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

Promoting COVID-19 vaccine acceptance: recommendations from the *Lancet* Commission on Vaccine Refusal, Acceptance, and Demand in the USA

Saad B Omer, Regina M Benjamin, Noel T Brewer, Alison M Buttenheim, Timothy Callaghan, Arthur Caplan, Richard M Carpiano, Chelsea Clinton, Renee DiResta, Jad A Elharake, Lisa C Flowers, Alison P Galvani, Rekha Lakshmanan, Yvonne A Maldonado, SarahAnn M McFadden, Michelle M Mello, Douglas J Opel, Dorit R Reiss, Daniel A Salmon, Jason L Schwartz, Joshua M Sharfstein, Peter J Hotez

Since the first case of COVID-19 was identified in the USA in January, 2020, over 46 million people in the country have tested positive for SARS-CoV-2 infection. Several COVID-19 vaccines have received emergency use authorisations from the US Food and Drug Administration, with the Pfizer–BioNTech vaccine receiving full approval on Aug 23, 2021. When paired with masking, physical distancing, and ventilation, COVID-19 vaccines are the best intervention to sustainably control the pandemic. However, surveys have consistently found that a sizeable minority of US residents do not plan to get a COVID-19 vaccine. The most severe consequence of an inadequate uptake of COVID-19 vaccines has been sustained community transmission (including of the delta [B.1.617.2] variant, a surge of which began in July, 2021). Exacerbating the direct impact of the virus, a low uptake of COVID-19 vaccines will prolong the social and economic repercussions of the pandemic on families and communities, especially low-income and minority ethnic groups, into 2022, or even longer. The scale and challenges of the COVID-19 vaccination campaign are unprecedented. Therefore, through a series of recommendations, we present a coordinated, evidence-based education, communication, and behavioural intervention strategy that is likely to improve the success of COVID-19 vaccine programmes across the USA.

Published **Online** November 15, 2021 https://doi.org/10.1016/S0140-6736(21)02507-1

Yale Institute for Global Health (Prof S B Omer PhD, J A Elharake MPH, S M McFadden PhD), **Infectious Diseases Section, Department of Internal Medicine, Yale School of Medicine** (Prof S B Omer, J A Elharake, S M McFadden), **Department of Epidemiology of Microbial Diseases** (Prof S B Omer), **Center for Infectious Disease Modeling and Analysis** (Prof A P Galvani PhD), **and Department of Health Policy and Management, Yale School of Public Health** (J L Schwartz PhD), **Yale University, New Haven, CT, USA; Yale School of Nursing, Yale University, Orange, CT, USA** (Prof S B Omer); **Gulf States Health Policy Center, Bayou La Batre, AL, USA** (R M Benjamin MD); **Department of Health Behavior, Gillings School of Global Public Health, and Lineberger Comprehensive Cancer Center, University of North Carolina, Chapel Hill, NC, USA** (Prof N T Brewer PhD); **Department of Family and Community Health, University of Pennsylvania School of Nursing, and Center for Health Incentives and Behavioral Economics, University of Pennsylvania, Philadelphia, PA,**

Introduction

The *Lancet* Commission on Vaccine Refusal, Acceptance, and Demand in the USA formed to address the persistent and important threat to public health in the USA posed by suboptimal uptake of some vaccines.[1] The focus of this first report by the Commission is the ongoing COVID-19 pandemic. Vaccine acceptance and uptake are essential to control the spread of COVID-19. Thus, the Commission has produced this report on current COVID-19 vaccine uptake in the USA, the consequences of low vaccination rates, and recommendations for the improvement of COVID-19 vaccine confidence and uptake.

Since the first case of COVID-19 was identified in the USA, in January, 2020, over 46 million people in the country have tested positive for SARS-CoV-2 and more than 735 000 people have died.[2] Several COVID-19 vaccines have received emergency use authorisations (table 1) from the US Food and Drug Administration (FDA),[3] but COVID-19 vaccine coverage in the USA remains insufficient to control the pandemic.[4]

Since January, 2021, 20% of adults in the USA have consistently reported that they will either get vaccinated only if required for work, or not get vaccinated at all.[5] One of the most pressing factors contributing to this reluctance has been the unprecedented political polarisation that has affected virtually all aspects of the US pandemic response, as a partisan divide emerged during the previous administration.[6,7] Research in political science, communications, and public health have shown that the politicisation of COVID-19 and the public health response to it has been highly detrimental to the success of the US response to the pandemic.[8]

In a survey from March, 2021, 49% of men affiliated with the Republican Party reported they would choose not to be vaccinated, as opposed to only 6% of men affiliated with the Democratic Party.[9] Such findings reflect the fact that political leaders from both parties have allowed the pursuit of partisan goals to guide their actions and rhetoric.[10,11] However, the rhetoric differs greatly and, therefore, the reasons for the current increase in COVID-19 cases and under-vaccination are not equally distributed. This increase also reflects rising anti-vaccine sentiments accelerated through the health freedom movement.[12] The increase in misinformation is fuelled both by long-standing anti-vaccine movements and by foreign interference, with all of these groups capitalising on the algorithms of social media.[13]

The anti-vaccine movement in the USA is undermining public health. When COVID-19 was declared a pandemic, in 2020, many anti-vaccine groups were already organised and ready to campaign against masks, contact tracing, physical distancing, and other measures essential to pandemic control.[14,15] Subsequently, the anti-vaccine movement in the USA has expanded its ongoing

	Initial FDA authorisation date	Vaccine type	Number of doses for full immunisation	Age for which use was approved
Pfizer-BioNTech*	Dec 11, 2020	mRNA	Two	12 years and older
Moderna	Dec 18, 2020	mRNA	Two	18 years and older
Janssen (Johnson & Johnson)	Feb 27, 2021	Viral vector (adenovirus type 26)	One	18 years and older

FDA=US Food and Drug Administration. *The Pfizer-BioNTech vaccine received full FDA approval on Aug 23, 2021.

