVID-19 vaccines, this trust has been damaged by the politicization of these processes and systems. The effect on vaccine uptake could be equally damaging if this loss of trust translates into health care providers giving only a weak recommendation to patients for an approved COVID-19 vaccine, or no recommendation at all.

Also complicating health care providers' communication regarding a COVID-19 vaccine are unique communication challenges. One prominent challenge is that COVID-19 vaccines are currently available to the public through an EUA, an event that is wholly unprecedented for vaccines outside of only one other instance in which anthrax vaccine was made available to high-risk groups.[30] This poses a challenge because not only is there confusion among the public about what an EUA means,[31] but also the use of an EUA to make a vaccine available has been associated with a decrease in vaccine acceptability.[32]

Some evidence-based provider vaccine communication strategies may also be problematic in the context of COVID-19 vaccine discussion while the vaccine is only available through an EUA. One such strategy is clinician use of a presumptive format to initiate the vaccine discussion with a patient. This format linguistically presupposes that the patient or parent will vaccinate, such as, "So, we'll do vaccines today." Though use of this format has been shown to

Elevating science over politics provides the opportunity to realize the potential of COVID-19 vaccines.

improve vaccine acceptance among parents,[33,34] the appropriateness of this strategy is dependent on the presence of a comprehensively studied, highly beneficial, low-burden, minimally invasive intervention for which simple consent is justifiable. Unlike routine vaccinations, a COVID-19 vaccine authorized for emergency use does not yet qualify as this type of intervention. Therefore, nonpresumptive formats that facilitate a discussion with patients and parents that approximates full informed consent are more appropriate with a COVID-19 vaccine authorized for emergency use.

Motivational interviewing—a patient-centered framework for behavior change that helps leverage inherent motivation for behavior—may be especially relevant here regarding how providers pursue a patient's reluctance to vaccinate. Motivational interviewing can deepen rapport, broaden understanding of patient motivations, communicate support, and improve receptivity to information being shared. Furthermore, it has been shown to be effective at improving acceptance among those who initially voice vaccine concerns or resistance.[10,35]

Science Rather Than Politics Driving The Process

The US response to COVID-19 has been plagued with politics, which has driven public health and messaging. Throughout the pandemic, then-President Donald Trump downplayed the seriousness of the disease, and as late as October 2020, as a major surge of disease was starting as predicted by many scientists, President Trump announced: "It's going to disappear. It is disappearing." He acknowledged that his approach was intentional.[36,37] In addition to downplaying the course of the pandemic, often attributed to increased testing, the FDA came under scrutiny that politics affected their decision to grant an EUA for hydroxychloroquine and later convalescent plasma.[38] The CDC, which normally would lead efforts around pandemic response and related communications, was largely sidelined in the response to COVID-19 with widespread accounts of political officials interfering with CDC COVID-19 reports.[39] The effect has been devastating. These messages misinformed the public and resulted in false beliefs about the seriousness of and projections on the pandemic and led to poor compliance with mask wearing and other recommended prevention methods. Moreover, the impact of politics on public health agencies undermined their credibility. These very same agencies must now authorize use, make vaccine recommendations, and launch a massive immunization program.

Shortly after retiring as CDC director in 2002, Jeffrey Koplan wrote a timely and timeless article titled "Plagues, Public Health, and Politics," warning of the potential for politics to undermine public health and science.[40] Koplan argued that science must drive public health, which, in turn, must drive policy. He provided many successful examples that have followed this pathway from science to public health to policy (for example, vaccination, family planning, and the control of infectious diseases). Aspects of the early US response to HIV/AIDS exemplifies the perils when this pathway is reversed. Public perceptions that politics has driven public health, which has in turn affected science, have undermined the credibility of these agencies that the US now must rely on in order for COVID-19 vaccines to effectively control the pandemic.

Fortunately, preliminary Phase III trial data from Pfizer/BioNTech[41] and Moderna[42] of their respective COVID-19 vaccines was reported weeks after, and not before, the presidential election in November 2020. These data were subsequently reviewed by the FDA's VRBPAC and the CDC's ACIP in a transparent manner by independent scientists. This transparent process of science driving public health and then driving policy will hopefully help overcome public concerns that have plagued other aspects of the US COVID-19 response but likely will not be enough on its own without a prompt and thorough communication and engagement plan.

