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Vaccine hesitancy in migrant communities: a rapid review of latest evidence☆

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By refusing or delaying vaccination, vaccine hesitant individuals and communities undermine the prevention, and ultimately, elimination of communicable diseases against which safe and effective vaccines are available. We reviewed recent evidence of vaccine hesitancy within migrant communities in the context of increased human mobility and widespread anti-immigrant sentiment and manifest xenophobia. Among many immigrant parents and families, vaccine hesitancy is largely associated with fears and misinformation about vaccine harms, limited knowledge of both preventable diseases and vaccines, distrust of host countries' health systems and their attendant intentions, language barriers, and perceived incompatibility between vaccine uptake and migrants' religion. Hesitancy toward measles, influenza, and human papillomavirus vaccines are most discernible, and main migrant populations involved include Somalis and Poles.

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Introduction

In 2019 the World Health Organization (WHO) reported that measles, a disease for which a safe and effective vaccine has been available for more than half a century, had seen a 30% global increase in cases since 2016, and several countries that were either measles-free or approaching measles elimination status had recorded a resurgence of the highly contagious respiratory disease [1,2]. This worrying situation comes nearly a decade after WHO Member States endorsed the Global Vaccine Action Plan at the World Health Assembly in May 2012, resolving to eliminate measles in five of the six WHO regions by the year 2020 [3]. The Decade of Vaccines (2011–2020) has come and gone, and no WHO region has achieved and maintained measles elimination [4]. Evidence from systematic reviews suggests stagnating and declining measles vaccination rates are due in part to vaccine hesitancy [5], broadly defined by the WHO Strategic Advisory Group of Experts on Immunization (SAGE) Working Group on Vaccine Hesitancy as the delay in acceptance or refusal to vaccinate oneself or others despite availability of vaccination services [6]. Grounded in rumors and misinformation about the safety and effectiveness of vaccines [7•], and digitally enabled by the internet and social media [8,9], the viral spread of vaccine hesitancy has been associated with diminishing public trust in science and in vaccination in multiple countries [10,11,12•]. WHO declared vaccine hesitancy as one of the world's top 10 global health threats in 2019 [13], urging regular monitoring of vaccine sentiments at national and subnational levels to gauge declining trust in vaccination and prioritize research and intervention in populations and subpopulations most at-risk for hesitancy. This paper reviews recent evidence of vaccine hesitancy among migrant populations.

Our interest in migrants is motivated by several factors. At the 72nd World Health Assembly of 2019, WHO prioritized the health of refugees and migrants, recognizing that access to healthcare services including vaccination is more difficult for migrants and people on the move [14,15]. Further, human mobility is often linked to infectious disease transmission [16]. Although vaccination is often required for immigration and refugee resettlement, many immigrant communities experience lower immunization rates and

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higher burden of vaccine-preventable diseases than host populations [17]. When involuntary and on a large scale [16], migration can be highly disruptive to both the displaced population and the host country, undermining the resilience of the health system and compromising health service delivery in the latter, including vaccination services [18]. Among the newcomers, some concerns about vaccination may be rooted in the culture or experience of the home country, and hence may precede migration [19]. Xenophobia (real or perceived) and potential undocumented status in the host nation may render some migrants both reluctant to integrate and vaccinate [20•,21]. Lastly, multiple outbreaks of vaccine-preventable diseases among some immigrant communities in host countries with otherwise high vaccination coverage suggest vaccine hesitancy could be a factor in their health vulnerabilities [22•,23••].

Defining migrants

The International Organization for Migration (IOM) is credited with the following definition of migrant: 'Any person who is moving or has moved across an international border or within a state away from his/her habitual place of residence, regardless of (1) the person's legal status; (2) whether the movement is voluntary or involuntary; (3) what the causes for the movement are; or (4) what the length of the stay is' [24]. This inclusive definition, however, overlooks the multigenerational structure and cultural heritage of many migrant families. As conveyed by the phrase 'second-generation immigrant', some native-born individuals can still be viewed as 'migrants' or may identify as such even without any personal experience of transnational migration. Several generations post-relocation, the values and health belief systems of the descendants can remain strongly grounded in the traditional culture of the country of national origin of their émigré parents, grandparents, or great grandparents. This is mostly evidenced in the religion of various migrant populations who become minorities in Western countries such as the Amish and Orthodox Jews in the United States (US), communities with documented histories of underimmunization and vaccine-preventable disease outbreaks [25,26]. Alternatively, upon arrival in the host country, some recent immigrants may be grouped with the long-established population of shared descent, even without assimilation. Hence, examining vaccine hesitancy among migrant populations in some host countries without implicating ethnic/racial minority populations can become challenging and problematic. In this review, we consider the ethnic/racial minority population of shared national origin with recent migrants in a given host country as members of the same emigrant group or diaspora.