Table 1: **COVID-19 vaccines FDA-approved for emergency use in the USA as of June 14, 2021**

USA (A M Buttenheim PhD); **Department of Health Policy and Management, School of Public Health** (T Callaghan PhD), **Hagler Institute for Advanced Study at Texas A&M University** (Prof P J Hotez PhD), **and Scowcroft Institute of International Affairs, Bush School of Government and Public Service Texas** (Prof P J Hotez), **A&M University, College Station, TX, USA; Langone School of Medicine, New York University, New York, NY, USA** (Prof A Caplan PhD); **School of Public Policy, University of California, Riverside, CA, USA** (Prof R M Carpiano PhD); **Clinton Foundation, New York, NY, USA** (C Clinton DPhil); **Mailman School of Public Health, Columbia University, New York, NY, USA** (C Clinton); **Stanford Internet Observatory** (R DiResta BS), **School of Medicine** (Prof Y A Maldonado MD, Prof M M Mello PhD), **Stanford Law School** (Prof M M Mello), **and Freeman Spogli Institute for International Studies** (Prof M M Mello), **Stanford University, Stanford, CA, USA; Department of Obstetrics & Gynecology, Emory University, Atlanta, GA, USA** (Prof L C Flowers MD); **The Immunization Partnership, Houston, TX, USA** (R Lakshmanan MHA); **Department of Pediatrics, University of Washington School of Medicine, Seattle, WA, USA** (Prof D J Opel MD); **Seattle Children's Research Institute, Seattle, WA, USA** (Prof D J Opel); **UC Hastings College of Law, University of California, San Francisco, CA, USA** (Prof D J Opel, Prof D R Reiss PhD); **Institute for Vaccine Safety, Department of International Health** (Prof D A Salmon PhD) **and Department of Health Policy and Management** (Prof J M Sharfstein MD), **Johns Hopkins Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD, USA; Texas Children's Center for Vaccine Development, Departments of Pediatrics and Molecular Virology & Microbiology, National School of Tropical Medicine, Baylor College of Medicine, Houston, TX, USA** (Prof P J Hotez); **Department of Biology, Baylor**

activities against both science and scientists.[16] Ultimately, the major sources of anti-COVID-19 vaccine aggression emerging in the USA were led by political elements from the far right, together with anti-vaccine non-governmental organisations, including those identified as the so-called disinformation dozen by the Center for Countering Digital Hate.[13,16] Such activities were further amplified by state actors, including Russia, seeking to destabilise the USA.[13,16] Thus, overcoming the politicisation surrounding COVID-19, public health measures, and medical countermeasures has become a complex undertaking that, in some cases, will require interventions from outside of the health sector. Such comprehensive actions will be necessary to counter widespread hesitancy about COVID-19 vaccines and to prevent broader repercussions of low vaccination and risk behaviours.

Beyond the political divides, evidence amassing over the course of the pandemic has shown that COVID-19 disproportionately affects minority ethnic groups. In particular, the Centers for Disease Control and Prevention (CDC) have found vast disparities in the rates of COVID-19 cases, hospitalisations, and deaths for African Americans, Native Americans and Alaskan Natives, and Latinx groups, compared with their white counterparts.[17] Inequities and disparities in the social determinants of health, including ongoing structural racism, access to adequate health care, socioeconomic status, physical environment, educational opportunity, and employment status, further exacerbate exposure to SARS-CoV-2 and the severity of COVID-19 disease.[18]

These disparities are compounded by inequalities in vaccination. Tracking by the Kaiser Family Foundation has found consistently lower rates of vaccination among African American and Latinx people than among white US residents,[19] which also contributes to the sustained transmission of COVID-19. These low rates are driven both by hesitancy and by access problems. Work to ensure equitable access to vaccines must also be coupled with efforts to address hesitancy. After sustained efforts at the community level to engage African Americans and Latinx people, some evidence shows that hesitancy in these communities is declining. In a March 2021 national poll, 25% of African American respondents and 37% of Latinx respondents reported choosing not to be vaccinated, compared with 28% of white respondents.[9]

Potential consequences of insufficient COVID-19 vaccine confidence

The most severe consequence of failing to ensure adequate uptake of COVID-19 vaccines will be sustained community transmission. Exacerbating the direct impact of the virus, low uptake of COVID-19 vaccines will prolong the social and economic repercussions of the pandemic on families and communities. Currently, the lowest rates of COVID-19 vaccine coverage are found in conservative areas of the southern USA, including Louisiana, Mississippi, Alabama, and in the Mountain states of Idaho and Wyoming.[20] These states have approximately 50% of the level of single-dose and two-dose vaccination coverage of that in the New England states of New York, New Jersey, California, and New Mexico. An important concern is the potential resurgence of COVID-19 in states with low vaccination coverage, similar to the peak of COVID-19 from July to September, 2020, in southern USA.[21] Another concern is whether ongoing transmission might promote the emergence of variants, which could affect the ability of the USA to slow or halt COVID-19 virus transmission.

