

BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email info.bmjopen@bmj.com

BMJ Open

Taking stock of vaccine hesitancy among immigrants: a systematic scoping review protocol

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-035225
Article Type:	Protocol
Date Submitted by the Author:	25-Oct-2019
Complete List of Authors:	Tankwanchi, Akhenaten; University of Washington, School of Public Health Larson, Heidi; LSHTM Wiysonge, Charles; South African Medical Research Council, Cochrane South Africa Vermund, Sten; Yale University School of Medicine, Yale School of Public Health
Keywords:	IMMUNOLOGY, PUBLIC HEALTH, SOCIAL MEDICINE

SCHOLARONE™
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Taking stock of vaccine hesitancy among immigrants: a systematic scoping review protocol

Akhenaten B. Siankam Tankwanchi¹, Heidi J Larson², Charles Shey Wiysonge³, Sten H. Vermund⁴

1. School of Public Health, University of Washington,
1959 NE Pacific Street, Box 357660
Seattle, WA, USA 98195-7660
Akhent76@uw.edu
Phone: (+1) 832.732.2256
2. School of Public Health, University of Washington; Department of Infectious Disease Epidemiology,
London School of Hygiene and Tropical Medicine, London, UK. (Heidi.Larson@LSHTM.ac.uk)
3. Cochrane South Africa, South African Medical Research Council, Cape Town, SA; Department of
Global Health, Stellenbosch University, Cape Town, SA; School of Public Health and Family
Medicine, University of Cape Town, Cape Town, SA. (charles.wiysonge@mrc.ac.za)
4. Yale School of Public Health, Yale University, New Haven, CT, USA. (sten.vermund@yale.edu)

ABSTRACT

Introduction

At the 72nd World Health Assembly of May 2019, WHO member states prioritized a global action plan to promote migrant and refugee health. Five months earlier, WHO had declared vaccine hesitancy—the reluctance or refusal to vaccinate despite the availability of vaccination services—a top ten threat to global health in 2019. While vaccination is often a requirement for immigration, repeated outbreaks of vaccine-preventable diseases within certain immigrant communities in some host nations suggest they may be particularly vulnerable to vaccine hesitancy. Studies of the prevalence and determinants of vaccine hesitancy among immigrants globally seem to be lacking. This scoping review will 1) identify research on vaccine hesitancy among immigrants; 2) examine the extent and nature of the extant evidence; and 3) determine the value of undertaking a full systematic review.

Methods and analysis

The framework for systematic scoping review proposed by the Joanna Briggs Institute will be used. The search strategy will follow the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) guidelines. Studies, published between January 1999 and December 2019, will be drawn from the following multidisciplinary databases: Africa-Wide Information, Allied and Complementary Medicine, Cochrane Library, Cumulative Index of Nursing and Allied Health Literature, Embase, Index Medicus for the Eastern Mediterranean Region, International Bibliography of Social Sciences, Literature in the Health Sciences in Latin America and the Caribbean, Medline, Proquest Theses/Dissertations, PsycInfo, and Web of Science. The search will include an extensive list of keywords to capture multiple dimensions of confidence and hesitancy vis-à-vis vaccines among migrants. Findings will be reported through summary narratives, tables, flowcharts and evidence maps.

Ethics and dissemination

This review is based on published works and thus exempt from formal ethical approval. It will be published in a peer-reviewed open access journal to ensure wide dissemination.

For peer review only

ARTICLE SUMMARY

Strengths and limitations of this study

- This study may be the very first comprehensive review of vaccine hesitancy focusing exclusively on immigrants.
- Findings from this review will shed light on the research gaps on vaccine hesitancy among migrant individuals and communities.
- One possible major limitation of this review is the potential exclusion of important studies not published in English or French.

INTRODUCTION

Disparities in opportunity structures often compel people to move, internally or internationally. So, migration is a universal phenomenon that affects most countries. Migrants are driven by many factors including the prospects of improving their access to work, civil, political and religious rights, security and healthcare [1]. One important aspect of healthcare that may affect migration is immunization. People are often required to vaccinate in order to immigrate. On the other hand, access to vaccination and continuity of care is more challenging for people on the move such as migrants, refugees, or nomadic populations [2-3]. Long after they have settled in the host country, vaccination coverage among immigrants may still be suboptimal when compared to that of the general population [4-5]. With vaccine skeptics and populist politicians in some host countries openly challenging evidence-based science [6-8], unsuspecting immigrants may succumb to anti-immunization messaging and begin to resist vaccination for philosophical, religious or political reasons, empowered by their newfound freedoms and rights in the host nation. The repeated measles outbreaks among Somali-Americans are instructive [9-10].

Measles, a highly contagious respiratory disease and leading cause of vaccine-preventable infant mortality worldwide, was declared eliminated in the United States (U.S.) in 2000 [9]. But, since then

1
2
3 several outbreaks have occurred in various U.S. states, with index cases often linked to overseas travels
4 [10-12]. In 2011 and 2017, two measles outbreaks totaling 100 cases and largely confined to the Somali
5 community occurred in the U.S. state of Minnesota [13-14]. Analyses reveal that inaccurate information
6 about a link between autism and measles-mumps-rubella (MMR) vaccine originating from a discredited
7 Lancet study and propagated by local vaccine-skeptical advocacy groups (e.g., Vaccine Safety Council of
8 Minnesota, the Minnesota Natural Health Coalition, Minnesota Vaccine Freedom Coalition, and The
9 Organic Consumers Association) had permeated this immigrant community and fueled Somali parents'
10 fears of vaccination. From 92% in 2004, MMR vaccination compliance among Somali-American children
11 plummeted to 42% in 2014% [15-18].
12
13
14
15
16
17
18
19
20
21

22
23 When vaccination services are available yet underutilized, and barriers to access are minimal,
24 behavioral factors more so than structural ones may better explain lower vaccination rates. One such
25 factor that conspires against universal vaccination coverage and is gaining currency in the literature is
26 “vaccine hesitancy” [19-23]. Broadly defined as the reluctance or refusal to vaccinate despite the
27 availability of vaccination services, vaccine hesitancy entails a continuum of complex and context
28 specific attitudes and behaviors, ranging from total acceptance to complete refusal, and varying across
29 time, place and vaccines. Underlying hesitancy are issues of confidence, complacency, and convenience
30 [24]. The authoritative working group on vaccine hesitancy appointed by the World Health
31 Organization’s (WHO) Strategic Advisory Group of Experts (SAGE) on Immunization has developed a
32 multi-level explanatory model of vaccine hesitancy encompassing contextual influences (e.g., religion,
33 communication and media environment, politics, etc.), individual/group factors (e.g., beliefs, attitudes and
34 motivation about health, trust in health system, past experience with vaccination, peer influence, etc.), and
35 vaccine- and vaccination-specific determinants (e.g., cost, vaccination schedule, mode of administration,
36 etc.) [25]. Vaccine hesitancy theories and models may help to explain why vaccine-hesitant individuals
37 may accept all vaccines but remain concerned or unsure about vaccines, may shun or delay some vaccines
38 yet accept others, or may refuse all vaccines [25-27].
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 As a core topic, vaccine hesitancy is relatively new, with only six articles using the phrase in either
4 the title or abstract between 2009 and 2011 [25]. Even its qualification as a behavior has been called into
5 question [26]. Yet, the resurgence and repeated outbreaks of vaccine-preventable diseases like measles
6 that were considered eliminated in some Western countries have prompted WHO to declare vaccine
7 hesitancy one of the world's top ten threats to global health in 2019 [28]. If vaccine hesitancy is indeed a
8 global threat to health, and if immigrant communities are potential "hotspots" for vaccine hesitancy, then
9 its prevalence and determinants within these communities must be examined.
10
11

12
13
14
15
16
17
18
19 The overall aim of this scoping review is to take stock of the current evidence of vaccine hesitancy
20 among immigrants. Toward this end, the proposed review will address the following objectives:

- 21 1. Identify evidence of vaccine hesitancy among immigrant individuals and communities.
 - 22 2. Examine the extent and nature of the extant evidence.
 - 23 3. Determine the value of undertaking a full systematic review.
- 24
25
26
27
28
29
30
31

32 **METHODS**

33
34

35 A methodological framework for scoping review was first outlined by Arksey and O'Malley [29],
36 subsequently clarified by Levac and colleagues [30], and further elaborated into a "systematic scoping
37 review" by the Joanna Briggs Institute (JBI) [31]. JBI's elaboration of the framework contains 11 items:
38 (1) title; (2) background; (3) review question/objective; (4) inclusion criteria; (5) types of participants; (6)
39 concept; (7) context; (8) searching; (9) extracting and charting the results; (10) discussion; (11)
40 conclusions and implications for research and practice. We will apply this framework to organize our
41 scoping review, supplementing it with relevant items from the Preferred Reporting Items for Systematic
42 Review and Meta-Analysis Protocols (PRIMA-P) [32]. The rest of this section details how we will
43 address items 3 to 9 of the framework.
44
45
46
47
48
49
50
51
52

53 **3. Review question/objective**

54
55
56
57
58
59
60

1
2
3 In lieu of review questions, we have stated three main review objectives at the end of the Background
4 section: (1) Identifying evidence of vaccine hesitancy among immigrant individuals and communities; (2)
5 Examining the extent and nature of the existing evidence; (3) Determining the value of undertaking a full
6 systematic review.
7
8
9
10

11 12 **4. Inclusion criteria** 13

14
15 Articles will be included if they focus on the theme of vaccine hesitancy and its variations (e.g.,
16 vaccine acceptance, vaccine confidence, vaccine attitudes and behaviors, trust, distrust, concerns,
17 perceptions, and beliefs about vaccines and vaccination programs). Articles will be included if published
18 in the last two decades (January 1999 – December 2019) and if the full text is available in either French or
19 English. Articles will be excluded if written in any language other than the above and for which open
20 access automated translation programs such as Google Translate are not suitable. Studies that do not focus
21 on human vaccine or that do not involve immigrants will be excluded.
22
23
24
25
26
27
28
29

30 31 **5. Types of participants** 32

33 Target participants for this review are immigrant individuals, communities, or populations. We define
34 immigrants as including all individuals whose country of national origin (or whose parents' country of
35 origin) is different from their country of residence, irrespective of manner of entry and legal/documentated
36 status in the host country. Further details on participants are provided in Table 1 and Table 2.
37
38
39
40

41 42 **6. Concept** 43

44 The concept or principal focus explored by this scoping review is vaccine hesitancy. As described in
45 the previous section of this protocol, vaccine hesitancy is an inclusive concept that encompass varying
46 degrees of indecision about vaccination in general or certain vaccines in particular. Underlying factors of
47 hesitancy include issues of confidence (do not trust vaccine or provider), complacency (do not perceive a
48 need for a vaccine), and convenience (access) [24]. The SAGE working group on vaccine hesitancy state:
49 “Vaccine-hesitant individuals *may accept* all vaccines *but remain concerned* about vaccines, some may
50 refuse or delay some vaccines, but accept others; some individuals may refuse all vaccines” [24].
51
52
53
54
55
56
57
58
59
60

7. Context

The context in this review could include the WHO Region of the studies, immigrants' host country, their home or origin country, their cultural heritage (e.g., religion, language, and health-seeking traditions), their residential neighborhood, and the location of immunization services.