Measles vaccine hesitancy in the Somali and Romanian diasporas

Although a consistent body of research has shown no causal relationship between the measles–mumps–rubella (MMR) vaccine and autism [27], misinformation about such a link has permeated several clusters of the global Somali diaspora [23••,28,29•]. In the US Midwest state of Minnesota, home to the largest US-based Somali immigrant population, MMR vaccination compliance among Somali children plummeted from 92% in 2004 to 42% in 2016 as a result of Somali parents' ill-informed fears of a link between the MMR vaccine and autism, driven by anti-vaccination activism targeted at the Somali Minnesotan community [28]. Ultimately, this sharp decline in immunization rate led to a 75-case measles outbreak between March and August 2017, which was largely confined to Somali Minnesotans who constituted 81% of the cases [23••]. Although no fatalities were reported, the cost of the outbreak was significant as more than 8000 individuals were exposed to measles and more than 500 persons were excluded from childcare and school for 21 days. The state of Minnesota and public health partners spent over US $2 million on the measles outbreak response [23••]. A 21-case measles outbreak had already afflicted the same community in 2011, after an unvaccinated 30-month-old Somali American child contracted measles following travel to Kenya [28]. In the same year in Northern Europe, an 18-case measles epidemic broke out in Oslo, Norway, and 70% of the unvaccinated children infected were from the local Somali community [29•]. In Sweden, Somali mothers who delayed MMR vaccine were concerned that their children may stop talking as a side effect from vaccination [30]. This delay was also compounded by Somali mothers' perceived stigmatization by Swedish health personnel who ignored their concerns or prejudged their stance on vaccination [30].

In the United Kingdom (UK), some migrant populations and subpopulations from Eastern Europe, namely Romanians and Roma Romanians, have been the focus of recent investigations after three measles outbreaks totalling 174 confirmed cases afflicted their communities between 2017 and 2018 in the cities of Birmigham, Leeds, and Liverpool [22•,31]. Findings from these studies revealed that rather than intentional delay or active refusal of vaccination, the main determinants of underimmunization in these immigrant communities were access-related, including language and literacy barriers as well as cuts to spending and services for medically underserved communities [22•,31].

Influenza vaccine hesitancy among Polish families in the UK

Current global estimates suggest that seasonal influenza is associated with more than five million hospitalizations [32], and up to about 650 000 deaths annually, including up to about 100 000 deaths among underfive children [33]. Annual vaccination is the primary prevention method against this acute viral respiratory disease. The UK is home to large numbers of migrants from Eastern Europe,

the region with both the world's overall highest mortality rate of influenza lower respiratory tract infections in 2017 (5.2 per 100 000 people) [34], and the world's lowest percentage (50%) of public trust in vaccine safety in 2018 [12•]. Research has documented low vaccination uptake rates among UK-based Polish immigrant children [35•,36••]. A cross-sectional study of vaccine uptake among primary school students in Edinburgh, Scotland, found that 37% of Polish families declined influenza vaccine for their children, compared to only 6% of White British families, resulting in a threefold difference in influenza vaccine uptake between White British (71%) and Polish immigrant (25%) children [35•]. Evidence suggests that Polish immigrant parents held many of their health beliefs and vaccination concerns before moving to the UK and continued to be influenced by the Polish diaspora mass media and social media as well as by opinions and current developments in Poland where a highly organized anti-vaccine movement is currently thriving [11,36••]. Likely amplified by Russian media [37], Poland's anti-vaccine movement is bolstered by widespread political populism in Eastern Europe associated with anti-science, anti-Western, and anti-immigrant sentiments [38•].