Strategies to promote COVID-19 vaccine acceptance

The scale and challenges of the COVID-19 vaccination campaign are unprecedented. A coordinated, evidence-based education, communication, and behavioural intervention strategy is essential to the success of this programme. Implementation should apply insights from research on vaccine education and communication while also recognising the extraordinary obstacles associated with developing and rolling out vaccines for the current public health emergency. Likewise, the plan should recognise potential implications of COVID-19 vaccines and vaccination on attitudes regarding routine vaccination.

Behavioural interventions

Public trust is a fundamental element of vaccination interventions and policies that achieve high coverage.[22] We herein present evidence-based provider and health-care system interventions to promote vaccination, and unique considerations in their applicability to COVID-19 vaccination (table 2). We organise our discussion according to a key factor for uptake: individual intention to receive the vaccine.

The most effective way to increase COVID-19 vaccine uptake is to make vaccination straightforward, so that it acts on existing intentions to vaccinate.[36] One such approach is to keep vaccinations on people's minds. Vaccination reminders do so by alerting a patient that a vaccine is available or due. Reminders are generally effective at increasing vaccination of children and adolescents, but their effectiveness for adults is unclear.[37] How the reminder is written is also an important consideration. For example, reminders sent twice to people already scheduled for an appointment and stating that a dose is "reserved for you" were most effective at increasing seasonal influenza vaccine uptake[38] and should be considered for COVID-19 vaccine, especially for the second dose or for booster doses. Because few providers use existing reminder systems,[39] centralising implementation of reminders within a health-care system or health department might be more effective.[39] Nevertheless, the use of such alerts is more challenging for underserved populations who do not have regular sources of care, internet access, smartphones, or are otherwise disconnected from mass

	Target population or setting	Settings where efficacy is unknown	Special challenges to COVID-19 vaccination
Centralised reminder [23,24]	Children (aged <18 years*; requires that contact information for most patients is available and that clinics agree to have their name on the reminder notice)	Adolescent and adult vaccination	Challenges with interoperability between COVID-19 vaccine registries and electronic health records might limit implementation of the reminder; reminders that use contact information in immunisation registries will have minimal penetration into adult populations because not all states input adult immunisations into online registries
Default appointments[25]	Adults	Childhood and adolescent vaccination	Would not reach those who do not already have established providers, which might correspond to high-risk populations (eg, the homeless)
Standing orders[26–29]	Adults in hospitals and nursing facilities	Childhood and adolescent vaccination	Anticipated increased scepticism or questions regarding COVID-19 vaccines compared with other vaccines might make standing orders less effective
Presumptive provider communication[30–32]	Children and adolescents	Adult vaccination or when there is not yet a trusted relationship with the provider	Questions or scepticism around vaccine release and informed consent for COVID-19 vaccination might make this approach less useful
Onsite vaccination[33]	Adults in worksites, children in school health centres; school mass vaccination days	Adolescent vaccination	Both the Pfizer-BioNTech and Moderna vaccines require two doses for full immunisation
Incentives and mandates[34,35]	Applicable to most vaccines	Past mandates have generally applied only to specific groups; acceptability of mandates for an entire population is unknown	Might encounter political barriers and fuel disinformation efforts from anti-vaccine and other counter-activism movements

Interventions are shown ordered to match a clinical encounter. *Childhood vaccines generally refer to vaccines administered to very young children (often from birth to children entering kindergarten [aged 5–6 years]); however, currently, there are no COVID-19 vaccines authorised or approved for use in children younger than 12 years.

Table 2: **Proposed interventions to increase vaccine uptake**

messaging systems, which further contributes to inequities in vaccine coverage. Therefore, all efforts must be made to ensure that reminders reach everyone.

Another approach to increasing COVID-19 vaccine uptake is presumptive communication by health-care providers to initiate vaccine discussions.[40] Unlike participatory formats (eg, "what do you want to do about vaccines today?"), the presumptive format (eg, "you are due to get a vaccine today") presents vaccination like other routine medical services and can facilitate vaccination via simple consent. Similarly, opt-out framing is more effective than opt-in formats in bolstering seasonal influenza vaccination.[25] These approaches can be effective with routine childhood and adolescent vaccines.[31,40] However, presumptive communication for COVID-19 vaccines might be problematic before vaccines receive full FDA approval for all age groups. Instead, a non-presumptive approach might be necessary to facilitate discussion of the unique information accompanying COVID-19 vaccines to ensure patients are fully informed.[7]

Another approach is to reduce barriers to vaccination with logistics and behavioural defaults. For example, default appointments, or automatically scheduling people for vaccination appointments, increase uptake among adults[25,41] and health-care workers,[42] but their effect for children and adolescents has not been established. Finally, onsite vaccination, such as at worksites, is effective for adult seasonal influenza vaccination[43] and can be particularly promising for COVID-19 vaccination, such as by using school-based vaccination sites.