Conclusion

The potential for vaccines to control a pandemic, affecting everyday life and demonstrating the value of vaccination and public health, has never been greater than this moment with COVID-19. Despite multiple vaccines with extremely high efficacy and reasonably good safety profiles, the success of COVID-19 vaccines to accomplish this tremendous potential is not assured. Public health has the tools to understand and engage the public, with particular attention to subpopu-

lations at increased risk of COVID-19 or immunization refusal, to improve vaccine-informed decision making, vaccine acceptance, and disease control. Health care providers have a very important role and can use well-validated approaches to inform their patients and assist them with their vaccine decisions. Elevating science over politics provides the opportunity to realize the potential of COVID-19 vaccines. ■

An unedited version of this article was published online February 4, 2021, as a Fast Track Ahead Of Print article. That version is available in the online appendix. To access the appendix, click on the Details tab of the article online.

NOTES

1 Food and Drug Administration [Internet]. Silver Spring (MD): FDA; 2020. Press release, FDA takes key action in fight against COVID-19 by issuing Emergency Use Authorization for first COVID-19 vaccine; 2020 Dec 11 [cited 2021 Jan 27]. Available from: https://www.fda.gov/news-events/press-announcements/fda-takes-key-action-fight-against-covid-19-issuing-emergency-use-authorization-first-covid-19

2 Food and Drug Administration [Internet]. Silver Spring (MD): FDA; 2020. Press release, FDA takes additional action in fight against COVID-19 by issuing Emergency Use Authorization for second COVID-19 vaccine; 2020 Dec 18 [cited 2021 Jan 27]. Available from: https://www.fda.gov/news-events/press-announcements/fda-takes-additional-action-fight-against-covid-19-issuing-emergency-use-authorization-second-covid

3 Department of Health and Human Services. From the factory to the frontlines: the Operation Warp Speed strategy for distributing a COVID-19 vaccine [Internet]. Washington (DC): HHS; [cited 2021 Feb 1]. Available from: https://www.hhs.gov/sites/default/files/strategy-for-distributing-covid-19-vaccine.pdf

4 Fontanet A, Cauchemez S. COVID-19 herd immunity: where are we? Nature Rev Immunol. 2020;20(10):583–4.

5 Phadke VK, Bednarczyk RA, Salmon DA, Omer SB. Association between vaccine refusal and vaccine-preventable diseases in the United States: a review of measles and pertussis. JAMA. 2016;315(11):1149–58.

6 Niepel C, Kranz D, Borgonovi F, Emslander V, Greiff S. The coronavirus (COVID-19) fatality risk perception of US adult residents in March and April 2020. Br J Health Psychol. 2020;25(4):883–8.

7 Funk C, Tyson A. Intent to get a COVID-19 vaccine rises to 60% as confidence in research and development process increases [Internet]. Washington (DC): Pew Research Center; 2020 Dec 3 [cited 2021 Jan 27]. Available from: https://www.pewresearch.org/science/2020/12/03/intent-to-get-a-covid-19-vaccine-rises-to-60-as-confidence-in-research-and-development-process-increases/

8 Reinhart RJ. More Americans now willing to get COVID-19 vaccine [Internet]. Washington (DC): Gallup, Inc.; 2020 Nov 17 [cited 2021 Jan 27]. Available from: https://news.gallup.com/poll/325208/americans-willing-covid-vaccine.aspx

9 Brenan M. Willingness to Get COVID-19 vaccine ticks up to 63% in U.S. [Internet]. Washington (DC): Gallup, Inc.; 2020 Dec 8 [cited 2021 Jan 27]. Available from: https://news.gallup.com/poll/327425/willingness-covid-vaccine-ticks.aspx

10 Hamel L, Kirzinger A, Muñana C, Brodie M. KFF COVID-19 vaccine monitor: December 2020 [Internet]. San Francisco (CA): Henry J. Kaiser Family Foundation; 2020 Dec 15 [cited 2021 Jan 27]. Available from: https://www.kff.org/coronavirus-covid-19/report/kff-covid-19-vaccine-monitor-december-2020/

11 Head KJ, Kasting ML, Sturm LA, Hartsock JA, Zimet GD. A national survey assessing SARS-CoV-2 vaccination intentions: implications for future public health communication efforts. Sci Commun. 2020;42(5):698–723.

12 Dubé E, Gagnon D, MacDonald NE. Strategies intended to address vaccine hesitancy: review of published reviews. Vaccine. 2015;33(34):4191–203.