HPV vaccine hesitancy in immigrant populations

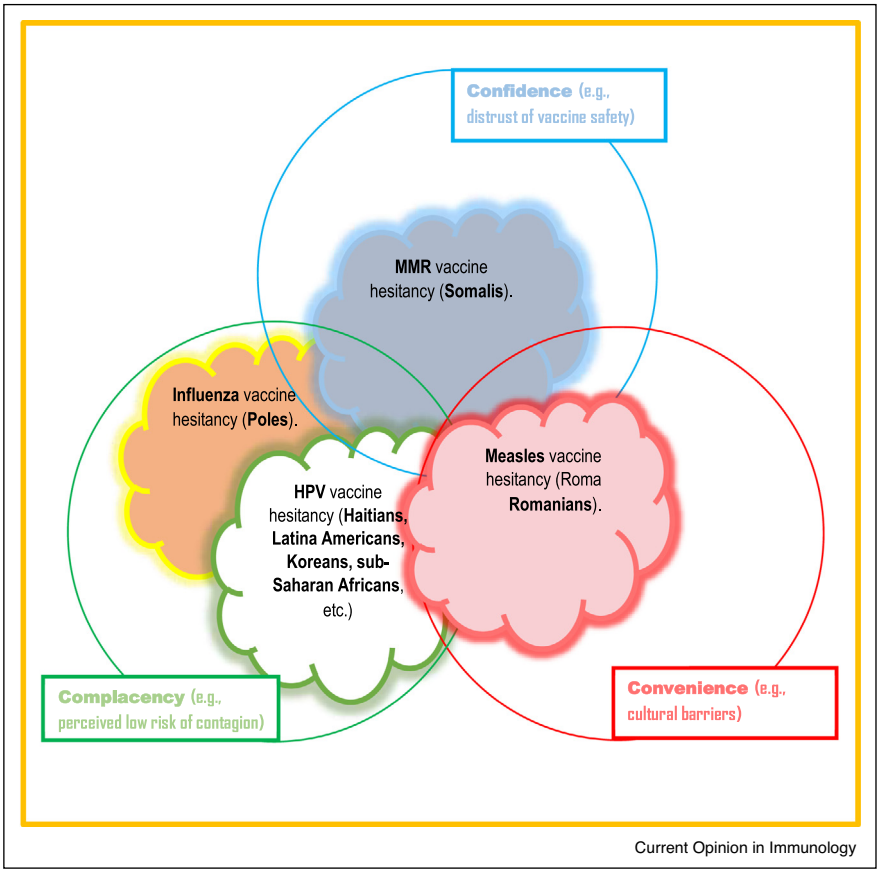
Sexually transmitted human papillomavirus (HPV) infects both men and women, causing genital warts and cervical cancer. The latter is the fourth most common malignancy among women worldwide after breast, colorectal, and lung cancers [39]. An effective vaccine against HPV has been approved by the US Food and Drug Adminsitration since 2006 and is recommended to teens before the onset of sexual activity to prevent cervical cancer [40]. African countries have some of the world's highest incidence rates of cervical HPV infection [41]. Yet, a study of parental attitudes towards HPV vaccine found widespread reluctance *vis-à-vis* the vaccine among UK-based immigrant parents from Kenya, Nigeria, South Africa, Zambia, and Zimbabwe; many of whom have been in the UK for two decades or more [42•]. Hesitancy was driven by concerns that approving the HPV vaccine for their daughters was tantamount to granting them a license for promiscuity. Because of its relative recency, the most suspicious parents believed HPV vaccine is a racist biopolitical strategy designed to sterilize Black/African girls for population control purposes [42•].

In the US, research found similar reluctance *vis-à-vis* HPV vaccination among Haitian parents and recently immigrated young Korean women. The latter believed the HPV vaccine is more appropriate for promiscuous women [43]. The former reported being uncomfortable vaccinating their children against sexually transmitted infections as they believe children should not be sexually active [44]. Other US-based studies on HPV vaccine acceptance have involved the Latin American and Somali diasporas. A recent study of Latina immigrant mothers of 9–12 years old daughters in Alabama (southern US), found 35% of them manifested HPV vaccine hesitancy, operationalized as 'Don't know/Not sure' in response to the hypothetical question: 'If your daughter's doctor recommended that she gets the HPV vaccine, would you let her get it?' [45••]. The main determinants of hesitancy included health insurance status, HPV awareness, and perceived risk of HPV infection [45••]. Meanwhile, Somali Minnesotan parents and young adults perceived an incompatibility between HPV vaccine uptake and their Muslim faith which precludes premarital sex [46•]. Likewise, research from the Netherlands identified multiple barriers to cervical cancer prevention among Somali immigrant women, including, perceived low risk of HPV and cancer because of premarital sexual prohibitions by Islam, being embarrassed to get Pap smears due to female genital mutilation, having a male gynecologist, and overall distrust of the Dutch healthcare system [47]. By and large, limited knowledge of both cervical cancer and HPV vaccination, and religion-driven social conservatism which hinders open and informed conversation about sexual and reproductive health, are some of the main drivers of HPV vaccine hesitancy among many immigrant families.