Providers have several options when addressing the heterogeneous group of people who are disinclined to receive a COVID-19 vaccine. Patient counselling using reflective listening techniques or motivational interviewing might assuage vaccine hesitancy,[44] but training providers on these communication techniques can be time-consuming, making scale-up challenging. For patients who refuse COVID-19 vaccination, recommending it at subsequent visits is a strategy supported by evidence based on parents who refuse human papillomavirus vaccination for adolescents.[45] Whether this strategy works with adult patients is yet to be determined.

Other interventions, besides trying to persuade people, can effectively shape vaccination behaviour. Patient incentives can increase vaccine uptake; for example, financial incentives that eliminated out-of-pocket costs for the influenza vaccine appear to be effective.[46] However, incentives might widen disparities if their use mirrors existing variation across health systems and public health jurisdictions.

Mandates—with or without non-medical opt-outs—are effective for vaccination across all age groups and health-care workers.[47,48] To be ethical and practical, mandates are most appropriate after several criteria are met, including good access, an established safety record, and widespread support.[49] The form, legality, and effect of mandates are complex, and a full discussion of these aspects is outside of the scope of this paper.

In general, the case for COVID-19 vaccine mandates is strongest for health-care workers, adults living in

University, Waco, TX, USA (Prof P J Hotez); **James A Baker III Institute for Public Policy, Rice University, Houston, TX, USA** (Prof P J Hotez)

Correspondence to:
Prof Saad B Omer, Infectious Diseases Section, Department of Internal Medicine, Yale School of Medicine, New Haven, CT 06510, USA
saad.omer@yale.edu

congregate settings (such as universities), employment settings, and for activities where physical distancing is not possible (such as indoor concerts or crowded workplaces). Mandates for teachers and other adults in schools might increase vaccine uptake and reduce the transmission to children. Given the consequences of keeping children from school, mandates for school-aged children (aged 5–18 years) should be considered only after extensive experience with the vaccine and education for parents. Allowing individuals with proof of vaccination and communities with low rates of transmission to return to otherwise restricted social activities can also be an incentive for vaccination. Additionally, based on the 1905 landmark case, Jacobson versus Massachusetts, which resulted in the US Supreme Court upholding the rights of states to pass and enforce compulsory vaccination laws, the government has the right to enforce reasonable COVID-19 vaccine mandates for the protection of public health and safety of its citizens.[50] With considerations of the aforementioned criteria and given the recent FDA approval of the Pfizer–BioNTech COVID-19 vaccine,[51] appropriate COVID-19 vaccine mandates are an important and necessary element to controlling the pandemic.

Addressing sociodemographic inequities

Considering the devastating burden of COVID-19 on minority ethnic and socially vulnerable communities, guaranteeing equitable access to COVID-19 vaccines means ensuring even application of the approaches previously described, as well as of approaches used for other health promotion foci, such as pharmacist-administered vaccinations[52] and outreach to community sites (eg, hair salons and churches).[53] Identifying effective strategies to improve COVID-19 vaccination in marginalised communities[54] could mitigate the disproportionate burden of COVID-19.[55] More specifically, public health officials must engage with community leaders and local organisations to support accurate vaccine messaging that is culturally attuned to their respective communities.[56] COVID-19 interventions and response efforts that address inequities and disparities need to be prioritised.

Promoting public health communication

Social media is an important channel to disseminate science-grounded messages about COVID-19 vaccination. Analytics tools and other methodologies enable researchers to assess the spread and reach of memes and narratives targeting distinct communities on social platforms. Videoclips from broadcast media and article weblinks from news sites provide additional visibility into mass-media messages that communities are sharing on social channels. Data on sharing behaviours, content, and reach can provide an understanding of what emerging narratives are gaining in popularity within specific communities or on distinct platforms. These data provide an opportunity to tailor a response or debunk misinformation for the communities that have already seen it, and enables those in charge of communication in a particular area or setting to establish whether a more widespread so-called prebunking is useful to ensure that the broader public receives accurate information on the misinformation topic before it gains traction.

An effective education and communication strategy should articulate the roles and responsibilities of the many entities that will contribute to COVID-19 vaccination efforts—beginning with federal, state, and local public health agencies, and extending to physicians, nurses, other health-care providers, and their respective professional organisations, among other contributors. Federal leadership through the CDC will be instrumental to the successful development and implementation of a coordinated national approach. Similarly, companion regional-based, state-based, and community-based efforts will be essential to tailor activities to the many audiences they are intended to reach, particularly health-care providers and the public.[57] A vital role of the CDC and companion efforts is to provide people with opportunities to have their questions about the vaccines answered.

All vaccine education and communication efforts must include specific attention to minority ethnic groups and other populations who bear disproportionate burdens of COVID-19. Because of ongoing and historical mistreatment, distrust in government medical and public health programmes is pervasive among these groups. Tailoring pro-vaccine messages and engaging with local leaders across white, Christian, and conservative communities who also have low levels of vaccine uptake is likewise important.[58] Without sustained, tailored efforts to reach and engage all US communities, COVID-19 vaccination programmes might not reach those who stand to benefit the most from these vaccines, potentially exacerbating disparities in morbidity and mortality.[59] Developing approaches to engage and respond to those views with evidence and empathy is imperative. By partnering with local organisations, religious leaders, and other trusted community voices, health officials will be able to better understand and address specific questions and concerns about COVID-19 vaccines among such populations.