8. Searching

One of the most comprehensive systematic reviews of published literature on vaccine hesitancy to date was published in 2014 by members of the SAGE working group on vaccine hesitancy which includes one of the senior co-authors of this protocol [25]. We will build on that 2014 publication, identifying relevant studies for our scoping review through several of the same databases included in that systematic review. Databases to be explored will include all or most of the following: Africa-Wide Information, Allied and Complementary Medicine, Cochrane Library, Cumulative Index of Nursing and Allied Health Literature, Embase, Index Medicus for the Eastern Mediterranean Region, International Bibliography of Social Sciences, Literature in the Health Sciences in Latin America and the Caribbean, Medline, Proquest Theses/Dissertations, PsycInfo, and Web of Science. Given that we aim at examining both the scientific and grey literature, we will also search Google and Google Scholar in addition to the multidisciplinary mainstream and regional databases listed above.

Table 1. PICO elements for study selection criteria

Participant/population	Intervention	Comparators	Outcomes
Diaspora, emigrés, emigrants, migrants, immigrants, refugees foreigners,	Immunization, vaccination, vaccine- related communication	General population, non-migrant, local, native population	vaccine confidence, vaccine uptake, vaccine refusal, vaccine hesitancy, vaccine delay, missed schedule of vaccine,

	migrant, refugee	anti- vaccination, anti-vax, concern, distrust, misinformati on, resistance, compulsory, dropout, MMR, skeptic, critic, exemption, objector, attitude, choice, fear, opposition, autism, controversy, hesitancy, perception, rumor, rumour, avoidance, decision, hesitation, phobia, awareness, delay, intention, refusal, belief, barrier, denial, knowledge, rejection, dilemma, behavior,	tance) OR anxiety) OR anti-vaccination) OR anti-vaxx) OR attitude) OR autism) OR avoidance) OR awareness) OR barrier) OR behavior) OR behaviour) OR concern) OR confidence) OR compulsory) OR controversy) OR choice) OR critic) OR delay) OR denial) OR decision) OR dilemma) OR distrust) OR doubt) OR dropout) OR exemption) OR fear) OR hesitancy) OR hesitation) OR intention) OR knowledge) OR mandatory) OR misconception) OR misinformation) OR mistrust) OR MMR) OR objector) OR opposition) OR perception) OR phobia) OR refusal) OR rejection) OR reluctance) OR resistance) OR rumor) OR rumour) OR skeptic) OR trust) OR uptake) AND ("1999/01/01"[PDat] : "2019/12/31"[PDat]))	
--	---------------------	--	---	--

		behavior, misconception, mandatory, reluctancy		
--	--	---	--	--

9. Extracting and charting the results

It is standard in scoping reviews to illustrate the numerical outputs from the search and the inclusion decision process by means of a PRISMA flowchart. Our flowchart will clearly describe the review decision process, results from the search, removal of duplicate citations, study selection, full retrieval, any additions from reference list scanning, and final summary presentation. In scoping review, “charting the results” is an iterative process which involves the extraction of relevant data from all the studies included in the review [32]. To enable consistency in data extraction among reviewers, we have developed a data charting template (Table 3) to record characteristics of articles included and key data pertinent to the objectives of our review. We anticipate refinement (or consolidation) of this form after data from a small sample of studies (two or three) have been charted independently by two or more reviewers. We anticipate that results of the review will include both quantitative and qualitative data. We will present these results through summary narratives and visuals such as evidence “maps” and tabular presentations.

Table 3. Data charting template

Data	Data description
Study reference	Name and surname of authors, publication year.
Article type	Quantitative; qualitative; mixed methods; research; review; policy; perspective; comment; letter; unpublished report; media article.
Region of origin	WHO region where country of study is located

Purpose	Overall aim and objectives of the study
Population	Main characteristics of populations, communities, and individuals participating in the study.
Country of immigration	Host country where immigrant participants reside.
Country of national origin	Foreign country where immigrants or parents of second-generation immigrants came from.
Country of transit	Country where immigrants may have resided as refugee before relocating in current host country
Place of residence	Neighborhood, city, or state where immigrant participants reside.
Location of immunization center	Neighborhood, city, or state where vaccination service is provided.
Religion	Main religion of immigrants
Native language	First language primarily spoken by immigrants
Ethnic/racial identity	Ethnic or racial group of immigrants
Comparator	Outgroup members with whom immigrants are compared.
Concept	Underlying determinants of vaccine hesitancy explored by study
Intervention	Types of intervention attempted or evaluated by study (e.g., vaccine administration; health communication; policy, etc.)
Outcome	Outcomes from intervention (e.g., increase, decrease, or steady state in vaccination rate)
Findings	Relevant key findings from study

Patient and public involvement

1
2
3 This review will be based solely on published articles and will not involve any patients or the public.
4
5

6 **DISCUSSION**

7

8
9 In at least the last ten years, migrant and refugee health has been a persistent concern for global health
10 stakeholders. The health of migrants was a central theme of the 2009 Human Development Report [1]. It
11 was a recurring feature of the 2018 Global Compact of Migration [33] and the focus of the UCL-Lancet
12 Commission on Migration and Health [34-36]. It is a component of health-related targets of the
13 Sustainable Development Goals [37]. The Consortium of Universities for Global Health Executive Board
14 recommended the field of global health prioritize migrant-worker health [38]. Recently, at the 72nd World
15 Health Assembly of May 2019, WHO member states prioritized a global action plan to promote the health
16 of migrants and refugees [2]. These priorities emphasize robust health information and health
17 communication systems in order to generate better health data on migrants and refugees and to counter
18 misperceptions and dispel fears about any health risks they pose [2]. Just as misperceptions about
19 migrants and refugees may give rise to anti-migration sentiments, outright xenophobia and racism [39],
20 misperceptions about health-damaging effects of vaccines may lead to reluctance to vaccinate or outright
21 refusal of vaccination.
22
23
24
25
26
27
28
29
30
31
32
33
34
35

36
37 While we are aware that there is strong evidence of high vaccine hesitancy rates among Somali
38 immigrants in the U.S., we do not know at this writing how prevalent this issue is among non-Somali
39 immigrants and among Somali immigrants living in other host countries. We do not even know if the
40 main determinant of vaccine hesitancy among Somali-Americans is the same main factor that might
41 explain vaccine hesitancy among Somali immigrants in other countries with much larger number of
42 Somalis (e.g., Kenya, Ethiopia). Moreover, we are not aware of any published review of vaccine
43 hesitancy among migrant populations in general. This is the reason why we are conducting this review. In
44 deciding between a scoping review and a systematic review, we opted for the former because its findings
45 will inform both the potential development of a full systematic review and the development of a research
46 proposal on vaccine hesitancy among immigrants in a developing nation.
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Except for the possible exclusion of important studies that are not published in English or French, it is
4
5 difficult to anticipate other main limitations of this review. Any departure from this protocol will be
6
7 reported and justified. This protocol is not registered in the International Prospective Register of
8
9 Systematic Reviews (PROSPERO) because this registry does not accept scoping reviews anymore [40].
10

11 12 13 **CONCLUSIONS AND IMPLICATIONS FOR RESEARCH AND PRACTICE**

14
15
16 We believe this work will represent an important contribution to the vaccine behavior literature as it
17
18 will condense what is known (and not known) to date on vaccine hesitancy among migrants globally.
19
20 Most migrants come from and hosted by countries of the global South [34], while most studies of vaccine
21
22 hesitancy to date have been conducted in high-income nations of the global North [25, 41]. High
23
24 prevalence rates of vaccine hesitancy among migrants in host nations of the global North should compel
25
26 future studies to investigate the prevalence and determinants of vaccine hesitancy among migrants in host
27
28 countries of the global South and in the general populations of the countries of origin. With several of
29
30 these countries becoming experimental fields for new vaccines against malaria, Ebola, or HIV, the need
31
32 for conducting and supporting research on vaccine hesitancy in these countries becomes more compelling
33
34 [44-46].
35
36
37

38 **Declaration of interests**

39
40
41 The authors declare no conflicts of interest.
42
43

44 **Funding**

45
46
47 No specific funder supported this publication.
48
49

50 **Authors' contributions**

1
2
3 ABST, HJL, CSW conceived the study. ABST wrote the first draft of the protocol. HJL, CSW and SHV
4
5 revised the manuscript critically for important intellectual content.
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

REFERENCES

1. United Nations Development Programme. Human development report 2009. Overcoming barriers: Human mobility and development. New York: Palgrave Macmillan (October 5, 2009).
2. World Health Organization. Promoting the health of refugees and migrants. Draft global action plan, 2019 – 2023. Geneva: WHO (May, 2019).
3. Markkula N, Cabieses B, Lehti V, Uphoff E, Astorga S, Stutzin F. Use of health services among international migrant children—a systematic review. *Globalization and health*. 2018 Dec;14(1):52.
4. Mipatrini D, Stefanelli P, Severoni S, Rezza G. Vaccinations in migrants and refugees: a challenge for European health systems. A systematic review of current scientific evidence. *Pathog Glob Health*. 2017;111:59–68.
5. Awoh AB, Plugge E. Immunisation coverage in rural-urban migrant children in low and middle-income countries (LMICs): a systematic review and meta-analysis. *J Epidemiol Community Health*. 2016;70:305–11.
6. Kennedy J. Populist politics and vaccine hesitancy in Western Europe: an analysis of national-level data, *European Journal of Public Health*. 2019;29:512-16. doi:10.1093/eurpub/ckz004.
7. Motta M. The dynamics and political implications of anti-intellectualism in the United States. *American Politics Research*. 2018 May;46(3):465-98.
8. Camargo Jr K, Grant R. Public health, science, and policy debate: being right is not enough. *American journal of public health*. 2015 Feb;105(2):232-5.
9. Katz SL, Hinman AR. Summary and conclusions: Measles elimination meeting, 16–17 March 2000. *J Infect Dis*. 2004;189:S43–7.
10. Fiebelkorn AP, Redd SB, Gallagher K et al. Measles in the United States during the postelimination era. *J Infect Dis*. 2010;202:1520-8.
11. Gastañaduy PA, Redd SB, Fiebelkorn AP et al. Measles—United States, January 1–May 23, 2014. *MMWR*. 2014; 63:496.