13 Scharff DP, Mathews KJ, Jackson P, Hoffsuemmer J, Martin E, Edwards D. More than Tuskegee: understanding mistrust about research participation. J Health Care Poor Underserved. 2010;21(3):879–97.

14 MacDougall D, Halperin BA, Isenor J, MacKinnon-Cameron D, Li L, McNeil SA, et al. Routine immunization of adults by pharmacists: attitudes and beliefs of the Canadian public and health care providers. Hum Vaccin Immunother. 2016;12(3):623–31.

15 Salmon DA, Dudley MZ, Glanz JM, Omer SB. Vaccine hesitancy: causes, consequences, and a call to action. Vaccine. 2015;33 Suppl 4:D66–71.

16 Schonberger LB, Bregman DJ, Sullivan-Bolyai JZ, Keenlyside RA, Ziegler DW, Retailliau HF, et al. Guillain-Barre syndrome following vaccination in the National Influenza Immunization Program, United States, 1976–1977. Am J Epidemiol. 1979;110(2):105–23.

17 Sarkanen TO, Alakuijala APE, Dauvilliers YA, Partinen MM. Incidence of narcolepsy after H1N1 influenza and vaccinations: systematic review and meta-analysis. Sleep Med Rev. 2018;38:177–86.

18 Shukla R, Ramasamy V, Shanmugam RK, Ahuja R, Khanna N. Antibody-dependent enhancement: a challenge for developing a safe Dengue vaccine. Front Cellular Infection Microbiol. 2020;10:572681.

19 Fendos J. South Korea's flu vaccine deaths preview COVID-19 vaccine distribution challenges. Diplomat [serial on the Internet]. 2020 Nov 4 [cited 2021 Jan 27]. Available from: https://thediplomat.com/2020/11/south-koreas-flu-vaccine-deaths-preview-covid-19-vaccine-distribution-challenges/

20 World Health Organization. Communicating risk in public health emergencies: a WHO guideline for emergency risk communication (ERC) policy and practice. Geneva: WHO; 2018 Jan 10.

21 Chou W-YS, Burgdorf CE, Gaysynsky A, Hunter CM. COVID-19 vaccination* communication: applying behavioral and social science to address vaccine hesitancy and foster vaccine confidence** [Internet]. Bethesda (MD): National Institutes of Health; 2020 [cited 2021 Feb 1]. Available from: https://obssr.od.nih.gov/wp-content/uploads/2020/12/COVIDReport_Final.pdf

22 Healy CM, Rench MA, Montesinos DP, Ng N, Swaim LS. Knowledge and attitudes of pregnant women and their providers towards recommendations for immunization during pregnancy. Vaccine. 2015;33(41):5445–51.

23 National Cancer Institute. Trust in

health information sources among American adults [Internet]. Bethesda (MD); NCI; 2019 May [cited 2021 Jan 27]. (Hints Briefs No. 39). Available from: https://hints.cancer.gov/docs/Briefs/HINTS_Brief_39.pdf

24 Funk C, Gramlich J. Amid coronavirus threat, Americans generally have a high level of trust in medical doctors [Internet]. Washington (DC): Pew Research Center; 2020 Mar 13 [cited 2021 Jan 27]. Available from: https://www.pewresearch.org/fact-tank/2020/03/13/amid-coronavirus-threat-americans-generally-have-a-high-level-of-trust-in-medical-doctors/

25 Earnshaw VA, Eaton LA, Kalichman SC, Brousseau NM, Carly Hill E, Fox AB. COVID-19 conspiracy beliefs, health behaviors, and policy support. Transl Behav Med. 2020;10(4):850–6.

26 Lutz CS, Carr W, Cohn A, Rodriguez L. Understanding barriers and predictors of maternal immunization: identifying gaps through an exploratory literature review. Vaccine. 2018;36(49):7445–55.

27 Smith PJ, Stokley S, Bednarczyk RA, Orenstein WA, Omer SB. HPV vaccination coverage of teen girls: the influence of health care providers. Vaccine. 2016;34(13):1604–10.

28 McCauley MM, Kennedy A, Basket M, Sheedy K. Exploring the choice to refuse or delay vaccines: a national survey of parents of 6- through 23-month-olds. Acad Pediatr. 2012;12(5):375–83.

29 Gust DA, Darling N, Kennedy A, Schwartz B. Parents with doubts about vaccines: which vaccines and reasons why. Pediatrics. 2008;122(4):718–25.