Another element that must be addressed are the programmes of so-called weaponised health communication against COVID-19 vaccines. As mentioned before, the sources of this weaponised health communication include dedicated anti-vaccine groups that promote COVID-19 conspiracies through social media and e-commerce platforms[60] and systematic attempts to destabilise the USA in this space from some foreign governments, including Russia.[61,62] Countering such activities requires a multifaceted response, possibly including the de-platforming of the more egregious anti-COVID-19 vaccine disinformation and strengthening diplomatic channels with Russia. Since January, 2021, some US conservative news outlets, including cable news networks, have also pursued a path of weaponised

health communication.[63] Counteracting these activities by amplifying accurate and timely vaccine information is essential, but there are concerns that this action by itself will not be sufficient.[13] Therefore, looking at levers outside the traditional health sector that previously have been successful in countering aggressive disinformation is urgently necessary.

Overall, a national campaign for COVID-19 vaccine education and communication must be dynamic, agile, and supported by adequate financial resources to help local and regional groups to improve vaccine uptake in their communities. Just as important as the development of these materials is their dissemination; the messaging means must be selected for maximum effect. Public health leaders and contributors must use evidence to re-evaluate the campaign formally and continuously, nimbly responding to shifting circumstances and knowledge, and revising approaches accordingly. Public education and communication efforts outlined here provide the opportunity for COVID-19 vaccinations to gain widespread public confidence and maximise the effectiveness of implementation in shifting the trajectory of this ongoing public health crisis.

Summary of major findings

The political environment has profoundly affected COVID-19 vaccine development, distribution, and ultimately uptake. This challenge requires continued direct and substantive communication to groups and prominent individuals connected to people who are indicating they will not be vaccinated, such as conservative groups. This area is one that many vaccine experts and scientists could find uncomfortable, but it might become essential for success. The USA now has a sharp geopolitical vaccine uptake divide, as states in the south and the Mountain region lag substantially behind the northeast or West Coast. These areas are at high risk of ongoing COVID-19 transmission. Compounding the vaccine geopolitical divide is systematic weaponised health communication from both dedicated anti-vaccine groups with tens of millions of social media followers, and state actors such as the Russian Government.

Another aspect of constructive public health policies is the recognition of the importance of human behaviour in shifting the course of the COVID-19 pandemic in the USA. However, established approaches offer guidance on how to examine the specifics of health behaviours around vaccination, and COVID-19 vaccines specifically. Applying state-of-the-art behavioural science to vaccination presents opportunities to address issues surrounding vaccine uptake.

Recommendations

To address the gaps outlined in this report, the Commission presents some recommendations to national, state, and local governments, as well as to other public and private entities.

First, pre-marketing and post-marketing vaccine surveillance needs to be communciated clearly and continually to the public, press, community organisations and leaders (especially for populations experiencing social and economic disadvantage), and health-care providers who will be engaging with distrustful or hesitant patients. Communication must adapt to reflect emerging situations, such as extent of community spread, safety events, level and durability of protective immunity, availability of new vaccines, requirements for boosting, and need for targeted campaigns based on the best evidence from behavioural science. Messaging and framing are also key: experts who communicate on local and national platforms should have relevant expertise in infectious diseases, epidemiology, vaccinology, immunology, social and behavioural science, and public health.

Second, science communication and knowledge translation outreach and partnership efforts should engage with local and national press and journalistic organisations to educate journalists, news editors and production staff, and social media staff to communicate accurate and non-sensational vaccine messaging; and offer technical advising (eg, regarding topics, issue framing, and graphics or visualisation) to news outlets and social media platforms to produce news content and public service announcements. This content should be designed to effectively educate and reassure broad, diverse audiences regarding key vaccine-related topics. Ideally, these media engagement efforts to build public trust on vaccines should be formulated and implemented as soon as possible.

Third, the most effective way to increase COVID-19 vaccine uptake is to make it straightforward to act on existing intentions to vaccinate. We recommend behavioural interventions with evidence of improving vaccine uptake for other immunisations, including reminders, strong clinician recommendations, and onsite clinics.

Fourth, once provided with the clear evidence that minority ethnic groups are disproportionately affected by the COVID-19 pandemic, community leaders should engage with local organisations to increase access to COVID-19 vaccines by implementing additional community-based vaccination sites with health-care staff who are culturally competent (ie, who integrate knowledge about individuals and groups of people into practices that are used in appropriate cultural settings to increase the quality of care). Additionally, this engagement could support accurate vaccine messaging that is culturally based and catered to such communities and other populations experiencing social disadvantage. Special focus, interventions, and response efforts to ensure equitable access and uptake should be a priority.

Fifth, outreach to politically conservative groups around the urgency of vaccinating all US residents, which includes engaging conservative leaders willing to serve as COVID-19 vaccine champions, should be promoted.

Finally, interagency government task forces need to be established to examine options for countering coordinated disinformation from both national anti-vaccine activist groups and state actors. Beyond the Health and Human Services agencies, such as the CDC, all government agencies must recognise the impact of anti-vaccine activities on homeland security, commerce, and justice, and consider representation from these branches of the federal government. Efforts must also include the Department of State to address the weaponised health communication around COVID-19 vaccines.