Summary of determinants of vaccine hesitancy in migrant populations

Taken together, the identified drivers of vaccine hesitancy in migrant populations can be aggregated in three main analytical categories consistent with the 'three Cs' of vaccine hesitancy proposed by the SAGE Working Group on Vaccine Hesitancy: complacency, confidence, and convenience (Figure 1) [6]. There is complacency when risks of contracting vaccine-preventable diseases are perceived as low, and vaccination is deemed unnecessary. HPV vaccine hesitancy among migrant parents from various races and national origins appears to be driven largely by complacency-related drivers like deference to religious and cultural norms as protective factors [41,45••,46•]. Likewise, childhood influenza vaccine refusal among Polish parents in the UK is to a large extent a manifestation of complacency [35•,36••]. Confidence encompasses issues of trust, including trust in the safety and effectiveness of vaccines, and trust in the health system and health providers that deliver them [6,48]. Low confidence is the essential underlying factor of MMR vaccine hesitancy among Somali parents in the US, Norway, and Sweden [23••,29•,30]. Last, convenience mostly involves structural drivers of vaccination hesitancy. The reviewed literature suggests that low vaccination uptake within the UK-based Romanian and Roma Romanian communities is driven primarily by convenience issues such as cultural barriers and ease of registration with a general practitioner [22•,31]. It is most likely that the 'three Cs' interact to cause vaccine

Figure 1



Underlying determinants of vaccine hesitancy in migrant populations.

hesitancy among migrants through a pathway of social exclusion. Experiences of marginalization or discrimination in host countries may lead immigrant communities to distrust the health system and health providers, culminating in vaccine hesitancy as an expression of cultural alienation or even an active skepticism of the healthcare practices of the host culture [49].

Conclusion

There is little doubt that migrant populations are susceptible to vaccine hesitancy, especially those relocated in democratic societies besieged by anti-science extremism [50]. However, this neither implies that the main determinants of underimmunization or non-vaccination among immigrants are more of an agentic/volitional nature than of a structural/external one, nor that the onus of addressing hesitancy within their midst should be mostly on them [51••]. We have observed elsewhere that both political discourses that fuel prejudice and exclusion of the other, and restrictive policies that materially deny good quality healthcare to the poor and prohibit access to universal health coverage to migrant populations, especially undocumented migrants, represent as great barrier to immunization as vaccine hesitancy [52], and perhaps fuel the latter. In the US, the putative immigrant country par excellence, the recent Trump presidency was defined by racist rhetoric, anti-immigrant federal policies, high-profile acts of police brutality against minority communities of color, and heightened awareness of structural racism as a formidable contribution to disparities in disease infection and mortality [53,54]. More than any vaccine-related concerns, these factors may have exacerbated ethnic minorities and immigrants' fragile trust in government and alienation from available public healthcare services like COVID-19 vaccination [54]. Such low levels of trust in government and the public healthcare system may also fuel vaccine hesitancy. Ultimately, we believe the most effective strategies to increase and sustain optimal vaccination coverage in migrant populations will be those that combine community-based immunization service delivery tailored to the specific health issues and unmet social needs of a given immigrant community with migrant-friendly health systems and policies that affirm and protect their human rights and dignity [55–57].

Conflict of interest statement

Charles S Wiysonge is one of the editors of this themed issue on Vaccines.

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References and recommended reading

Papers of particular interest, published within the period of review, have been highlighted as:

- • of special interest
- •• of outstanding interest

1. Tanne JH: **Measles cases and deaths are increasing worldwide, warn health agencies**. *BMJ* 2020, **371**:m4450 http://dx.doi.org/10.1136/bmj.m4450.

2. Feemster KA, Szipszky C: **Resurgence of measles in the United States: how did we get here?** *Curr Opin Pediatr* 2020, **32**:139-144 http://dx.doi.org/10.1097/MOP.0000000000000845.

3. MacDonald N, Mohsni E, Al-Mazrou Y, Kim Andrus J, Arora N, Elden S, Madrid MY, Martin R, Mahmoud Mustafa A, Rees H *et al.*: **Global vaccine action plan - lessons learned I: recommendations for the next decade**. *Vaccine* 2020, **38**:5364-5371 http://dx.doi.org/10.1016/j.vaccine.2020.05.003.

4. Patel MK, Goodson JL, Alexander JP Jr, Kretsinger K, Sodha SV, Steulet C, Gacic-Dobo M, Rota PA, McFarland J, Menning L *et al.*: **Progress toward regional measles elimination - worldwide, 2000-2019**. *MMWR Morb Mortal Wkly Rep* 2020, **69**:1700-1705 http://dx.doi.org/10.15585/mmwr.mm6945a6.