30 Food and Drug Administration. Authorization of emergency use of anthrax vaccine adsorbed for prevention of inhalation anthrax by individuals at heightened risk of exposure due to attack with anthrax; availability. Fed Regist. 2005;70(21):5452–6.

31 Liu BF, Quinn SC, Egnoto M, Freimuth V, Boonchaisri N. Public understanding of medical countermeasures. Health Secur. 2017;15(2):194–206.

32 Quinn SC, Kumar S, Freimuth VS, Kidwell K, Musa D. Public willingness to take a vaccine or drug under Emergency Use Authorization during the 2009 H1N1 pandemic. Biosecur Bioterror. 2009;7(3):275–90.

33 Gagneur A, Lemaître T, Gosselin V, Farrands A, Carrier N, Petit G, et al. A postpartum vaccination promotion intervention using motivational interviewing techniques improves short-term vaccine coverage: PromoVac study. BMC Public Health. 2018;18(1):811.

34 Dempsey AF, Pyrznawoski J, Lockhart S, Barnard J, Campagna EJ, Garrett K, et al. Effect of a health care professional communication training intervention on adolescent human papillomavirus vaccination: a cluster randomized clinical trial. JAMA Pediatr. 2018;172(5):e180016.

35 Opel DJ, Mangione-Smith R, Robinson JD, Heritage J, DeVere V, Salas HS, et al. The influence of provider communication behaviors on parental vaccine acceptance and visit experience. Am J Public Health. 2015;105(10):1998–2004.

36 Wolfe D, Dale D. "It's going to disappear": a timeline of Trump's claims that Covid-19 will vanish. CNN [serial on the Internet]. 2020 Oct 31 [cited 2021 Jan 27]. Available from: https://www.cnn.com/interactive/2020/10/politics/covid-disappearing-trump-comment-tracker/

37 Oh I. Trump admits that he lied about the coronavirus. Mother Jones [serial on the Internet]. 2020 Sep 9 [cited 2021 Jan 27]. Available from: https://www.motherjones.com/coronavirus-updates/2020/09/trump-admits-that-he-lied-about-the-coronavirus/

38 Kupferschmidt K, Cohen J. In FDA's green light for treating COVID-19 with plasma, critics see thin evidence—and politics [Internet]. Washington (DC): American Association for the Advancement of Science; 2020 Aug 24 [cited 2021 Jan 27]. Available from: https://www.sciencemag.org/news/2020/08/fda-s-green-light-treating-covid-19-plasma-critics-see-thin-evidence-and-politics

39 Diamond D. Trump officials interfered with CDC reports on Covid-19. Politico [serial on the Internet]. 2020 Sep 11 [cited 2021 Jan 27]. Available from: https://www.politico.com/news/2020/09/11/exclusive-trump-officials-interfered-with-cdc-reports-on-covid-19-412809

40 Koplan JP, McPheeters M. Plagues, public health, and politics. Emerg Infect Dis. 2004;10(11):2039–43.

41 Pfizer Inc. [Internet]. New York (NY): Pfizer Inc.; 2020. Press release, Pfizer and BioNTech announce vaccine candidate against COVID-19 achieved success in first interim analysis from phase 3 study; 2020 Nov 9 [cited 2021 Jan 27]. Available from: https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-announce-vaccine-candidate-against

42 Moderna [Internet]. Cambridge (MA): Moderna; 2020. Press release, Moderna's COVID-19 vaccine candidate meets its primary efficacy endpoint in the first interim analysis of the Phase 3 COVE study; 2020 Nov 16 [cited 2021 Jan 27]. Available from: https://investors.modernatx.com/news-releases/news-release-details/modernas-covid-19-vaccine-candidate-meets-its-primary-efficacy

This is Exhibit **12** referred to in the Affidavit of **Dr. Arjumand Siddiqi.** Affirmed remotely by **Dr. Arjumand Siddiqi** of the City of Toronto in the Province of Ontario, before me at the City of Vaughan in the Province of Ontario, this 12 AK. day of March, 2021.

Anoop Kalsi LSO# P13598

A Commissioner, etc.