Conclusions

COVID-19 vaccines present the most plausible intervention to sustainably control the pandemic. However, surveys suggest that a substantial number of individuals might not seek the vaccine. Furthermore, because of vaccine hesitancy and refusal linked to politics, the USA is at high risk of having regions with considerably low vaccine coverage, such as the southern and Mountain states, where sustained COVID-19 transmission is underway, and which might also promote the ongoing emergence of variants of concern. Fuelling vaccine refusal are programmes of anti-vaccine disinformation. Therefore, a national communication and behavioural intervention campaign is essential to ensure a high enough COVID-19 vaccination coverage to effectively control the COVID-19 pandemic and thus allow a return to normal social and economic activity in the USA. Interagency government efforts must be simultaneously implemented to examine options to further defuse anti-vaccine disinformation.

Contributors

All authors contributed to the drafting and revising of the manuscript.

Declaration of interests

The *Lancet* Commission on Vaccine Refusal, Acceptance, and Demand in the USA is co-hosted by the Yale Institute for Global Health (New Haven, CT) and the Baylor College of Medicine (Houston, TX). PJH is a developer of a COVID-19 vaccine construct that was licensed by the Baylor College of Medicine to Biological E, a commercial vaccine manufacturer, for scale-up, production, testing, and licensing. NTB reports personal fees from WHO, Centers for Disease Control and Prevention, and Merck, outside the submitted work. RMC reports research grant funding from the Novo Nordisk Foundation outside the submitted work. RL reports grants from Pfizer, GlaxoSmithKline, Sanofi Pasteur, and Merck; and personal fees from Biotechnology Innovation Organization, outside the submitted work. YAM is a member of a Data Safety Monitoring Board for Pfizer and a site principal investigator for a Pfizer vaccine trial unrelated to the submitted work. MMM reports personal fees from law firms representing retail pharmacies and generic drug companies that have sued other drug companies for anti-trust law violations, outside the submitted work. DJO reports grants from the US National Institutes of Health outside the submitted work. DRR reports that herself, her spouse, and her children own stocks in GlaxoSmithKline, a vaccine manufacturer. DRR also reports serving in an unpaid volunteer capacity on Moderna's ethics allocation committee. DAS reports grants from Merck and personal fees from Pfizer, outside the submitted work. All other authors declare no competing interests.

References

1 Hotez PJ, Cooney RE, Benjamin RM, et al. Announcing the *Lancet* Commission on Vaccine Refusal, Acceptance, and Demand in the USA. *Lancet* 2021; **397:** 1165–67.

2 Johns Hopkins Medicine. Coronavirus Resource Center. https://coronavirus.jhu.edu/map.html (accessed Sept 30, 2021).

3 US Food and Drug Administration. COVID-19 vaccines. https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/covid-19-vaccines (accessed Sept 30, 2021).

4 Kaiser Family Foundation. COVID-19 vaccines delivered and administered. https://www.kff.org/other/state-indicator/covid-19-vaccines-delivered-and-administered/?currentTimeframe= 0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D (accessed Sept 30, 2021).

5 Hamel L, Lopes L, Kearney A, Sparks G, Stokes M, Brodie M. KFF COVID-19 vaccine monitor: June 2021. June 30, 2021. https://www.kff.org/coronavirus-covid-19/poll-finding/kff-covid-19-vaccine-monitor-june-2021/ (accessed Sept 30, 2021).

6 Schuchat A. Summary of guidance review. March 10, 2021. https://www.cdc.gov/coronavirus/2019-ncov/downloads/communication/Guidance-Review.pdf (accessed Sept 30, 2021).

7 Salmon D, Opel DJ, Dudley MZ, Brewer J, Breiman R. Reflections on governance, communication, and equity: challenges and opportunities in COVID-19 vaccination. *Health Aff (Millwood)* 2021; **40:** 419–25.

8 Chen HF, Karim SA. Relationship between political partisanship and COVID-19 deaths: future implications for public health. *J Public Health (Oxf)* 2021; published online April 29. https://doi.org/10.1093/pubmed/fdab136.

9 Marist Poll. NPR/PBS Newshour/Marist poll results: the Biden Administration & COVID-19. http://maristpoll.marist.edu/npr-pbs-newshour-marist-poll-results-the-biden-administration-covid-19/#sthash.gqdrQTXP.dpbs (accessed Oct 22, 2021).

10 Druckman JN, Peterson E, Slothuus R. How elite partisan polarization affects public opinion formation. *Am Polit Sci Rev* 2013; **107:** 57–79.

11 Bolsen T, Druckman JN. Do partisanship and politicization undermine the impact of a scientific consensus message about climate change? *Group Process Intergroup Relat* 2018; **21:** 389–402.

12 Hotez PJ. America's deadly flirtation with antiscience and the medical freedom movement. *J Clin Invest* 2021; **131:** 149072.

13 Hotez P. COVID vaccines: time to confront anti-vax aggression. *Nature* 2021; **592:** 661.

14 Hotez PJ. COVID19 meets the antivaccine movement. *Microbes Infect* 2020; **22:** 162–64.

15 Hotez PJ, Nuzhath T, Colwell B. Combating vaccine hesitancy and other 21st century social determinants in the global fight against measles. *Curr Opin Virol* 2020; **41:** 1–7.

16 Hotez PJ. Mounting antiscience aggression in the United States. *PLoS Biol* 2021; **19:** e3001369.

17 Centers for Disease Control and Prevention. COVID-19 data tracker. https://covid.cdc.gov/covid-data-tracker/#demographics (accessed Oct 22, 2021).