5. Wilder-Smith AB, Qureshi K: **Resurgence of measles in Europe: a systematic review on parental attitudes and beliefs of measles vaccine**. *J Epidemiol Glob Health* 2020, **10**:46-58 http://dx.doi.org/10.2991/jegh.k.191117.001.

6. MacDonald NE, SAGE Working Group on Vaccine Hesitancy: **Vaccine hesitancy: definition, scope and determinants**. *Vaccine* 2015, **33**:4161-4164 http://dx.doi.org/10.1016/j.vaccine.2015.04.036.

7. • Larson HJ: **The biggest pandemic risk? Viral misinformation**. *Nature* 2018, **562**:309 http://dx.doi.org/10.1038/d41586-018-07034-4

With piercing insight, the author discusses the detrimental effects of online misinformation on pandemic spread and response more one than a year before the COVID-19 outbreak.

8. Germani F, Biller-Andorno N: **The anti-vaccination infodemic on social media: a behavioral analysis**. *PLoS One* 2021, **16**:e0247642 http://dx.doi.org/10.1371/journal.pone.0247642.

9. Wilson SL, Wiysonge C: **Social media and vaccine hesitancy**. *BMJ Glob Health* 2020, **5**:e004206 http://dx.doi.org/10.1136/bmjgh-2020-004206.

10. de Figueiredo A, Simas C, Karafillakis E, Paterson P, Larson HJ: **Mapping global trends in vaccine confidence and investigating barriers to vaccine uptake: a large-scale retrospective temporal modelling study**. *Lancet* 2020, **396**:898-908.

11. Gallup: *Wellcome Global Monitor: How Does the World Feel about Science and Health*. London, UK: Wellcome Trust; 2018 https://wellcome.ac.uk/reports/wellcome-global-monitor.

12. • Milondzo T, Meyer JC, Dochez C, Burnett RJ: **Misinformation drives low human papillomavirus vaccination coverage in South African girls attending private schools**. *Front Public Health* 2021, **9**:598625 http://dx.doi.org/10.3389/fpubh.2021.598625

This study presents early evidence of online misinformation-generated HPV vaccine hesitancy in an African country.

13. Qayum I: **Top ten global health threats for 2019: the WHO list**. *J Rehman Med Inst* 2019, **5**:01-02.

14. Turner R, PLOS Medicine editors: **Migrants and refugees: improving health and well-being in a world on the move**. *PLoS Med* 2019, **16**:e1002876 http://dx.doi.org/10.1371/journal.pmed.1002876.

15. Gostin LO, Abubakar I, Guerra R, Rashid SF, Friedman EA, Jakab Z: **WHO takes action to promote the health of refugees and migrants**. *Lancet* 2019, **393**:2016-2018 http://dx.doi.org/10.1016/S0140-6736(19)31051-7.

16. Tuite AR, Thomas-Bachli A, Acosta H, Bhatia D, Huber C, Petrasek K, Watts A, Yong JHE, Bogoch II, Khan K: **Infectious disease implications of large-scale migration of Venezuelan nationals**. *J Travel Med* 2018, **25**:tay077 http://dx.doi.org/10.1093/jtm/tay077.

17. Charania NA, Gaze N, Kung JY, Brooks S: **Vaccine-preventable diseases and immunisation coverage among migrants and non-migrants worldwide: a scoping review of published literature, 2006 to 2016**. *Vaccine* 2019, **37**:2661-2669 http://dx.doi.org/10.1016/j.vaccine.2019.04.001.

18. Kotsiou OS, Kotsios P, Srivastava DS, Kotsios V, Gourgoulianis KI, Exadaktylos AK: **Impact of the refugee crisis on the Greek healthcare system: a long road to Ithaca**. *Int J Environ Res Public Health* 2018, **15**:1790 http://dx.doi.org/10.3390/ijerph15081790.

19. Wilson L, Rubens-Augustson T, Murphy M, Jardine C, Crowcroft N, Hui C, Wilson K: **Barriers to immunization among newcomers: a systematic review**. *Vaccine* 2018, **36**:1055-1062 http://dx.doi.org/10.1016/j.vaccine.2018.01.025.

20. • Suleman S, Garber KD, Rutkow L: **Xenophobia as a determinant of health: an integrative review**. *J Public Health Policy* 2018, **39**:407-423 http://dx.doi.org/10.1057/s41271-018-0140-1

This comprehensive review synthesizes evidence of the negative impact of xenophobia on the health of individuals and communities.