AS

Insights | COVID-19

Medicaid and COVID-19 Vaccination—Translating Equitable Allocation Into Equitable Administration

Chethan Bachireddy, MD, MSc[1,2,3]; Mohammad Dar, MD[4]; Christopher Chen, MD, MBA[5]

Author Affiliations | Article Information

February 17, 2021

RELATED

Medicaid's Response to COVID-19: Securing the Safety Net and Protecting Public Health

Community-Level Disparities in COVID-19 Infections and Deaths in Large US Metropolitan Areas

SEE MORE: CORONAVIRUS (COVID19) | HEALTH CARE ECONOMICS, INSURANCE, PAYMENT | VACCINATION

The risk of infection, morbidity, and mortality—and ultimately suffering—from coronavirus disease 2019 (COVID-19) has been borne unevenly. A disproportionate burden of disease has been shouldered by low-income and marginalized populations, many of whom rely on the Medicaid program for access to health care.[1] Medicaid provides health coverage for more than 75 million individuals, including those receiving com-

those residing in low-resource neighborhoods, and an estimated 10% of all essential and front-line workers.[2]

The rapid development and approval of COVID-19 vaccines present a remarkable opportunity to limit suffering from the COVID-19 crisis. To date, states have primarily focused on making thoughtful allocation decisions for a limited vaccine supply based on feedback from stakeholders and the principles of advancing health, equity, and trust. While **federal recommendations** and state distribution decisions take equity into consideration, much work is needed to realize these plans.

During the course of the pandemic, individuals and communities with higher risk have been less likely to receive critical resources, including COVID-19 testing, novel COVID-19 therapies, and support services.[3] In this context, Medicaid programs must ensure equitable administration of COVID-19 vaccines.[4] We highlight 3 strategies to achieve this aim: (1) make it easy for Medicaid members to access COVID-19 vaccines; (2) build trust through clear, consistent, and inclusive messaging; and (3) partner widely to ensure successful implementation.

Make It Easy to Access COVID-19 Vaccines

As a condition of receiving **enhanced federal funding during the public health emergency**, Medicaid programs are required to provide COVID-19 vaccines without patient cost-sharing. Medicaid must clearly communicate that COVID-19 vaccines are free for members. Medicaid managed care networks are often a source of confusion, and Medicaid programs should work with their managed care plans to suspend limits on out-of-network coverage to ensure members can receive COVID-19 vaccines from in-network as well as out-of-network services.

The implementation details of vaccine allocation decisions are critical. For example, many states are planning to allocate COVID-19 vaccines to individuals with high-risk con-

be daunting for individuals to understand when they are eligible. Medicaid can empower members by proactively communicating when they are eligible and where they can access vaccines through online navigation tools such as the **CDC-funded Vaccine Finder**.

Medicaid programs can reduce geographic barriers by meeting people where they are and delivering COVID-19 vaccines at local pharmacies, grocery stores, community health centers, doctors' offices, senior centers, and schools. Already, national pharmacy chains have been recruited to assist with administering COVID-19 vaccines in long-term care facilities. These partnerships should be expanded given that **90% of Americans live within 5 miles of a community pharmacy**. Medicaid programs are **required to provide a nonemergency medical transportation benefit** and can waive copays or prior authorizations for those who need rides to COVID-19 administration sites.

Build Trust Through Clear, Consistent, and Inclusive Messaging

According to a recent survey,[5] 27% of US residents probably or definitely would not get a COVID-19 vaccine, and these numbers are higher among rural-dwelling and Black populations. More than half of this group cites concerns about possible adverse effects, the role of politics in vaccine development, and overall mistrust in the government. How can trust in COVID-19 vaccines among Medicaid members be enhanced?

During the pandemic, Medicaid programs have coordinated with state public health departments to **deliver messages** on COVID-19 prevention, testing, and treatment through letters, emails, text messages, phone calls, and social media. Medicaid programs must continue this work by delivering clear, consistent, and culturally inclusive messaging about COVID-19 vaccines. Building trust is not a linear process and will require partnering with trusted messengers to deliver trusted messages. Medicaid programs can post testimonial videos and messages about why to get vaccinated from respected leaders in faith and minority communities who may share experiences with Medicaid members.

The strategies outlined above will require state Medicaid programs to effectively partner with state and local public health departments, health care professionals and systems, and Medicaid members. In most states, COVID-19 vaccine messaging, allocation decisions, and administration monitoring are being led through public health departments. Medicaid programs can play a valuable role in refining and amplifying public health messaging and data sharing and strategy. To ensure the translation of equitable allocation into equitable administration, timely and transparent metrics must be developed. No single database in any state will hold all of the needed information, such as occupation, comorbidities, age, socioeconomic status, race, ethnicity, language, and geography.