18 National Academies of Sciences Engineering and Medicine. Framework for equitable allocation of COVID-19 vaccine. Washington, DC: National Academies Press, 2020.

19 Ndugga N, Pham O, Hill L, Artiga S. Latest data on COVID-19 vaccinations by race/ethnicity. KFF, Sept 22, 2021. https://www.kff.org/coronavirus-covid-19/issue-brief/latest-data-on-covid-19-vaccinations-race-ethnicity/ (accessed Sept 30, 2021).

20 The New York Times. See how vaccinations are going in your county and states. The New York Times, April 28, 2021. https://www.nytimes.com/interactive/2020/us/covid-19-vaccine-doses.html (accessed Oct 22, 2021).

21 Hotez P. Variants and vaccines: what's in store for America this summer? The Hill, May 10, 2021. https://thehill.com/opinion/healthcare/552726-variants-and-vaccines-whats-in-store-for-america-this-summer (accessed Oct 22, 2021).

22 Larson HJ, Heymann DL. Public health response to influenza A(H1N1) as an opportunity to build public trust. *JAMA* 2010; **303:** 271–72.

23 Jacobson Vann JC, Jacobson RM, Coyne-Beasley T, Asafu-Adjei JK, Szilagyi PG. Patient reminder and recall interventions to improve immunization rates. *Cochrane Database Syst Rev* 2018; **1:** CD003941.

24 Kempe A, Saville AW, Dickinson LM, et al. Collaborative centralized reminder/recall notification to increase immunization rates among young children: a comparative effectiveness trial. *JAMA Pediatr* 2015; **169:** 365–73.

25 Chapman GB, Li M, Colby H, Yoon H. Opting in *vs* opting out of influenza vaccination. *JAMA* 2010; **304:** 43–44.

26 Immunization Action Coalition. 10 steps to implementing standing orders for immunization in your practice setting. 2020. https://www.immunize.org/catg.d/p3067.pdf (accessed June 28, 2021).

27 Herman CJ, Speroff T, Cebul RD. Improving compliance with immunization in the older adult: results of a randomized cohort study. *J Am Geriatr Soc* 1994; **42:** 1154–59.

28 Dempsey AF, Pyrzanowski J, Brewer S, Barnard J, Sevick C, O'Leary ST. Acceptability of using standing orders to deliver human papillomavirus vaccines in the outpatient obstetrician/gynecologist setting. *Vaccine* 2015; **33:** 1773–79.

29 Hoppe KK, Eckert LO. Achieving high coverage of H1N1 influenza vaccine in an ethnically diverse obstetric population: success of a multifaceted approach. *Infect Dis Obstet Gynecol* 2011; **2011:** 746214.

30 Opel DJ, Heritage J, Taylor JA, et al. The architecture of provider-parent vaccine discussions at health supervision visits. *Pediatrics* 2013; **132:** 1037–46.

31 Brewer NT, Hall ME, Malo TL, Gilkey MB, Quinn B, Lathren C. Announcements versus conversations to improve HPV vaccination coverage: a randomized trial. *Pediatrics* 2017; **139:** e20161764.

32 Opel DJ, Robinson JD, Spielvogle H, et al. 'Presumptively Initiating Vaccines and Optimizing Talk with Motivational Interviewing' (PIVOT with MI) trial: a protocol for a cluster randomised controlled trial of a clinician vaccine communication intervention. *BMJ Open* 2020; **10:** e039299.

33 Briss PA, Rodewald LE, Hinman AR, et al. Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents, and adults. *Am J Prev Med* 2000; **18** (suppl)**:** 97–140.

34 Lau D, Hu J, Majumdar SR, Storie DA, Rees SE, Johnson JA. Interventions to improve influenza and pneumococcal vaccination rates among community-dwelling adults: a systematic review and meta-analysis. *Ann Fam Med* 2012; **10:** 538–46.

35 Omer SB, Pan WK, Halsey NA, et al. Nonmedical exemptions to school immunization requirements: secular trends and association of state policies with pertussis incidence. *JAMA* 2006; **296:** 1757–63.

36 Brewer NT, Chapman GB, Rothman AJ, Leask J, Kempe A. Increasing vaccination: putting psychological science into action. *Psychol Sci Public Interest* 2017; **18:** 149–207.

37 Jacobson Vann JC, Jacobson RM, Coyne-Beasley T, Asafu-Adjei JK, Szilagyi PG. Patient reminder and recall interventions to improve immunization rates. *Cochrane Database Syst Rev* 2018; **1:** CD003941.

38 Milkman KL, Patel MS, Gandhi L, et al. A megastudy of text-based nudges encouraging patients to get vaccinated at an upcoming doctor's appointment. *Proc Natl Acad Sci USA* 2021; **118:** e2101165118.

39 Kempe A, Saville AW, Dickinson LM, et al. Collaborative centralized reminder/recall notification to increase immunization rates among young children: a comparative effectiveness trial. *JAMA Pediatr* 2015; **169:** 365–73.

40 Opel DJ, Heritage J, Taylor JA, et al. The architecture of provider-parent vaccine discussions at health supervision visits. *Pediatrics* 2013; **132:** 1037–46.