21. Alfaro-Velcamp T: **"Don't send your sick here to be treated, our own people need it more": immigrants' access to healthcare in South Africa**. *Int J Migr Health Soc Care* 2018, **13**:53-68 http://dx.doi.org/10.1108/IJMHSC-04-2015-0012.

22. • Bell S, Saliba V, Ramsay M, Mounier-Jack S: **What have we learnt from measles outbreaks in 3 English cities? A qualitative exploration of factors influencing vaccination uptake in Romanian and Roma Romanian communities**. *BMC Public Health* 2020, **20**:381 http://dx.doi.org/10.1186/s12889-020-8454-x

This study provides evidence that underimmunization among Romanian migrants in the UK is due mostly to marginalization than to hesitancy.

23. •• Banerjee E, Griffith J, Kenyon C, Christianson B, Strain A, Martin K, McMahon M, Bagstad E, Laine E, Hardy K *et al.*: **Containing a measles outbreak in Minnesota, 2017: methods and challenges**. *Perspect Public Health* 2020, **140**:162-171 http://dx.doi.org/10.1177/1757913919871072

The authors present a methodical and data-dense account of the extensive process, collaboration, and resources used to contain a major measles outbreak largely confined to an immigrant community in the US.

24. Abbas M, Aloudat T, Bartolomei J, Carballo M, Durieux-Paillard S, Gabus L, Jablonka A, Jackson Y, Kaojaroen K, Koch D *et al.*: **Migrant and refugee populations: a public health and policy perspective on a continuing global crisis**. *Antimicrob Resist Infect Control* 2018, **7**:113 http://dx.doi.org/10.1186/s13756-018-0403-4.

25. McDonald R, Ruppert PS, Souto M, Johns DE, McKay K, Bessette N, McNulty LX, Crawford JE, Bryant P, Mosquera MC *et al.*: **Notes from the field: measles outbreaks from imported cases in Orthodox Jewish communities - New York and New Jersey, 2018-2019**. *MMWR Morb Mortal Wkly Rep* 2019, **68**:444-445 http://dx.doi.org/10.15585/mmwr.mm6819a4.

26. Gastañaduy PA, Funk S, Paul P, Tatham L, Fisher N, Budd J, Fowler B, de Fijter S, DiOrio M, Wallace GS *et al.*: **Impact of public health responses during a measles outbreak in an Amish community in Ohio: modeling the dynamics of transmission**. *Am J Epidemiol* 2018, **187**:2002-2010 http://dx.doi.org/10.1093/aje/kwy082.

27. DeStefano F, Shimabukuro TT: **The MMR vaccine and autism**. *Annu Rev Virol* 2019, **6**:585-600 http://dx.doi.org/10.1146/annurev-virology-092818-015515.

28. Gahr P, DeVries AS, Wallace G, Miller C, Kenyon C, Sweet K, Martin K, White K, Bagstad E, Hooker C *et al.*: **An outbreak of measles in an undervaccinated community**. *Pediatrics* 2014, **134**:e220-e228 http://dx.doi.org/10.1542/peds.2013-4260.

29. • Jenness SM, Aavitsland P, White RA, Winje BA: **Measles vaccine coverage among children born to Somali immigrants in Norway**. *BMC Public Health* 2021, **21**:668 http://dx.doi.org/10.1186/s12889-021-10694-z
This large-scale study revealed suboptimal measles vaccination coverage in the Somali Norwegian population. It founds much lower vaccine uptake among children of Somali parents who have been living in Norway for a longer time than among those from recently emigrated Somali parents.

30. Jama A, Ali M, Lindstrand A, Butler R, Kulane A: **Perspectives on the measles, mumps and rubella vaccination among Somali mothers in Stockholm**. *Int J Environ Res Public Health* 2018, **15**:2428 http://dx.doi.org/10.3390/ijerph15112428.

31. Bell S, Saliba V, Evans G, Flanagan S, Ghebrehewet S, McAuslane H, Sibal B, Mounier-Jack S: **Responding to measles outbreaks in underserved Roma and Romanian populations in England: the critical role of community understanding and engagement**. *Epidemiol Infect* 2020, **148**:e138 http://dx.doi.org/10.1017/S0950268820000874.

32. Lafond KE, Porter RM, Whaley MJ, Suizan Z, Ran Z, Aleem MA, Thapa B, Sar B, Proschle VS, Peng Z *et al.*: **Global burden of influenza-associated lower respiratory tract infections and hospitalizations among adults: a systematic review and meta-analysis**. *PLoS Med* 2021, **18**:e1003550 http://dx.doi.org/10.1371/journal.pmed.1003550.