12. Arciuolo RJ, Brantley TR, Asfaw MM. et al. Measles outbreak among members of a religious community—Brooklyn, New York, March–June 2013. *MMWR*. 2013;62:752.
13. Gahr P, DeVries AS, Wallace G, et al. An outbreak of measles in an undervaccinated community. *Pediatrics*. 2014;134:e220-8.
14. Leslie TF, Delamater PL, Yang YT. It could have been much worse: The Minnesota measles outbreak of 2017. *Vaccine*. 2018 Mar 27;36(14):1808-10.
15. Dyer O. Measles outbreak in Somali American community follows anti-vaccine talks. *BMJ*. 2017;357: j2378 doi: 10.1136/bmj.j2378
16. Deer B. How the case against the MMR vaccine was fixed. *BMJ*. 2011;342:c5347.
17. Godlee F, Smith J, Marcovitch H. Wakefield's article linking MMR vaccine and autism was fraudulent. *BMJ*. 2011;342:c7452.
18. Zdechlik M. Unfounded autism fears are fueling Minnesota's measles outbreak. NPR. <https://www.npr.org/sections/health-shots/2017/05/03/526723028/autism-fears-fueling-minnesotas-measles-outbreak>.
19. Hickler B, Guirguis S, Obregon R. Special issue on vaccine hesitancy. *Vaccine*. 2015;33:4155-6.
20. Goldstein S, MacDonald NE, Guirguis S. Health communication and vaccine hesitancy. *Vaccine*. 2015;33:4212-4.
21. MacDonald NE. Vaccine hesitancy: Definition, scope and determinants. *Vaccine*. 2015;33:4161-4.
22. Bedford H, Attwell K, Danchin M, Marshall H, Corben P, Leask J. Vaccine hesitancy, refusal and access barriers: The need for clarity in terminology. *Vaccine*. 2018;36:6556-8.
23. Salmon DA, Dudley MZ, Glanz JM, Omer SB. Vaccine hesitancy: causes, consequences, and a call to action. *Vaccine*. 2015;33:D66-71.
24. World Health Organization. Report of the SAGE working group on vaccine hesitancy. Geneva, Switzerland: WHO. (2014 Nov).

- 1
2
3 25. Larson HJ, Jarrett C, Eckersberger E, Smith DM, Paterson P. Understanding vaccine hesitancy
4
5 around vaccines and vaccination from a global perspective: a systematic review of published
6
7 literature, 2007–2012. *Vaccine*. 2014;32:2150-9.
- 8
9 26. Peretti-Watel P, Larson HJ, Ward JK, Schulz WS, Verger P. Vaccine hesitancy: clarifying a
10
11 theoretical framework for an ambiguous notion. *PLoS Curr*. 2015;7. doi:
12
13 10.1371/currents.outbreaks.6844c80ff9f5b273f34c91f71b7fc289.
- 14
15 27. Williams SE. What are the factors that contribute to parental vaccine-hesitancy and what can we do
16
17 about it? *Human vaccines & immunotherapeutics*. 2014;10:2584-96.
- 18
19 28. World Health Organization. Ten threats to global health in 2019. Geneva: WHO.
20
21 <https://www.who.int/emergencies/ten-threats-to-global-health-in-2019>
22
23
- 24 29. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International journal*
25
26 *of social research methodology*. 2005;8:19-32.
- 27
28 30. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implementation*
29
30 *science*. 2010;5:69.
- 31
32 31. Peters MD, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting
33
34 systematic scoping reviews. *International journal of evidence-based healthcare*. 2015;13:141-6.
- 35
36 32. Shamseer L, Moher D, Clarke M, et al. PRISMA-P Group. Preferred reporting items for systematic
37
38 review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ*.
39
40 2015;349:g7647.
- 41
42 33. UN General Assembly. Global Compact for Safe, Orderly and Regular Migration. *International*
43
44 *Journal of Refugee Law*. 2018;30(4):774-816.
- 45
46 34. Abubakar I, Aldridge RW, Devakumar D, et al. The UCL–Lancet Commission on Migration and
47
48 Health: the health of a world on the move. *The Lancet*. 2018;392:2606-54.
- 49
50 35. Clark J, Horton R. Opening up to migration and health. *The Lancet*. 2018;392:2523-5.
- 51
52
53 36. Wickramage K, Annunziata G. Advancing health in migration governance, and migration in health
54
55 governance. *The Lancet*. 2018;392:2528-30.
- 56
57
58
59
60

- 1
2
3 37. World Health Organization. World health statistics 2016: monitoring health for the SDGs, sustainable
4 development goals. Geneva: WHO, 2016. [https://www.who.int/gho/publications/world_health_](https://www.who.int/gho/publications/world_health_statistics/2016/en/)
5 [statistics/2016/en/](https://www.who.int/gho/publications/world_health_statistics/2016/en/)
6
7
8
9 38. Koplan JP, Bond TC, Merson MH, et al. Towards a common definition of global health. *The Lancet*.
10 2009;373:1993–5.
11
12
13 39. Vearey J, Orcutt M, Gostin L, Braham CA, Duigan P. Building alliances for the global governance of
14 migration and health. *BMJ*. 2019;366:l4143. doi:<http://dx.doi.org/10.1136/bmj.l4143>
15
16
17 40. National Institute of Health Research. International prospective register of systematic reviews:
18 inclusion criteria. <https://www.crd.york.ac.uk/prospero/#guidancenotes>
19
20
21
22 41. Cooper S, Betsch C, Sambala EZ, Mchiza N, Wiysonge CS. Vaccine hesitancy—a potential threat to
23 the achievements of vaccination programmes in Africa. *Human vaccines & immunotherapeutics*.
24 2018 Oct 3;14(10):2355-7.
25
26
27 42. United Nations. New malaria vaccine trial in Malawi marks ‘an innovation milestone’, declares UN
28 health agency. *UN News*. <https://news.un.org/en/story/2019/04/1037101>
29
30
31
32 43. Wise J. WHO is “cautiously optimistic” about Ebola ring vaccination programme in DRC.
33 *BMJ* 2018; 361 doi: 10.1136/bmj.k2388.
34
35
36 44. Abbasi J. Large HIV vaccine trial launches in South Africa. *JAMA*. 2017;317:350.
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

PRISMA-P 2015 Checklist

This checklist has been adapted for use with protocol submissions to *Systematic Reviews* from Table 3 in Moher D et al: Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews* 2015 4:1

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
ADMINISTRATIVE INFORMATION					
Title					
Identification	1a	Identify the report as a protocol of a systematic review	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Registration	2	If registered, provide the name of the registry (e.g., PROSPERO) and registration number in the Abstract	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Authors					
Contact	3a	Provide name, institutional affiliation, and e-mail address of all protocol authors; provide physical mailing address of corresponding author	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Support					
Sources	5a	Indicate sources of financial or other support for the review	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Sponsor	5b	Provide name for the review funder and/or sponsor	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Role of sponsor/funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
INTRODUCTION					
Rationale	6	Describe the rationale for the review in the context of what is already known	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
METHODS					
Eligibility criteria	8	Specify the study characteristics (e.g., PICO, study design, setting, time frame) and report characteristics (e.g., years considered, language, publication status) to be used as criteria for eligibility for the review	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Information sources	9	Describe all intended information sources (e.g., electronic databases, contact with study authors, trial registers, or other	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
		grey literature sources) with planned dates of coverage			
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
STUDY RECORDS					
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	<input type="checkbox"/>	<input type="checkbox"/>	
Selection process	11b	State the process that will be used for selecting studies (e.g., two independent reviewers) through each phase of the review (i.e., screening, eligibility, and inclusion in meta-analysis)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Data collection process	11c	Describe planned method of extracting data from reports (e.g., piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Data items	12	List and define all variables for which data will be sought (e.g., PICO items, funding sources), any pre-planned data assumptions and simplifications	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
DATA					
Synthesis	15a	Describe criteria under which study data will be quantitatively synthesized	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data, and methods of combining data from studies, including any planned exploration of consistency (e.g., I^2 , Kendall's tau)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	15c	Describe any proposed additional analyses (e.g., sensitivity or subgroup analyses, meta-regression)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (e.g., publication bias across studies, selective reporting within studies)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (e.g., GRADE)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

BMJ Open

Taking stock of vaccine hesitancy among migrants: a scoping review protocol

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-035225.R1
Article Type:	Protocol
Date Submitted by the Author:	31-Mar-2020
Complete List of Authors:	Tankwanchi, Akhenaten; University of Washington, School of Public Health Jaca, Anelisa; South African Medical Research Council, Larson, Heidi; LSHTM Wiysonge, Charles; South African Medical Research Council, Cochrane South Africa Vermund, Sten; Yale University School of Medicine, Yale School of Public Health
Primary Subject Heading:	Global health
Secondary Subject Heading:	Infectious diseases, Health services research, Evidence based practice, Epidemiology, Communication
Keywords:	IMMUNOLOGY, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Public health < INFECTIOUS DISEASES, Paediatric infectious disease & immunisation < PAEDIATRICS, Community child health < PAEDIATRICS

SCHOLARONE™
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Taking stock of vaccine hesitancy among migrants: a scoping review protocol

Akhenaten B. Siankam Tankwanchi^{1*}, Anelisa Jaca², Heidi J Larson³, Charles Shey Wiysonge^{2,4},
Sten H. Vermund⁵

1. School of Public Health, University of Washington,
1959 NE Pacific Street, Box 357660
Seattle, WA, USA 98195-7660
Akhent76@uw.edu
Phone: (+1) 832.732.2256
2. Cochrane South Africa, South African Medical Research Council, Cape Town, SA
(anelisa.jaca@mrc.ac.za)
3. Institute of Health Metrics and Evaluation, University of Washington; Department of Infectious
Disease Epidemiology, London School of Hygiene and Tropical Medicine, London, UK.
(heidi.larson@LSHTM.ac.uk)
4. Department of Global Health, Stellenbosch University, Cape Town, SA; School of Public
Health and Family Medicine, University of Cape Town, Cape Town, SA.
(charles.wiysonge@mrc.ac.za)
5. Yale School of Public Health, Yale University, New Haven, CT, USA.
(sten.vermund@yale.edu)

Correspondence to Dr. Siankam Tankwanchi; abs.tankwanchi@gmail.com

ABSTRACT

Introduction

At the 72nd World Health Assembly of May 2019, WHO member states prioritized a global action plan to promote migrant and refugee health. Five months earlier, WHO had declared vaccine hesitancy—the reluctance to vaccinate despite the availability of vaccination services—a top ten threat to global health. While vaccination is often a requirement for immigration, repeated outbreaks of vaccine-preventable diseases within certain immigrant communities in some host nations suggest that vaccine hesitancy could be a factor in their susceptibility to vaccine-preventable diseases. Studies of the prevalence and determinants of vaccine hesitancy among migrants globally seem to be lacking. This scoping review will 1) identify articles on vaccine hesitancy among migrants; 2) examine the extent and nature of the extant evidence; and 3) determine the value of undertaking a full systematic review.