Medicaid programs should work with state agencies and clinical partners to share these data securely and to develop metrics to ensure groups eligible for vaccinations receive them. These metrics can serve as a foundation for productive partnerships. For instance, if vaccine uptake is limited among those with substance use disorder in a particular geographic area, Medicaid and public health departments can work with harm reduction programs and addiction clinics to colocate vaccine administration to improve vaccine access for this group.

Conclusion

COVID-19 vaccines represent a beacon of hope amid a crisis that has revealed and exacerbated structural inequities in health. The burden of the pandemic has fallen hardest on individuals and communities with the highest risk—many of whom rely on Medicaid for access to care. The anticipated scope of COVID-19 vaccine implementation is unprecedented, and unforeseen obstacles will be experienced most profoundly by those experiencing the most marginalization. Therefore, Medicaid programs must partner, listen, and innovate to meet the needs of their members and ensure equitable implementation of COVID-19 vaccines. The health and lives of the Medicaid members with the most risk depend on it.

Corresponding Author: Chethan Bachireddy, MD, MSc, Virginia Department of Medical Assistance Services, 600 E Broad St, Richmond, VA, 23219 (chethan.bachireddy@dmas.virginia.gov).

Conflict of Interest Disclosures: None reported.

Disclaimer: The opinions expressed in this article are those of the authors and do not necessarily reflect those of an individual Medicaid or state agency.

Additional Contributions: The authors would like to acknowledge and thank Julie Donohue, Susan Kennedy, and Sunita Krishnan for their review and feedback.

References

1. Adhikari S, Pantaleo NP, Feldman JM, Ogedegbe O, Thorpe L, Troxel AB. Assessment of community-level disparities in coronavirus disease 2019 (COVID-19) infections and deaths in large US metropolitan areas. *JAMA Netw Open*. 2020;3(7):e2016938. doi:10.1001/jamanetworkopen.2020.16938
Article | Google Scholar

2. Broaddus M. 5 Million essential and front-line workers get health coverage through Medicaid. Center on Budget and Policy Priorities. Published August 4, 2020. Accessed February 8, 2021. https://www.cbpp.org/blog/5-million-essential-and-front-line-workers-get-health-coverage-through-medicaid

3. Lieberman-Cribbin W, Tuminello S, Flores RM, Taioli E. Disparities in COVID-19 testing and positivity in New York City. *Am J Prev Med*. 2020 Sep;59(3):326-332. doi:10.1016/j.amepre.2020.06.005.
Google Scholar | Crossref

4. Bachireddy C, Chen C, Dar M. Securing the safety net and protecting public health

2010. doi:10.1001/jama.2020.4272
Article | Google Scholar | Crossref

5. Hamel L, Kirzinger A, Muñana C, Brodie M. KFF COVID-19 vaccine monitor: December 2020. Kaiser Family Foundation. Published December 15, 2020. Accessed February 8, 2021. https://www.kff.org/coronavirus-covid-19/report/kff-covid-19-vaccine-monitor-december-2020/

See More

CORONAVIRUS (COVID19) | HEALTH CARE ECONOMICS, INSURANCE, PAYMENT | VACCINATION

Comment

MOST VIEWED

Report Outlines Strategy for Surveillance of Emerging Coronavirus Variants
Joan Stephenson, PhD

Taking Vaccine to Where the Virus Is—Equity and Effectiveness in Coronavirus Vaccinations
Kirsten Bibbins-Domingo, MD, PhD, MAS; Maya Petersen, MD, PhD; et al.

Mask Exemptions During the COVID-19 Pandemic—A New Frontier for Clinicians
Doron Dorfman, LLB, JSD; Mical Raz, MD, PhD, MSHP

AS.

DANESHVAR Applicant	and	HER MAJESTY THE QUEEN IN RIGHT OF ONTARIO AS REPRESENTED BY THE MINISTER OF HEALTH, and the HONOURABLE CHRISTINE ELLIOTT, MINISTER OF HEALTH for the PROVINCE OF ONTARIO Respondents	Court File No: 223/21

ONTARIO
SUPERIOR COURT OF JUSTICE
(DIVISIONAL COURT)

AFFIDAVIT OF DR. ARJUMAND SIDDIQI
(Sworn March 16, 2021)

bakerlaw
4711 Yonge Street, Suite 509
Toronto, ON M2N 6K8

David Baker LSO# 17674M
Kimberly Srivastava LSO# 69867U
Tel: (416) 533-0040
Email: dbaker@bakerlaw.ca
ksrivastava@bakerlaw.ca

Lawyers for the Applicant