33. Iuliano AD, Roguski KM, Chang HH, Muscatello DJ, Palekar R, Tempia S, Cohen C, Gran JM, Schanzer D, Cowling BJ *et al.*: **Estimates of global seasonal influenza-associated respiratory mortality: a modelling study**. *Lancet* 2018, **391**:1285-1300 http://dx.doi.org/10.1016/S0140-6736(17)33293-2.

34. GBD 2017 Influenza Collaborators: **Mortality, morbidity, and hospitalisations due to influenza lower respiratory tract infections, 2017: an analysis for the Global Burden of Disease Study 2017**. *Lancet Respir Med* 2019, **7**:69-89 http://dx.doi.org/10.1016/S2213-2600(18)30496-X.

35. • Bielecki K, Kirolos A, Willocks LJ, Pollock KG, Gorman DR: **Low uptake of nasal influenza vaccine in Polish and other ethnic minority children in Edinburgh, Scotland**. *Vaccine* 2019, **37**:693-697 http://dx.doi.org/10.1016/j.vaccine.2018.11.029
This study infers a high prevalence rate of vaccine hesitancy among Polish immigrant families in Scotland by comparing proportions of return of influenza vaccination consent forms among White British, Polish, and other ethnic minority students.

36. •• Gorman DR, Bielecki K, Larson HJ, Willocks LJ, Craig J, Pollock KG: **Comparing vaccination hesitancy in Polish migrant parents who accept or refuse nasal flu vaccination for their children**. *Vaccine* 2020, **38**:2795-2799 http://dx.doi.org/10.1016/j.vaccine.2020.02.028
This is reportedly the first study to survey a migrant parent group with the WHO SAGE recommended vaccine hesitancy questions. Its findings show that concerns about the measles vaccine in this group preceded migration.

37. Broniatowski DA, Jamison AM, Qi S, AlKulaib L, Chen T, Benton A, Quinn SC, Dredze M: **Weaponized health communication: Twitter bots and Russian trolls amplify the vaccine debate**. *Am J Public Health* 2018, **108**:1378-1384 http://dx.doi.org/10.2105/AJPH.2018.304567.

38. • Żuk P, Żuk P, Lisiewicz-Jakubaszko J: **The anti-vaccine movement in Poland: the socio-cultural conditions of the opposition to vaccination and threats to public health**. *Vaccine* 2019, **37**:1491-1494 http://dx.doi.org/10.1016/j.vaccine.2019.01.073
This is a persuasive and informative discussion of the development and enabling environment of the anti-vaccine movement in Poland.

39. Arbyn M, Weiderpass E, Bruni L, de Sanjosé S, Saraiya M, Ferlay J, Bray F: **Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis**. *Lancet Glob Health* 2020, **8**:e191-e203 http://dx.doi.org/10.1016/S2214-109X(19)30482-6.

40. Patel C, Brotherton JM, Pillsbury A, Jayasinghe S, Donovan B, Macartney K, Marshall H: **The impact of 10 years of human papillomavirus (HPV) vaccination in Australia: what additional disease burden will a nonavalent vaccine prevent?** *Euro Surveill* 2018, **23**:1700737 http://dx.doi.org/10.2807/1560-7917.ES.2018.23.41.1700737.

41. Lekoane KMB, Kuupiel D, Mashamba-Thompson TP, Ginindza TG: **Evidence on the prevalence, incidence, mortality and trends of human papilloma virus-associated cancer in sub-Saharan Africa: systematic scoping review**. *BMC Cancer* 2019, **19**:563 http://dx.doi.org/10.1186/s12885-019-5781-3.

42. • Mupandawana ET, Cross R: **Attitudes towards human papillomavirus vaccination among African parents in a city in the north of England: a qualitative study**. *Reprod Health* 2016, **13**:97 http://dx.doi.org/10.1186/s12978-016-0209-x
This paper describes early evidence of parental vaccine hesitancy among Western-based African immigrant parents who are not Somalis.

43. Lee HY, Lee MH: **Barriers to cervical cancer screening and prevention in young Korean immigrant women: implications for intervention development**. *J Transcult Nurs* 2017, **28**:353-362 http://dx.doi.org/10.1177/1043659616649670.

44. Joseph NP, Clark JA, Bauchner H *et al.*: **Knowledge, attitudes, and beliefs regarding HPV vaccination: ethnic and cultural differences between African American and Haitian immigrant women**. *Women's Health Issues* 2012, **22**:e571-e579 http://dx.doi.org/10.1016/j.whi.2012.09.003.