Methods and analysis

The framework for scoping review proposed by the Joanna Briggs Institute will be used. The search strategy will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist. Studies published in English or French between January 1999 and December 2019 will be drawn from most or all of the following multidisciplinary databases: Africa-Wide Information, Allied and Complementary Medicine, Cochrane Library, Cumulative Index of Nursing and Allied Health Literature, Embase, Index Medicus for the Eastern Mediterranean Region, International Bibliography of Social Sciences, Literature in the Health Sciences in Latin America and the Caribbean, Medline, Proquest Theses/Dissertations, PsycInfo, and Web of Science. The search will include an extensive list of keywords to capture multiple dimensions of confidence and hesitancy vis-à-vis vaccines among

1 migrants. Findings will be reported through summary narratives, tables, flowcharts and evidence
2
3 maps.
4
5

6 **Ethics and dissemination**

7
8 This review is exempted from ethical approval and will be published in a peer-reviewed open-
9
10 access journal to ensure wide dissemination.
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

ARTICLE SUMMARY

Strengths and limitations of this study

- This review will synthesize evidence of vaccine hesitancy among migrants over two decades.
- This review will glean out evidence from all WHO Regions.
- This review will include both qualitative and quantitative studies published in English or in French.
- The search synthesis and reporting of evidence will be guided by recommendations from the Joanna Briggs Institute and the PRISMA extension for Scoping Reviews (PRISMA-ScR) checklist.
- One possible limitation of this review is the potential exclusion of important studies not published in English or French.

INTRODUCTION

Disparities in opportunity structures often compel people to move, internally or internationally. Therefore, migration is a universal phenomenon that affects most countries. Migrants are driven by many factors including the prospects of improving their access to work, civil, political and religious rights, security and healthcare.¹ One important aspect of healthcare that may affect migration is immunization. People are often required to vaccinate in order to immigrate.²⁻⁴ On the other hand, access to vaccination and continuity of care is more challenging for people on the move such as migrants, refugees, or nomadic populations.^{5,6} Long after they have settled in the host country, vaccination coverage among migrants may still be suboptimal when compared to that of the general population.^{7,8} Vaccine skeptics and populist politicians in some host countries openly challenge the

1
2 scientific consensus about the effectiveness and safety of vaccination.⁹⁻¹¹ As a result, some migrants
3
4 with pre-established concerns about vaccination may see their concerns reinforced while others may
5
6 succumb to anti-immunization messaging and begin to question the benefits of some vaccines. The
7
8 repeated measles outbreaks among Somali-Americans are instructive.¹²⁻¹⁴
9

10
11
12 Measles, a highly contagious respiratory disease and leading cause of vaccine-preventable infant
13
14 mortality worldwide, was declared eliminated in the United States (U.S.) in 2000.¹² Since
15
16 elimination, however, several outbreaks have occurred in various U.S. states with index cases often
17
18 linked to overseas travels.¹³⁻¹⁵ In 2011 and 2017, two measles outbreaks with a total number of 100
19
20 cases, 72% of which were members of the Somali community of Hennepin County, Minnesota
21
22 occurred in the United States.^{16 17} Prior to the 2011 outbreak, measles-mumps-rubella (MMR)
23
24 vaccine coverage among two-year-old Somali children in Minnesota had declined significantly from
25
26 >91% in 2004 to 54% in 2010, as Somali parents began refusing MMR vaccine for their children
27
28 owing to concerns of high autism rate in their community.^{11 18} By 2014, MMR vaccine uptake was
29
30 down to 42% among Somali Minnesotan two-year olds.¹⁷ Many of these vaccine concerns and fears
31
32 were also fueled by local anti-vaccine activists and the author of a currently discredited Lancet
33
34 study which associated MMR vaccine with the development of autism.¹⁹⁻²⁰
35
36
37
38
39

40
41 Likewise, during a 2011 measles outbreak in Norway, 8 of 10 cases (80%) identified were from
42
43 the Somali community of Oslo.²¹ While there is evidence of vaccine hesitancy among Somali
44
45 migrants in the United States and in Norway, we do not know at this writing how prevalent this
46
47 issue is among Somalis living in other Western nations or non-Western host countries with a much
48
49 larger Somali diaspora (e.g., Ethiopia, Kenya, Yemen). It is also unclear whether, and if so why,
50
51 Somali migrants might be more susceptible to vaccine hesitancy than other African migrants. Non-
52
53 vaccinators are also found among Orthodox Jewish communities in New York,¹⁵ Greater London
54
55 and Belgium,²¹⁻²³ Amish communities in Ohio,²⁴ and anthroposophical believers across Europe.²⁵
56
57
58
59

1
2 When vaccination services are available yet underutilized, and barriers to access are reduced,
3
4 psychosocial processes more so than structural factors may better explain low vaccination uptake.
5
6 One such factor that conspires against universal vaccination coverage and is gaining currency in the
7
8 literature is “vaccine hesitancy.”²⁶ Broadly defined as the reluctance to vaccinate despite the
9
10 availability of vaccination services, vaccine hesitancy entails a continuum of complex and context
11
12 specific attitudes and behaviors, ranging from total acceptance to complete refusal, and varying
13
14 across time, place and vaccines. Underlying hesitancy are issues of confidence, complacency, and
15
16 convenience.^{27 28} The authoritative working group on vaccine hesitancy appointed by the World
17
18 Health Organization’s (WHO) Strategic Advisory Group of Experts on Immunization (SAGE) has
19
20 developed a multi-level explanatory model of vaccine hesitancy encompassing contextual
21
22 influences (e.g., religion, communication and media environment, politics, etc.), individual/group
23
24 factors (e.g., beliefs, attitudes and motivation about health, trust in health system, past experience
25
26 with vaccination, peer influence, etc.), and vaccine- and vaccination-specific determinants (e.g.,
27
28 cost, vaccination schedule, mode of administration, etc.).²⁷ Vaccine hesitancy theories and models
29
30 may help to explain why vaccine-hesitant individuals may accept all vaccines but remain concerned
31
32 or unsure about vaccines, may shun or delay some vaccines yet accept others, or may refuse all
33
34 vaccines.²⁸⁻³²

35
36
37
38
39
40
41
42 As a core topic, vaccine hesitancy is relatively new, with only six articles using the phrase in
43
44 either the title or abstract between 2009 and 2011.³² Even its definition is still evolving while its
45
46 qualification as a behavior has been called into question.^{33 34} Yet, the resurgence and repeated
47
48 outbreaks of vaccine-preventable diseases like measles that were considered eliminated in some
49
50 Western countries have prompted WHO to declare vaccine hesitancy one of the world’s top ten
51
52 threats to global health in 2019.³⁵ If vaccine hesitancy is indeed a global threat to health, and if
53
54 migrant communities are potential “hotspots” for vaccine hesitancy, then its prevalence and
55
56
57
58
59
60

1
2 determinants within these communities must be examined. The overall aim of this scoping review is
3
4 to take stock of the current evidence of vaccine hesitancy among migrants. Toward this end, the
5
6 proposed review will address the following objectives:
7

- 8
9 1. Identify evidence of vaccine hesitancy among migrant individuals and communities.
- 10
11 2. Examine the extent and nature of the extant evidence.
- 12
13 3. Determine the value of undertaking a full systematic review.
- 14
15

16
17 Given the relative recency of vaccine hesitancy as a research area and given that we are not
18
19 aware of any comprehensive evidence of vaccine hesitancy among migrant populations, the above
20
21 objectives are suitable and consistent with the “reconnaissance” purpose of the scoping review.³⁶
22
23 Scoping will also allow us to identify and define crucial concepts, gaps in the literature and types
24
25 and sources of evidence to inform practice, policy and research.³⁶ In choosing to focus on vaccine
26
27 hesitancy, neither do we imply nor believe that the main determinant of under-immunization in
28
29 migrant populations is their reluctance to vaccinate. Political discourses that fuel prejudice and
30
31 exclusion of the other, restrictive policies that deny good quality healthcare to the poor and access
32
33 to universal health coverage to migrant populations, especially undocumented migrants, may
34
35 represent far greater barriers to immunization than vaccine hesitancy.³⁷⁻³⁹ However, we also believe
36
37 that it is important to know the magnitude and nature of vaccine hesitancy in subpopulations like
38
39 migrant communities because even very “small clusters of non-vaccinators can have
40
41 disproportionately adverse effects on herd immunity and epidemic spread.”⁴⁰
42
43
44
45
46
47

48 **METHODS**

49

50
51 A methodological framework for scoping review was first outlined by Arksey and O’Malley,⁴¹
52
53 subsequently clarified by Levac and colleagues,⁴² and further elaborated by the Joanna Briggs
54
55 Institute (JBI).³⁶ JBI’s elaboration of the framework contains 11 items: (1) title; (2) background; (3)

1
2 review question/objective; (4) inclusion criteria; (5) types of participants; (6) concept; (7) context;
3
4 (8) searching; (9) extracting and charting the results; (10) discussion; and (11) conclusions and
5
6 implications for research and practice. We will apply this framework to organize our scoping
7
8 review, supplementing it with recommendations from the Preferred Reporting Items for Systematic
9
10 Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist.⁴³ The rest of
11
12 this section details how we will address items 3 to 9 of the framework.
13
14

15 16 **3. Review question/objective**

17
18
19 In lieu of review questions, we have stated three main review objectives at the end of the
20
21 introduction section: (1) Identifying evidence of vaccine hesitancy among migrant individuals and
22
23 communities; (2) Examining the extent and nature of the existing evidence; (3) Determining the
24
25 value of undertaking a full systematic review.
26
27

28 29 **4. Inclusion criteria**

30
31
32 Articles will be included if they focus on the theme of vaccine hesitancy and its variations (e.g.,
33
34 vaccine acceptance, vaccine confidence, vaccine attitudes and behaviors, trust, distrust, concerns,
35
36 perceptions, and beliefs about vaccines and vaccination programs). Articles will be included if
37
38 published in the last two decades (January 1999 – December 2019) and if the full text is available in
39
40 either French or English. Articles will be excluded if written in any language other than the above
41
42 and for which open access automated translation programs such as Google Translate are not
43
44 suitable. Articles that do not focus on human vaccine or that do not involve migrants will be
45
46 excluded. Articles that focus on vaccine hesitancy in the wider population but whose results are
47
48 disaggregated by immigration status will be included. Given that this is a scoping review, all
49
50 evidence will be included, from single-case reports to population-level studies, and from primary
51
52 research to review articles, policy reports and commentaries.
53
54
55
56
57
58
59
60

5. Types of participants

Target participants for this review are migrant populations, migrant communities and migrant individuals, including parents, expecting parents, childfree adults, and children. We define migrants as including all individuals whose country of national origin (or whose parents' country of origin) is different from their country of residence, irrespective of manner of entry and legal/documented status in the host country. Further details on participants are provided in Table 1 and Table 2.

6. Concept

The concept or principal focus explored by this scoping review is vaccine hesitancy. As described in the previous section of this protocol, vaccine hesitancy is an inclusive concept that encompasses varying degrees of indecision about vaccination in general or certain vaccines in particular. Underlying factors of hesitancy include issues of confidence (do not trust vaccine or provider), complacency (do not perceive a need for a vaccine), and convenience (access).²⁸ The final report from the SAGE Working Group on Vaccine Hesitancy states: "Vaccine-hesitant individuals *may accept all vaccines but remain concerned* about vaccines, some may refuse or delay some vaccines, but accept others; some individuals may refuse all vaccines."²⁷

7. Context

The context in this review could include the WHO Region of the studies, migrants' host country, their home or origin country, their cultural heritage (e.g., religion, language, and health-seeking traditions), their residential neighborhood, and the location/place where vaccination services are provided.