41 Chapman GB, Li M, Leventhal EA, Leventhal EA. Default clinic appointments promote influenza vaccination uptake without a displacement effect. *Behav Sci Policy* 2016; **2:** 40–50.

42 Lehmann BA, Chapman GB, Franssen FM, Kok G, Ruiter RA. Changing the default to promote influenza vaccination among health care workers. *Vaccine* 2016; **34:** 1389–92.

43 Briss PA, Rodewald LE, Hinman AR, et al. Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents, and adults. *Am J Prev Med* 2000; **18** (suppl)**:** 97–140.

44 Gagneur A, Lemaître T, Gosselin V, et al. A postpartum vaccination promotion intervention using motivational interviewing techniques improves short-term vaccine coverage: PromoVac study. *BMC Public Health* 2018; **18:** 811.

45 Kornides ML, McRee AL, Gilkey MB. Parents who decline HPV vaccination: who later accepts and why? *Acad Pediatr* 2018; **18:** S37–43.

46 Lau D, Hu J, Majumdar SR, Storie DA, Rees SE, Johnson JA. Interventions to improve influenza and pneumococcal vaccination rates among community-dwelling adults: a systematic review and meta-analysis. *Ann Fam Med* 2012; **10:** 538–46.

47 Thompson EL, Livingston MD 3rd, Daley EM, Zimet GD. Human papillomavirus vaccine initiation for adolescents following Rhode Island's school-entry requirement, 2010–2016. *Am J Public Health* 2018; **108:** 1421–23.

48 Caplan AL. Morality of influenza vaccine mandates. *Clin Ther* 2013; **35:** 106–08.

49 Omer SB, Salmon DA, Orenstein WA, deHart MP, Halsey N. Vaccine refusal, mandatory immunization, and the risks of vaccine-preventable diseases. *N Engl J Med* 2009; **360:** 1981–88.

50 Mariner WK, Annas GJ, Glantz LH. Jacobson v Massachusetts: it's not your great-great-grandfather's public health law. *Am J Public Health* 2005; **95:** 581–90.

51 US Food & Drug Administration. FDA approves first COVID-19 vaccine: approval signifies key achievement for public health. Aug 23, 2021. https://www.fda.gov/news-events/press-announcements/fda-approves-first-covid-19-vaccine (accessed Oct 22, 2021).

52 Kirkdale CL, Nebout G, Megerlin F, Thornley T. Benefits of pharmacist-led flu vaccination services in community pharmacy. *Ann Pharm Fr* 2017; **75:** 3–8.

53 Linnan LA, D'Angelo H, Harrington CB. A literature synthesis of health promotion research in salons and barbershops. *Am J Prev Med* 2014; **47:** 77–85.

54 Lott BE, Okusanya BO, Anderson EJ, et al. Interventions to increase uptake of human papillomavirus (HPV) vaccination in minority populations: a systematic review. *Prev Med Rep* 2020; **19:** 101163.

55 Price-Haywood EG, Burton J, Fort D, Seoane L. Hospitalization and mortality among Black patients and White patients with COVID-19. *N Engl J Med* 2020; **382:** 2534–43.

56 Dempsey AF, Pyrzanowski J, Brewer S, Barnard J, Sevick C, O'Leary ST. Acceptability of using standing orders to deliver human papillomavirus vaccines in the outpatient obstetrician/gynecologist setting. *Vaccine* 2015; **33:** 1773–79.

57 Schoch-Spana M, Brunson E, Long R, et al. The public's role in COVID-19 vaccination: planning recommendations informed by design thinking and the social, behavioral, and communication sciences. Johns Hopkins Center for Health Security, July 9, 2020. https://www.centerforhealthsecurity.org/our-work/publications/the-publics-role-in-covid-19-vaccination (accessed Sept 30, 2021).

58 Public Religion Research Institute and Interfaith Youth Core. Religious identities and the race against the virus: engaging faith communities on COVID-19 vaccination (wave 1: March 2021). April 22, 2021: https://www.prri.org/research/prri-ifyc-covid-vaccine-religion-report/ (accessed June 28, 2021).

59 Callaghan T, Moghtaderi A, Lueck JA, et al. Correlates and disparities of intention to vaccinate against COVID-19. *Soc Sci Med* 2021; **272:** 113638.

60 Center for Countering Digital Hate. The anti-vaxx industry: how big tech powers and profits from vaccine misinformation. 2020. https://www.counterhate.com/anti-vaxx-industry (accessed Oct 22, 2021).

61 Broniatowski DA, Jamison AM, Qi S, et al. Weaponized health communication: Twitter bots and Russian trolls amplify the vaccine debate. *Am J Public Health* 2018; **108:** 1378–84.

62 Gordon MR, Volz D. Russian disinformation campaign aims to undermine confidence in Pfizer, other COVID-19 vaccines, US officials say. The Wall Street Journal. March 7, 2021. https://www.wsj.com/articles/russian-disinformation-campaign-aims-to-undermine-confidence-in-pfizer-other-covid-19-vaccines-u-s-officials-say-11615129200 (accessed Oct 22, 2021).

63 Waldman P. Opinion: Sorry, Tucker Carlson. Polling suggests your anti-vax campaign is failing. The Washington Post. May 6, 2021. https://www.washingtonpost.com/opinions/2021/05/06/sorry-tucker-carlson-polling-suggests-your-anti-vax-campaign-is-failing/ (accessed June 28, 2021).