45. •• Khodadadi AB, Redden DT, Scarinci IC: **HPV vaccination hesitancy among Latina immigrant mothers despite physician recommendation**. *Ethn Dis* 2020, **30**:661-670 http://dx.doi.org/10.18865/ed.30.4.661
This paper uses a simple and clear operational definition of HPV vaccine hesitancy to measure it among Latina immigrant mothers as part of a randomized controlled trial to promote HPV vaccination in this US population.

46. • Pratt R, Njau SW, Ndagire C, Chaisson N, Toor S, Ahmed N, Mohamed S, Dirks J: **"We are Muslims and these diseases don't happen to us": a qualitative study of the views of young Somali men and women concerning HPV immunization**. *Vaccine* 2019, **37**:2043-2050 http://dx.doi.org/10.1016/j.vaccine.2019.03.006
This qualitative study of HPV immunization within the Somali community of Minnesota details the experiences and views on HPV vaccination in 20-year-old Somali Americans; it finds many of the same barriers and cultural dynamics reported among older Somali immigrant adults and parents.

47. Salad J, Verdonk P, de Boer F, Abma TA: **"A Somali girl is Muslim and does not have premarital sex. Is vaccination really necessary?" A qualitative study into the perceptions of Somali women in the Netherlands about the prevention of cervical cancer**. *Int J Equity Health* 2015, **14** http://dx.doi.org/10.1186/s12939-015-0198-3.

48. Larson HJ, Schulz WS, Tucker JD, Smith DM: **Measuring vaccine confidence: introducing a global vaccine confidence index**. *PLoS Curr* 2015, **7** ecurrents.outbreaks.ce0f6177bc32602a8e3fe7d7f7cc4.

49. Wiysonge CS, Ndwandwe D, Ryan J, Jaca A, Batouré O, Anya BM, Cooper S: **Vaccine hesitancy in the era of COVID-19: could lessons from the past help in divining the future?** *Hum Vaccin Immunother* 2021:1-3 http://dx.doi.org/10.1080/21645515.2021.1893062.

50. Hotez PJ: **Anti-science extremism in America: escalating and globalizing**. *Microbes Infect* 2020, **22**:505-507 http://dx.doi.org/10.1016/j.micinf.2020.09.005.

51. •• Khan MS, Ali SAM, Adelaine A, Karan A: **Rethinking vaccine hesitancy among minority groups**. *Lancet* 2021, **397**:1863-1865 http://dx.doi.org/10.1016/S0140-6736(21)00938-7
The authors make a cogent commentary on the need to reframe the discussion of vaccine hesitancy among minority communities from one that blames minoritized groups for not becoming less hesitant to one that urges public health systems to become more trustworthy and accessible.

52. Tankwanchi AS, Jaca A, Larson HJ, Wiysonge CS, Vermund SH: **Taking stock of vaccine hesitancy among migrants: a scoping review protocol**. *BMJ Open* 2020, **10**:e035225 http://dx.doi.org/10.1136/bmjopen-2019-035225.

53. Woolhandler S, Himmelstein DU, Ahmed S, Bailey Z, Bassett MT, Bird M, Bor J, Bor D, Carrasquillo O, Chowkwanyun M *et al.*: **Public policy and health in the Trump era**. *Lancet* 2021, **397**:705-753 http://dx.doi.org/10.1016/S0140-6736(20)32545-9.

54. Ayers CK, Kondo KK, Williams BE, Kansagara D, Advani SM, Smith M, Young S, Saha S: **Disparities in H1N1 vaccination rates: a systematic review and evidence synthesis to inform COVID-19 vaccination efforts**. *J Gen Intern Med* 2021:1-12 http://dx.doi.org/10.1007/s11606-021-06715-7.

55. Dubé E, Leask J, Wolff B, Hickler B, Balaban V, Hosein E, Habersaat K: **The WHO Tailoring Immunization Programmes (TIP) approach: review of implementation to date**. *Vaccine* 2018, **36**:1509-1515 http://dx.doi.org/10.1016/j.vaccine.2017.12.012.

56. Legido-Quigley H, Pajin L, Fanjul G, Urdaneta E, McKee M: **Spain shows that a humane response to migrant health is possible in Europe**. *Lancet Public Health* 2018, **3**:e358 http://dx.doi.org/10.1016/S2468-2667(18)30133-6.

57. Legido-Quigley H, Pocock N, Tan ST, Pajin L, Suphanchaimat R, Wickramage K, McKee M, Pottie K: **Healthcare is not universal if undocumented migrants are excluded**. *BMJ* 2019, **366**:l4160 http://dx.doi.org/10.1136/bmj.l4160.