8. Searching

One of the most comprehensive systematic reviews of published literature on vaccine hesitancy to date was published in 2014 by members of the SAGE Working Group on Vaccine Hesitancy which includes one of the senior co-authors of this protocol.³² We will build on that 2014

publication, identifying relevant studies for our scoping review through several of the same databases included in that systematic review. All or most of the following databases will be searched from 1st January 1999 to 31st December 2019: Africa-Wide Information, Allied and Complementary Medicine, Cochrane Library, Cumulative Index of Nursing and Allied Health Literature, Embase, Index Medicus for the Eastern Mediterranean Region, International Bibliography of Social Sciences, Literature in the Health Sciences in Latin America and the Caribbean, Medline, Proquest Theses/Dissertations, PsycInfo, and Web of Science. Given that we aim at examining both the scientific and grey literature, we will also search Google and Google Scholar in addition to the multidisciplinary mainstream and regional databases listed above. Last, we will contact the authors of all studies included in our synthesis to identify potential additional sources. We anticipate that the search for articles will be run across all databases between April and June 2020.

Table 1. PICO elements for study selection criteria

Participant/population	Intervention	Comparators	Outcomes
Diaspora, émigrés, emigrants, migrants, immigrants, refugees, foreigners, foreign-born, newcomers	Immunization, vaccination, vaccine-related communication	General population, non-migrant, local, native population, no comparator	Vaccine confidence, vaccine uptake, vaccine refusal, vaccine hesitancy, vaccine delay, missed schedule of vaccine, non-medical vaccination exemption

1				
2		migrant,	vaccination,	attitude) OR autism) OR avoidance)
3		refugee	anti-vax,	OR awareness) OR barrier) OR
4			concern,	behavior) OR behaviour) OR concern)
5			distrust,	OR confidence) OR compulsory) OR
6			misinformati	controversy) OR choice) OR critic) OR
7			on,	delay) OR denial) OR decision) OR
8			resistance,	dilemma) OR distrust) OR doubt) OR
9			compulsory,	dropout) OR exemption) OR fear) OR
10			dropout,	hesitancy) OR hesitation) OR
11			MMR,	intention) OR knowledge) OR
12			skeptic,	mandatory) OR misconception) OR
13			critic,	misinformation) OR mistrust) OR
14			exemption,	MMR) OR objector) OR opposition)
15			objector,	OR perception) OR phobia) OR
16			attitude,	refusal) OR rejection) OR reluctance)
17			choice, fear,	OR resistance) OR rumor) OR rumour)
18			opposition,	OR skeptic) OR trust) OR uptake) AND
19			autism,	("1999/01/01"[PDat] :
20			controversy,	"2019/12/31"[PDat]))
21			hesitancy,	
22			perception,	
23			rumor,	
24			rumour,	
25			avoidance,	
26			decision,	
27			hesitation,	
28			phobia,	
29			awareness,	
30			delay,	
31			intention,	
32			refusal,	
33			belief,	
34			barrier,	
35			denial,	
36			knowledge,	
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				

		rejection, dilemma, behavior, behavior, misconception, mandatory, reluctancy		
--	--	--	--	--

9. Extracting and charting the results

Table 3. Data charting template

Data	Data description
Study reference	Name and surname of authors, publication year.
Article type	Quantitative; qualitative; mixed methods; research; review; policy; perspective; comment; letter; unpublished report; media article.
Region of origin	WHO region where country of study is located.
Purpose	Overall aim and objectives of the study.
Population	Main characteristics of populations, communities, and individuals participating in the study.
Country of immigration	Host country where migrant participants reside.
Country of national origin	Foreign country where migrants or parents of second-generation immigrants came from.

Country of transit	Country where migrants may have resided as refugee before relocating in current host country.
Place of residence	Neighborhood, city, or state where migrant participants reside.
Location of immunization center	Neighborhood, city, or state where vaccination service is provided.
Religion	Main religion of migrants.
Native language	First language primarily spoken by migrants.
Ethnic/racial identity	Ethnic or racial group of migrants.
Comparator	Outgroup members with whom migrants are compared.
Concept	Underlying determinants of vaccine hesitancy explored by study.
Intervention	Types of intervention attempted or evaluated by study (e.g., vaccine administration; health communication; policy, etc.).
Outcome	Outcomes from intervention (e.g., increase, decrease, or steady state in vaccination rate).
Vaccine	Specific vaccine that is accepted, delayed, or rejected.
Findings	Relevant key findings from study.

It is standard in scoping reviews to illustrate the numerical outputs from the search and the inclusion decision process by means of a PRISMA flowchart. Our flowchart will clearly describe the review decision process, results from the search, removal of duplicate citations, study selection, full retrieval, any additions from reference list scanning, and final summary presentation. In scoping

1
2 review, “charting the results” is an iterative process which involves the extraction of relevant data
3
4 from all the studies included in the review.³⁶ To enable consistency in data extraction among
5
6 reviewers, we have developed a data charting template (Table 3) to record characteristics of articles
7
8 included and key data pertinent to the objectives of our review. We anticipate refinement (or
9
10 consolidation) of this form after data from a small sample of studies (two to three) have been
11
12 charted independently by two or more reviewers. We anticipate that results of the review will
13
14 include both quantitative and qualitative data. We will present these results through summary
15
16 narratives and visuals such as evidence “maps” and tabular presentations.
17
18
19
20

21 **Protocol registration**

22
23
24 This protocol is not registered in the International Prospective Register of Systematic Reviews
25
26 (PROSPERO) because this registry does not accept scoping reviews.⁴⁴
27
28

29 **Patient and public involvement**

30
31
32 This review will be based solely on published articles and will not involve any patients or the
33
34 public.
35
36

37 **ETHICS AND DISSEMINATION**

38
39
40 This review will be based on published works, and thus is exempted from formal ethical
41
42 approval. It will be published in a peer-reviewed open access journal to ensure wide dissemination.
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

REFERENCES

1. United Nations Development Programme (UNDP). Human Development Report 2009. Overcoming barriers: human mobility and development. New York: Palgrave Macmillan, 2009.
2. U.S. Citizenship and Immigration Services (USCIS). Applicability of medical examination and vaccination requirement. USCIS Policy Manual. Washington, DC: USCIS, 2017.
3. Center for Disease Control and Prevention. Vaccines for immigrants and refugees. <https://www.cdc.gov/vaccines/adults/rec-vac/immigrants-refugees.html> [accessed 18 March 2020].
4. Hong MK, Varghese RE, Jindal C, *et al*. Refugee policy implications of US immigration medical screenings: a new era of inadmissibility on health-related grounds. *Int J Environ Res Public Health* 2017;14:1107.
5. World Health Organization (WHO). Promoting the health of refugees and migrants. Draft global action plan, 2019 – 2023. Geneva: WHO, 2019.
6. Markkula N, Cabieses B, Lehti V, *et al*. Use of health services among international migrant children—a systematic review. *Global Health* 2018;14:52.
7. Mipatrini D, Stefanelli P, Severoni S, *et al* Vaccinations in migrants and refugees: a challenge for European health systems. A systematic review of current scientific evidence. *Pathog Glob Health* 2017;111:59–68.
8. Awoh AB, Plugge E. Immunisation coverage in rural-urban migrant children in low and middle-income countries (LMICs): a systematic review and meta-analysis. *J Epidemiol Community Health* 2016;70:305–11.
9. Kennedy J. Populist politics and vaccine hesitancy in Western Europe: an analysis of national-level data. *Eur J Public Health* 2019;29:512-16. doi:10.1093/eurpub/ckz004.

10. Camargo Jr K, Grant R. Public health, science, and policy debate: being right is not enough. *Am J Public Health* 2015;105:232-5.
11. Dyer O. Measles outbreak in Somali American community follows anti-vaccine talks. *BMJ* 2017;357: j2378 doi: 10.1136/bmj.j2378.
12. Katz SL, Hinman AR. Summary and conclusions: Measles elimination meeting, 16–17 March 2000. *J Infect Dis* 2004;189:S43–7.
13. Fiebelkorn AP, Redd SB, Gallagher K, *et al.* Measles in the United States during the postelimination era. *J Infect Dis* 2010;202:1520-8.
14. Gastañaduy PA, Redd SB, Fiebelkorn AP, *et al.* Measles—United States, January 1–May 23, 2014. *MMWR* 2014; 63:496.
15. Arciuolo RJ, Brantley TR, Asfaw MM, *et al.* Measles outbreak among members of a religious community—Brooklyn, New York, March–June 2013. *MMWR* 2013;62:752.
16. Gahr P, DeVries AS, Wallace G, *et al.* An outbreak of measles in an undervaccinated community. *Pediatrics* 2014;134:e220-8.
17. Leslie TF, Delamater PL, Yang YT. It could have been much worse: The Minnesota measles outbreak of 2017. *Vaccine* 2018;36:1808-10.
18. Hewitt A, Hall-Lande J, Hamre K, *et al.* Autism Spectrum Disorder (ASD) Prevalence in Somali and Non-Somali Children. *J Autism Dev Disord* 2016;46(8):2599–608.
19. Deer B. How the case against the MMR vaccine was fixed. *BMJ* 2011;342:c5347.
20. Godlee F, Smith J, Marcovitch H. Wakefield’s article linking MMR vaccine and autism was fraudulent. *BMJ* 2011;342:c7452.
21. Vainio K, Rønning K, Steen TW, *et al.* Ongoing outbreak of measles in Oslo, Norway, January–February 2011. *Euro Surveill* 2011;16:1–3.

- 1
2 22. Butler R, MacDonald NE, SAGE Working Group on Vaccine Hesitancy. Diagnosing the
3
4 determinants of vaccine hesitancy in specific subgroups: The Guide to Tailoring Immunization
5
6 Programmes (TIP). *Vaccine* 2015;33:4176-9.
7
8
9 23. Williams GA, Bacci S, Shadwick R, *et al*. Measles among migrants in the European Union and
10
11 the European Economic Area. *Scand J Public Health* 2016;44:6-13.
12
13 24. Wenger OK, McManus MD, Bower JR, *et al*. Underimmunization in Ohio's Amish: parental
14
15 fears are a greater obstacle than access to care. *Pediatrics* 2011; 128:79-85.
16
17 <http://dx.doi.org/10.1542/peds.2009-2599>.
18
19
20 25. Hanratty BH, Holt T, Duffell E. UK measles outbreak in non-immune anthroposophic
21
22 communities: the implications for the elimination of measles from Europe. *Epidemiol Infect*
23
24 2000;125:377-83.
25
26
27 26. Hickler B, Guirguis S, Obregon R. Special issue on vaccine hesitancy. *Vaccine* 2015;33:4155-6.
28
29
30 27. World Health Organization. Report of the SAGE Working Group on Vaccine Hesitancy.
31
32 Geneva, Switzerland: WHO, 2014.
33
34 28. MacDonald NE. Vaccine hesitancy: Definition, scope and determinants. *Vaccine* 2015;33:4161-
35
36 4.
37
38
39 29. Goldstein S, MacDonald NE, Guirguis S. Health communication and vaccine hesitancy. *Vaccine*
40
41 2015;33:4212-4.
42
43
44 30. Salmon DA, Dudley MZ, Glanz JM, *et al*. Vaccine hesitancy: causes, consequences, and a call
45
46 to action. *Vaccine* 2015;33:D66-71.
47
48
49 31. Williams SE. What are the factors that contribute to parental vaccine-hesitancy and what can we
50
51 do about it? *Hum Vaccin Immunother* 2014;10:2584-96.
52
53
54
55
56
57
58
59
60

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
32. Larson HJ, Jarrett C, Eckersberger E, Smith DM, *et al.* Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012. *Vaccine* 2014;32:2150-9.
33. Bedford H, Attwell K, Danchin M, *et al.* Vaccine hesitancy, refusal and access barriers: The need for clarity in terminology. *Vaccine* 2018;36:6556-8.
34. Peretti-Watel P, Larson HJ, Ward JK, *et al.* Vaccine hesitancy: clarifying a theoretical framework for an ambiguous notion. *PLoS Curr.* 2015;7.
doi:10.1371/currents.outbreaks.6844c80ff9f5b273f34c91f71b7fc289.
35. World Health Organization. Ten threats to global health in 2019. Geneva: WHO.
<https://www.who.int/emergencies/ten-threats-to-global-health-in-2019> [accessed 18 March 2020].
36. Peters MD, Godfrey CM, Khalil H, *et al.* Guidance for conducting systematic scoping reviews. *Int J Evid Based Healthc* 2015;13:141-6.
37. Ottersen OP, Dasgupta J, Blouin C, *et al.* The political origins of health inequity: prospects for change. *Lancet* 2014;383:630-67.
38. Onarheim KH, Melberg A, Meier BM, *et al.* Towards universal health coverage: including undocumented migrants. *BMJ Glob Health* 2018;3:e001031.
doi:10.1136/bmjgh-2018-001031.
39. Abubakar I, Aldridge RW, Devakumar D, *et al.* The UCL–Lancet Commission on Migration and Health: the health of a world on the move. *Lancet* 2018;392:2606-54.
doi:[https://dx.doi.org/10.1016/S0140-6736\(18\)32114-7](https://dx.doi.org/10.1016/S0140-6736(18)32114-7).
40. Larson HJ, De Figueiredo A, Xiaohong Z, *et al.* The state of vaccine confidence 2016: global insights through a 67-country survey. *EBioMedicine* 2016;12:295-301.

- 1
2 41. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res*
3
4 *Methodol* 2005;8:19-32.
5
6 42. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement*
7
8 *Sci* 2010;5:69.
9
10 43. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR):
11
12 checklist and explanation. *Ann Intern Med* 2018;169:467-73.
13
14 44. National Institute of Health Research. International prospective register of systematic reviews:
15
16 inclusion criteria. <https://www.crd.york.ac.uk/prospero/#guidancenotes> [accessed 18 March
17
18 2020].
19
20
21
22
23

24 **Authors' contributions**

25
26 ABST, HJL, CSW conceived the study. ABST wrote the first draft of the protocol. AJ, HJL,
27
28 CSW and SHV revised the manuscript critically for important intellectual content.
29
30

31 **Funding**

32
33 This work received no specific grant from any funding agency in the public, commercial or not-
34
35 for-profit sectors.
36
37
38
39

40 **Competing interests statement**

41
42 The authors declare no competing interests.
43
44

45 **Word count:** 2247
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

BMJ Open

Taking stock of vaccine hesitancy among migrants: a scoping review protocol

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-035225.R2
Article Type:	Protocol
Date Submitted by the Author:	25-Apr-2020
Complete List of Authors:	Tankwanchi, Akhenaten; University of Washington, School of Public Health Jaca, Anelisa; South African Medical Research Council, Larson, Heidi; LSHTM Wiysonge, Charles; South African Medical Research Council, Cochrane South Africa Vermund, Sten; Yale University School of Medicine, Yale School of Public Health
Primary Subject Heading:	Global health
Secondary Subject Heading:	Infectious diseases, Health services research, Evidence based practice, Epidemiology, Communication
Keywords:	IMMUNOLOGY, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Public health < INFECTIOUS DISEASES, Paediatric infectious disease & immunisation < PAEDIATRICS, Community child health < PAEDIATRICS

SCHOLARONE™
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Taking stock of vaccine hesitancy among migrants: a scoping review protocol

Akhenaten B. Siankam Tankwanchi^{1*}, Anelisa Jaca², Heidi J Larson³, Charles Shey Wiysonge^{2 4},
Sten H. Vermund⁵

1. School of Public Health, University of Washington,
1959 NE Pacific Street, Box 357660
Seattle, WA, USA 98195-7660
Akhent76@uw.edu
Phone: (+1) 832.732.2256
2. Cochrane South Africa, South African Medical Research Council, Cape Town, SA
(anelisa.jaca@mrc.ac.za)
3. Institute of Health Metrics and Evaluation, University of Washington; Department of Infectious
Disease Epidemiology, London School of Hygiene and Tropical Medicine, London, UK.
(heidi.larson@LSHTM.ac.uk)
4. Department of Global Health, Stellenbosch University, Cape Town, SA; School of Public Health
and Family Medicine, University of Cape Town, Cape Town, SA. (charles.wiysonge@mrc.ac.za)
5. Yale School of Public Health, Yale University, New Haven, CT, USA. (sten.vermund@yale.edu)

Correspondence to Dr. Siankam Tankwanchi; abs.tankwanchi@gmail.com

ABSTRACT

Introduction

At the 72nd World Health Assembly of May 2019, WHO member states prioritized a global action plan to promote migrant and refugee health. Five months earlier, WHO had declared vaccine hesitancy—the reluctance to vaccinate despite the availability of vaccination services—a top ten threat to global health. While vaccination is often a requirement for immigration, repeated outbreaks of vaccine-preventable diseases within certain immigrant communities in some host nations suggest that vaccine hesitancy could be a factor in their susceptibility to vaccine-preventable diseases. Studies of the prevalence and determinants of vaccine hesitancy among migrants globally seem to be lacking. This scoping review will 1) identify articles on vaccine hesitancy among migrants; 2) examine the extent and nature of the extant evidence; and 3) determine the value of undertaking a full systematic review.

Methods and analysis

The framework for scoping review proposed by the Joanna Briggs Institute will be used. The search strategy will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist. Studies published in English or French between January 1999 and December 2019 will be drawn from most or all of the following multidisciplinary databases: Africa-Wide Information, Allied and Complementary Medicine, Cochrane Library, Cumulative Index of Nursing and Allied Health Literature, Embase, Index Medicus for the Eastern Mediterranean Region, International Bibliography of Social Sciences, Literature in the Health Sciences in Latin America and the Caribbean, Medline, Proquest Theses/Dissertations, PsycInfo, and Web of Science. The search will include an extensive list of keywords to capture multiple dimensions of confidence and hesitancy vis-à-vis vaccines among

1 migrants. Findings will be reported through summary narratives, tables, flowcharts, and evidence
2
3 maps.
4
5

6 **Ethics and dissemination**

7
8 This review is exempted from ethical approval and will be published in a peer-reviewed open-access
9
10 journal to ensure wide dissemination.
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

ARTICLE SUMMARY

Strengths and limitations of this study

- This review will synthesize evidence of vaccine hesitancy among migrants over two decades.
- This review will glean out evidence from all WHO Regions.
- This review will include both qualitative and quantitative studies published in English or in French.
- The search synthesis and reporting of evidence will be guided by recommendations from the Joanna Briggs Institute and the PRISMA extension for Scoping Reviews (PRISMA-ScR) checklist.
- One possible limitation of this review is the potential exclusion of important studies not published in English or French.

INTRODUCTION

Disparities in opportunity structures often compel people to move, internally or internationally. Therefore, migration is a universal phenomenon that affects most countries. Migrants are driven by many factors including the prospects of improving their access to work, civil, political, and religious rights, security, and healthcare.¹ One important aspect of healthcare that may affect migration is immunization. People are often required to vaccinate in order to immigrate.²⁻⁴ On the other hand, access to vaccination and continuity of care is more challenging for people on the move such as migrants, refugees, or nomadic populations.^{5,6} Long after they have settled in the host country, vaccination coverage among migrants may still be suboptimal when compared to that of the general population.^{7,8} Vaccine skeptics and populist politicians in some host countries openly challenge the

1
2 scientific consensus about the effectiveness and safety of vaccination.⁹⁻¹¹ As a result, some migrants
3
4 with pre-established concerns about vaccination may see their concerns reinforced while others may
5
6 succumb to anti-immunization messaging and begin to question the benefits of some vaccines. The
7
8 repeated measles outbreaks among Somali-Americans are instructive.¹²⁻¹⁴
9

10
11
12 Measles, a highly contagious respiratory disease and leading cause of vaccine-preventable infant
13
14 mortality worldwide, was declared eliminated in the United States (U.S.) in 2000.¹² Since
15
16 elimination, however, several outbreaks have occurred in various U.S. states with index cases often
17
18 linked to overseas travels.¹³⁻¹⁵ In 2011 and 2017, two measles outbreaks with a total number of 100
19
20 cases, 72% of which were members of the Somali community of Hennepin County, Minnesota
21
22 occurred in the United States.^{16 17} Prior to the 2011 outbreak, measles-mumps-rubella (MMR) vaccine
23
24 coverage among two-year-old Somali children in Minnesota had declined significantly from >91% in
25
26 2004 to 54% in 2010, as Somali parents began refusing MMR vaccine for their children owing to
27
28 concerns of high autism rate in their community.^{11 18} By 2014, MMR vaccine uptake was down to
29
30 42% among Somali Minnesotan two-year olds.¹⁷ Many of these vaccine concerns and fears were also
31
32 fueled by local anti-vaccine activists and the author of a currently discredited Lancet study which
33
34 associated MMR vaccine with the development of autism.^{19 20}
35
36
37
38
39

40
41 Likewise, during a 2011 measles outbreak in Norway, 8 of 10 cases (80%) identified were from
42
43 the Somali community of Oslo.²¹ While there is evidence of low measles vaccine uptake among
44
45 Somali migrants in the United States and in Norway, we do not know at this writing how prevalent
46
47 this issue is among Somalis living in other Western nations or non-Western host countries with a
48
49 much larger Somali diaspora (e.g., Ethiopia, Kenya, Yemen). It is also unclear whether, and if so
50
51 why, Somali migrants might be more represented among non-vaccinators than other African
52
53 migrants. Emerging evidence from England reveals human papillomavirus (HVP) vaccine
54
55 acceptance could be very low among UK-based immigrant parents from Eastern, Southern and
56
57
58
59

1
2 Western Africa due to fears that their young daughters might become promiscuous and even infertile
3
4 after HPV vaccination.²²
5
6

7 When vaccination services are available yet underutilized, and barriers to access are reduced,
8
9 psychosocial processes more so than structural factors may better explain low vaccination uptake.
10
11 One such factor that conspires against universal vaccination coverage and is gaining currency in the
12
13 literature is “vaccine hesitancy.”²³ Broadly defined as the reluctance to vaccinate despite the
14
15 availability of vaccination services, vaccine hesitancy entails a continuum of complex and context
16
17 specific attitudes and behaviors, ranging from total acceptance to complete refusal, and varying
18
19 across time, place and vaccines. Underlying hesitancy are issues of confidence, complacency, and
20
21 convenience.^{24 25} The authoritative working group on vaccine hesitancy appointed by the World
22
23 Health Organization’s (WHO) Strategic Advisory Group of Experts on Immunization (SAGE) has
24
25 developed a multi-level explanatory model of vaccine hesitancy encompassing contextual influences
26
27 (e.g., religion, communication and media environment, politics, etc.), individual/group factors (e.g.,
28
29 beliefs, attitudes and motivation about health, trust in health system, past experience with
30
31 vaccination, peer influence, etc.), and vaccine- and vaccination-specific determinants (e.g., cost,
32
33 vaccination schedule, mode of administration, etc.).²⁴ Vaccine hesitancy theories and models may
34
35 help to explain why vaccine-hesitant individuals may accept all vaccines but remain concerned or
36
37 unsure about vaccines, may shun or delay some vaccines yet accept others, or may refuse all
38
39 vaccines.²⁵⁻²⁹
40
41
42
43
44
45
46

47 As a core topic, vaccine hesitancy is relatively new, with only six articles using the phrase in
48
49 either the title or abstract between 2009 and 2011.²⁹ Even its definition is still evolving while its
50
51 qualification as a behavior has been called into question.^{30 31} Yet, the resurgence and repeated
52
53 outbreaks of vaccine-preventable diseases like measles that were considered eliminated in some
54
55 Western countries have prompted WHO to declare vaccine hesitancy one of the world’s top ten
56
57
58
59
60

1
2 threats to global health in 2019.³² If vaccine hesitancy is indeed a global threat to health, and if
3
4 migrant communities are potential “hotspots” for vaccine hesitancy, then its prevalence and
5
6 determinants within these communities must be examined. The overall aim of this scoping review is
7
8 to take stock of the current evidence of vaccine hesitancy among migrants. Toward this end, the
9
10 proposed review will address the following objectives:

- 11 1. Identify evidence of vaccine hesitancy among migrant individuals and communities.
- 12 2. Examine the extent and nature of the extant evidence.
- 13 3. Determine the value of undertaking a full systematic review.

14
15
16
17
18
19
20
21
22 Given the relative recency of vaccine hesitancy as a research area and given that we are not aware
23
24 of any comprehensive evidence of vaccine hesitancy among migrant populations, the above
25
26 objectives are suitable and consistent with the “reconnaissance” purpose of the scoping review.³³
27
28 Scoping will also allow us to identify and define crucial concepts, gaps in the literature and types and
29
30 sources of evidence to inform practice, policy and research.³³ In choosing to focus on vaccine
31
32 hesitancy, neither do we imply nor believe that the main determinant of under-immunization in
33
34 migrant populations is their reluctance to vaccinate. Political discourses that fuel prejudice and
35
36 exclusion of the other, restrictive policies that deny good quality healthcare to the poor and access to
37
38 universal health coverage to migrant populations, especially undocumented migrants, may represent
39
40 far greater barriers to immunization than vaccine hesitancy.³⁴⁻³⁶ However, we also believe that it is
41
42 important to know the magnitude and nature of vaccine hesitancy in subpopulations like migrant
43
44 communities because even very “small clusters of non-vaccinators can have disproportionately
45
46 adverse effects on herd immunity and epidemic spread.”³⁷
47
48
49
50
51
52
53
54
55
56
57
58
59
60

METHODS

A methodological framework for scoping review was first outlined by Arksey and O'Malley,³⁸ subsequently clarified by Levac and colleagues,³⁹ and further elaborated by the Joanna Briggs Institute (JBI).³³ JBI's elaboration of the framework contains 11 items: (1) title; (2) background; (3) review question/objective; (4) inclusion criteria; (5) types of participants; (6) concept; (7) context; (8) searching; (9) extracting and charting the results; (10) discussion; and (11) conclusions and implications for research and practice. We will apply this framework to organize our scoping review, supplementing it with recommendations from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist.⁴⁰ The rest of this section details how we will address items 3 to 9 of the framework.

3. Review question/objective

In lieu of review questions, we have stated three main review objectives at the end of the introduction section: (1) Identifying evidence of vaccine hesitancy among migrant individuals and communities; (2) Examining the extent and nature of the existing evidence; (3) Determining the value of undertaking a full systematic review.

4. Inclusion criteria

Articles will be included if they focus on the theme of vaccine hesitancy and its variations (e.g., vaccine acceptance, vaccine confidence, vaccine attitudes and behaviors, trust, distrust, concerns, perceptions, and beliefs about vaccines and vaccination programs). Articles will be included if published in the last two decades (January 1999 – December 2019) and if the full text is available in either French or English. Articles will be excluded if written in any language other than the above and for which open access automated translation programs such as Google Translate are not suitable. Articles that do not focus on human vaccine or that do not involve migrants will be excluded. Articles

1
2 that focus on vaccine hesitancy in the wider population but whose results are disaggregated by
3
4 immigration status will be included. Given that this is a scoping review, all evidence will be included,
5
6 from single-case reports to population-level studies, and from primary research to review articles,
7
8 policy reports, and commentaries.
9

10 11 12 **5. Types of participants** 13

14 Target participants for this review are migrant populations, migrant communities, and migrant
15
16 individuals, including parents, expecting parents, childfree adults, and children. We define migrants
17
18 as including all individuals whose country of national origin (or whose parents' country of origin) is
19
20 different from their country of residence, irrespective of manner of entry and legal/documented status
21
22 in the host country. Further details on participants are provided in Table 1 and Table 2.
23
24

25 26 **6. Concept** 27

28 The concept or principal focus explored by this scoping review is vaccine hesitancy. As described
29
30 in the previous section of this protocol, vaccine hesitancy is an inclusive concept that encompasses
31
32 varying degrees of indecision about vaccination in general or certain vaccines in particular.
33
34 Underlying factors of hesitancy include issues of confidence (do not trust vaccine or provider),
35
36 complacency (do not perceive a need for a vaccine), and convenience (access).²⁵ The final report
37
38 from the SAGE Working Group on Vaccine Hesitancy states: "Vaccine-hesitant individuals *may*
39
40 *accept all vaccines but remain concerned* about vaccines, some may refuse or delay some vaccines,
41
42 *but accept others; some individuals may refuse all vaccines.*"²⁴
43
44
45

46 47 **7. Context** 48

49 The context in this review could include the WHO Region of the studies, migrants' host country,
50
51 their home or origin country, their cultural heritage (e.g., religion, language, and health-seeking
52
53 traditions), their residential neighborhood, and the location/place where vaccination services are
54
55 provided.
56
57
58
59
60

8. Searching

One of the most comprehensive systematic reviews of published literature on vaccine hesitancy to date was published in 2014 by members of the SAGE Working Group on Vaccine Hesitancy which includes one of the senior co-authors of this protocol.²⁹ We will build on that 2014 publication, identifying relevant studies for our scoping review through several of the same databases included in that systematic review. All or most of the following databases will be searched from 1st January 1999 to 31st December 2019: Africa-Wide Information, Allied and Complementary Medicine, Cochrane Library, Cumulative Index of Nursing and Allied Health Literature, Embase, Index Medicus for the Eastern Mediterranean Region, International Bibliography of Social Sciences, Literature in the Health Sciences in Latin America and the Caribbean, Medline, Proquest Theses/Dissertations, PsycInfo, and Web of Science. Given that we aim at examining both the scientific and grey literature, we will also search Google and Google Scholar in addition to the multidisciplinary mainstream and regional databases listed above. Last, we will contact the authors of all studies included in our synthesis to identify potential additional sources. We anticipate that the search for articles will be run across all databases between April and June 2020.

Table 1. PICO elements for study selection criteria

Participant/population	Intervention	Comparators	Outcomes
Diaspora, émigrés, emigrants, migrants, immigrants, refugees, foreigners, foreign-born, newcomers	Immunization, vaccination, vaccine-related communication	General population, non-migrant, local, native population, no comparator	Vaccine confidence, vaccine uptake, vaccine refusal, vaccine hesitancy, vaccine delay, missed schedule of vaccine,

			non-medical vaccination exemption
--	--	--	---

To the extent possible, we will abide by the PRISMA-ScR checklist to select relevant studies. Studies will be selected according to elements of the PICO (Participants, Intervention, Comparators, and Outcome) model,⁴⁰ as outlined in Table 1. To capture multiple dimensions of vaccine hesitancy among migrants, the search strategy will include the non-exhaustive list of keywords and medical subject headings in Table 2. Once retrieved, all articles will first be screened by title and abstract by at least two reviewers to ascertain their relevance. When in doubt, the full article will be scanned to further determine its relevance or decide on its exclusion. Reference lists of relevant articles will also be perused to ensure literature saturation.

Table 2. Keywords and draft PMC search strategy for literature review on vaccine hesitancy

Intervention	Population	Outcome	PubMed Central (PMC) search details	Number of items found in MEDLINE
---------------------	-------------------	----------------	--	---

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60	Vaccination , vaccine, Immunisati on, immunizati on	Diaspora, émigré, emigrant, foreigner, immigran t, migrant, refugee	Acceptance, uptake, confidence, trust, anxiety, doubt, mistrust, anti- vaccination, anti-vax, concern, distrust, misinformati on, resistance, compulsory, dropout, MMR, skeptic, critic, exemption, objector, attitude, choice, fear, opposition, autism, controversy, hesitancy, perception, rumor, rumour, avoidance, decision, hesitation, phobia,	((((((vaccination) OR vaccine) OR immunization) OR immunisation)) AND (((((((emigre) OR emigrant) OR immigrant) OR migrant) OR refugee) OR diaspora) OR foreigner)) AND ((acce ptance) OR anxiety) OR anti- vaccination) OR anti-vaxx) OR attitude) OR autism) OR avoidance) OR awareness) OR barrier) OR behavior) OR behaviour) OR concern) OR confidence) OR compulsory) OR controversy) OR choice) OR critic) OR delay) OR denial) OR decision) OR dilemma) OR distrust) OR doubt) OR dropout) OR exemption) OR fear) OR hesitancy) OR hesitation) OR intention) OR knowledge) OR mandatory) OR misconception) OR misinformation) OR mistrust) OR MMR) OR objector) OR opposition) OR perception) OR phobia) OR refusal) OR rejection) OR reluctance) OR resistance) OR rumor) OR rumour) OR skeptic) OR trust) OR uptake) AND ("1999/01/01"[PDat] : "2019/12/31"[PDat]))	6887
---	--	--	---	--	------

		awareness, delay, intention, refusal, belief, barrier, denial, knowledge, rejection, dilemma, behavior, behavior, misconcepti on, mandatory, reluctance	
--	--	--	--

9. Extracting and charting the results

Table 3. Data charting template

Data	Data description
Study reference	Name and surname of authors, publication year.
Article type	Quantitative; qualitative; mixed methods; research; review; policy; perspective; comment; letter; unpublished report; media article.
Region of origin	WHO region where country of study is located.
Purpose	Overall aim and objectives of the study.
Population	Main characteristics of populations, communities, and individuals participating in the study.

Country of immigration	Host country where migrant participants reside.
Country of national origin	Foreign country where migrants or parents of second-generation immigrants came from.
Country of transit	Country where migrants may have resided as refugee before relocating in current host country.
Place of residence	Neighborhood, city, or state where migrant participants reside.
Location of immunization center	Neighborhood, city, or state where vaccination service is provided.
Religion	Main religion of migrants.
Native language	First language primarily spoken by migrants.
Ethnic/racial identity	Ethnic or racial group of migrants.
Comparator	Outgroup members with whom migrants are compared.
Concept	Underlying determinants of vaccine hesitancy explored by study.
Intervention	Types of intervention attempted or evaluated by study (e.g., vaccine administration; health communication; policy, etc.).
Outcome	Outcomes from intervention (e.g., increase, decrease, or steady state in vaccination rate).
Vaccine	Specific vaccine that is accepted, delayed, or rejected.
Findings	Relevant key findings from study.

1
2 It is standard in scoping reviews to illustrate the numerical outputs from the search and the
3
4 inclusion decision process by means of a PRISMA flowchart. Our flowchart will clearly describe the
5
6 review decision process, results from the search, removal of duplicate citations, study selection, full
7
8 retrieval, any additions from reference list scanning, and final summary presentation. In scoping
9
10 review, “charting the results” is an iterative process which involves the extraction of relevant data
11
12 from all the studies included in the review.³³ To enable consistency in data extraction among
13
14 reviewers, we have developed a data charting template (Table 3) to record characteristics of articles
15
16 included and key data pertinent to the objectives of our review. We anticipate refinement (or
17
18 consolidation) of this form after data from a small sample of studies (two to three) have been charted
19
20 independently by two or more reviewers. We anticipate that results of the review will include both
21
22 quantitative and qualitative data. We will present these results through summary narratives and
23
24 visuals such as evidence “maps” and tabular presentations.
25
26
27
28
29

30 **Protocol registration**

31
32
33 This protocol is not registered in the International Prospective Register of Systematic Reviews
34
35 (PROSPERO) because this registry does not accept scoping reviews.⁴¹
36
37

38 **Patient and public involvement**

39
40
41 This review will be based solely on published articles and will not involve any patients or the
42
43 public.
44
45

46 **ETHICS AND DISSEMINATION**

47
48
49 This review will be based on published works, and thus is exempted from formal ethical approval.
50
51 It will be published in a peer-reviewed open access journal to ensure wide dissemination.
52
53
54
55
56
57
58
59
60

REFERENCES

1. United Nations Development Programme (UNDP). Human Development Report 2009. Overcoming barriers: human mobility and development. New York: Palgrave Macmillan, 2009.
2. U.S. Citizenship and Immigration Services (USCIS). Applicability of medical examination and vaccination requirement. USCIS Policy Manual. Washington, DC: USCIS, 2017.
3. Center for Disease Control and Prevention. Vaccines for immigrants and refugees. <https://www.cdc.gov/vaccines/adults/rec-vac/immigrants-refugees.html> [accessed 18 March 2020].
4. Hong MK, Varghese RE, Jindal C, *et al*. Refugee policy implications of US immigration medical screenings: a new era of inadmissibility on health-related grounds. *Int J Environ Res Public Health* 2017;14:1107.
5. World Health Organization (WHO). Promoting the health of refugees and migrants. Draft global action plan, 2019 – 2023. Geneva: WHO, 2019.
6. Markkula N, Cabieses B, Lehti V, *et al*. Use of health services among international migrant children—a systematic review. *Global Health* 2018;14:52.
7. Mipatrini D, Stefanelli P, Severoni S, *et al* Vaccinations in migrants and refugees: a challenge for European health systems. A systematic review of current scientific evidence. *Pathog Glob Health* 2017;111:59–68.
8. Awoh AB, Plugge E. Immunisation coverage in rural-urban migrant children in low and middle-income countries (LMICs): a systematic review and meta-analysis. *J Epidemiol Community Health* 2016;70:305–11.
9. Kennedy J. Populist politics and vaccine hesitancy in Western Europe: an analysis of national-level data. *Eur J Public Health* 2019;29:512-16. doi:10.1093/eurpub/ckz004.

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
10. Camargo Jr K, Grant R. Public health, science, and policy debate: being right is not enough. *Am J Public Health* 2015;105:232-5.
11. Dyer O. Measles outbreak in Somali American community follows anti-vaccine talks. *BMJ* 2017;357: j2378 doi: 10.1136/bmj.j2378.
12. Katz SL, Hinman AR. Summary and conclusions: Measles elimination meeting, 16–17 March 2000. *J Infect Dis* 2004;189:S43–7.
13. Fiebelkorn AP, Redd SB, Gallagher K, *et al.* Measles in the United States during the postelimination era. *J Infect Dis* 2010;202:1520-8.
14. Gastañaduy PA, Redd SB, Fiebelkorn AP, *et al.* Measles—United States, January 1–May 23, 2014. *MMWR* 2014; 63:496.
15. Arciuolo RJ, Brantley TR, Asfaw MM, *et al.* Measles outbreak among members of a religious community—Brooklyn, New York, March–June 2013. *MMWR* 2013;62:752.
16. Gahr P, DeVries AS, Wallace G, *et al.* An outbreak of measles in an undervaccinated community. *Pediatrics* 2014;134:e220-8.
17. Leslie TF, Delamater PL, Yang YT. It could have been much worse: The Minnesota measles outbreak of 2017. *Vaccine* 2018;36:1808-10.
18. Hewitt A, Hall-Lande J, Hamre K, *et al.* Autism Spectrum Disorder (ASD) Prevalence in Somali and Non-Somali Children. *J Autism Dev Disord* 2016;46(8):2599–608.
19. Deer B. How the case against the MMR vaccine was fixed. *BMJ* 2011;342:c5347.
20. Godlee F, Smith J, Marcovitch H. Wakefield’s article linking MMR vaccine and autism was fraudulent. *BMJ* 2011;342:c7452.
21. Vainio K, Rønning K, Steen TW, *et al.* Ongoing outbreak of measles in Oslo, Norway, January–February 2011. *Euro Surveill* 2011;16:1–3.

- 1
- 2 22. Mupandawana ET, Cross R. Attitudes towards human papillomavirus vaccination among African
- 3
- 4 parents in a city in the north of England: a qualitative study. *Reprod Health* 2016;13:97.
- 5
- 6
- 7 23. Hickler B, Guirguis S, Obregon R. Special issue on vaccine hesitancy. *Vaccine* 2015;33:4155-6.
- 8
- 9 24. World Health Organization. Report of the SAGE Working Group on Vaccine Hesitancy. Geneva,
- 10 Switzerland: WHO, 2014.
- 11
- 12
- 13 25. MacDonald NE. Vaccine hesitancy: Definition, scope and determinants. *Vaccine* 2015;33:4161-4.
- 14
- 15
- 16 26. Goldstein S, MacDonald NE, Guirguis S. Health communication and vaccine hesitancy. *Vaccine*
- 17 2015;33:4212-4.
- 18
- 19
- 20 27. Salmon DA, Dudley MZ, Glanz JM, et al. Vaccine hesitancy: causes, consequences, and a call to
- 21 action. *Vaccine* 2015;33:D66-71.
- 22
- 23
- 24
- 25 28. Williams SE. What are the factors that contribute to parental vaccine-hesitancy and what can we
- 26 do about it? *Hum Vaccin Immunother* 2014;10:2584-96.
- 27
- 28
- 29 29. Larson HJ, Jarrett C, Eckersberger E, Smith DM, et al. Understanding vaccine hesitancy around
- 30 vaccines and vaccination from a global perspective: a systematic review of published literature,
- 31 2007–2012. *Vaccine* 2014;32:2150-9.
- 32
- 33
- 34
- 35
- 36 30. Bedford H, Attwell K, Danchin M, et al. Vaccine hesitancy, refusal and access barriers: The need
- 37 for clarity in terminology. *Vaccine* 2018;36:6556-8.
- 38
- 39
- 40
- 41 31. Peretti-Watel P, Larson HJ, Ward JK, et al. Vaccine hesitancy: clarifying a theoretical framework
- 42 for an ambiguous notion. *PLoS Curr.* 2015;7.
- 43
- 44
- 45
- 46 doi:10.1371/currents.outbreaks.6844c80ff9f5b273f34c91f71b7fc289.
- 47
- 48 32. World Health Organization. Ten threats to global health in 2019. Geneva: WHO.
- 49
- 50 <https://www.who.int/emergencies/ten-threats-to-global-health-in-2019> [accessed 18 March 2020].
- 51
- 52
- 53 33. Peters MD, Godfrey CM, Khalil H, et al. Guidance for conducting systematic scoping reviews.
- 54
- 55 *Int J Evid Based Healthc* 2015;13:141-6.
- 56
- 57
- 58
- 59
- 60

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
34. Ottersen OP, Dasgupta J, Blouin C, *et al.* The political origins of health inequity: prospects for change. *Lancet* 2014;383:630-67.
35. Onarheim KH, Melberg A, Meier BM, *et al.* Towards universal health coverage: including undocumented migrants. *BMJ Glob Health* 2018;3:e001031. doi:10.1136/bmjgh-2018-001031.
36. Abubakar I, Aldridge RW, Devakumar D, *et al.* The UCL–Lancet Commission on Migration and Health: the health of a world on the move. *Lancet* 2018;392:2606-54. doi:[https://dx.doi.org/10.1016/S0140-6736\(18\)32114-7](https://dx.doi.org/10.1016/S0140-6736(18)32114-7).
37. Larson HJ, De Figueiredo A, Xiaohong Z, *et al.* The state of vaccine confidence 2016: global insights through a 67-country survey. *EBioMedicine* 2016;12:295-301.
38. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* 2005;8:19-32.
39. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci* 2010;5:69.
40. Tricco AC, Lillie E, Zarin W, *et al.* PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med* 2018;169:467-73.
41. National Institute of Health Research. International prospective register of systematic reviews: inclusion criteria. <https://www.crd.york.ac.uk/prospero/#guidancenotes> [accessed 18 March 2020].

47 **Authors' contributions**

48
49
50
51
52
53
54
55
56
57
58
59
60

ABST, HJL, CSW conceived the study. ABST wrote the first draft of the protocol. AJ, HJL, CSW and SHV revised the manuscript critically for important intellectual content.

Funding

AJ and CSW are supported by the South African Medical Research Council. SHV is supported, in part, by a grant from the National Institutes of Health (P30MH062294). The funders had no role in the design and writing of the protocol or the decision to submit it for publication.

Competing interest statement

The authors declare no competing interests.

Word count: 2273

For peer review only