RESEARCH ARTICLE

COVID-19 vaccine hesitancy among health service providers: A single centre experience from Karachi, Pakistan

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Abstract

Objective: To assess the views of health service providers towards coronavirus disease 2019 vaccination with Cansino, Sinovac and Sinopharm vaccines.

Method: The analytical cross-sectional study was conducted at the Sindh Institute of Urology and Transplantation, Karachi, in May and June 2021, and comprised doctors, nurses, technical staff, and medical social officers. Data was collected using a questionnaire, in Urdu and English languages, assessing determinants of hesitancy. Data was analysed using SPSS 19.

Results: Of the 331 subjects, 156(47%) were males and 175(53%) were females. Overall, 183(55%) subjects were aged <30 years, and 7(2%) were aged >60 years. Among the responders, 274(83%) were vaccinated, 49(15%) wanted to delay, and 8(2.4%) were outright refusers. Among the hesitant, 43(80%) were women, and 56(98%) were aged <40 years. Age, gender, occupational group and personal experience with the disease had significant correlations with vaccination status ($p<0.05$). Personal safety 202(74%) followed by the perception of official requirement 162(59%) were the prime reasons for getting vaccinated. No respondent cited religious inhibitions or social media as the reason behind vaccine refusal.

Conclusion: A lack of trust in the safety and efficacy data of the available Chinese vaccines appeared as a factor inducing hesitancy. The resistance of younger respondents, especially trainee physicians, was a finding of concern since they form the backbone of the health system in the country.

Keywords: COVID-19, Vaccine hesitancy, Health service providers. (JPMA 72: 1142; 2022)

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Introduction

As the Coronavirus disease 2019 (COVID-19) pandemic continues to ravage the world, with the now common peaks and troughs, debates about lockdowns, restoring civil liberties, and livelihoods intensify. While non-pharmacological approaches, such as total or partial lockdown, masks and social distancing, are likely to continue, it is antibody-induced herd immunity that will probably interrupt severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus circulation. This implies that about 70% population has antibodies, either through infection or immunisation.[1,2]

While vaccine availability is imperative for any COVID-19 mass vaccination campaign to be initiated, its actual effectiveness depends not only on availability and its safety and efficacy, but also on several external factors, such as public perception of the intervention.[3-5]

The World Health Organisation (WHO) Strategic Advisory Group of Experts (SAGE) on immunisation defined vaccine hesitancy as "a delay in acceptance or refusal of vaccines despite availability of vaccine services". Vaccine hesitancy is complex and context-specific, manifesting itself in a variety of ways, from repeated delays to complete refusal.[6]

Complacency, confidence and convenience are among the various factors influencing vaccine acceptance. Complacency refers to a low perception of disease risk, with vaccination being considered unnecessary. In addition to confidence in health systems, vaccination acceptability is related to perceptions regarding the safety and efficacy of the product. Convenience includes the availability, affordability and delivery of vaccines.

Health service providers (HSPs), as opinion influencers, can play a critical role in shaping such perceptions towards vaccination. WHO characterises HSPs as professionally trained individuals delivering health services, including doctors, nurses, technicians/technologists, care coordinators and counsellors.[7]

It would be intuitive to assume that HSPs, with their relevant knowledge base, and their first-hand encounters with the ravages of the disease, would be most open to vaccination. They are also seen as the most reliable source of vaccine information by the public.[8]

However, studies indicate HSPs themselves exhibit

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hesitancy towards vaccination.[9-12] A survey by Gallup Pakistan revealed that 20% of the doctors were not convinced about the vaccines, while a similar number did not perceive COVID-19 as a major health threat.[13] It is imperative, therefore, that attention is focussed on HSP vaccine hesitancy, in an attempt to understand factors fuelling it.[8] Given their influence, any reluctance from them can fuel vaccine hesitancy among the public.

It is essential for health authorities to develop evidence-based policies to counter the hesitancy.[14] Immunisation programmes will only be successful if they have high acceptance rates. Hence, it is important to understand the dynamics within the medical community regarding vaccination acceptance or hesitancy.

The current study was planned to assess the perceptions and attitudes of HSPs towards COVID-19 vaccination with Cansino, Sinovac and Sinopharm vaccines.

Subjects and Methods

The questionnaire-based analytical cross-sectional study was conducted at various departments of the Sindh Institute of Urology and Transplantation (SIUT), Karachi, which has been offering out-patient as well as in-patient facilities for COVID-19 patients since the start of the pandemic. Vaccination facilities on its premises have been available to all HSPs, and then to the general public, since the beginning of the vaccination programme in the country.

After approval from the institutional ethics review committee, the sample size was calculated based on a previously published estimate of HSP hesitancy with 20% acceptance, 95% confidence interval (CI) and 5% margin of error.[13] The sample was derived using proportionate probability sampling technique from among doctors, including consultants and trainees/residents, nurses, technical staff, including medical technologists, technicians and laboratory staff, and medical social officers (MSOs) involved in care coordination and counselling.

Those included were part of one of the four HSP categories, and willing to participate. Employees outside of the defined categories, or unwilling to participate were excluded.

Data was collected after taking informed consent from all the subjects. The questionnaire, in both Urdu and English languages, assessing determinants of hesitancy, was designed using the SAGE Vaccine Hesitancy Matrix.[14] All the nine primary questions were closed-ended, with secondary questions allowing multiple choices. No respondent identifiers were collected to ensure the anonymity of the participants.

The questionnaire was pilot-tested on 30 individuals for validity, and was modified accordingly before administering them individually and in groups.

Data was analysed using Excel and SPSS 19. The variables are categorical, and, hence, were expressed as frequencies and percentages. The variables were compared among the categories using Chi-square tests. $P<0.05$ was considered statistically significant.

Results

Of the 331 subjects, 156(47%) were males and 175(53%) were females. Overall, 183(55%) subjects were aged <30 years, and 7(2%) were aged >60 years. Among the responders, 274(83%) were vaccinated, 49(15%) wanted to delay, and 8(2.4%) were outright refusers. Among the hesitant, 43(80%) were women, and 56(98%) were aged <40 years.

The most prominent cohort that remained unvaccinated at the time of data-collection was that of MSOs and the occupational group was a significant determinant of vaccination (p=0.00).

All the unvaccinated responders except 1(1.75%) were aged <40 years. The delaying group comprised 10(20%) men and 39(80%) women. Age and gender were significantly correlated with vaccination behaviour (p=0.001 each).

Overall, 130(39%) HSPs had themselves suffered Covid-19 infection, 166(50%) had someone in their family or friends affected, and 74(22%) recalled a Covid-19-related death in their social circle. Respondents aged <30 years had fewer infections 57(31%), while 31(56.4%) of those aged >30 years had contracted the infection. Physicians were infected most commonly 52(55%) and MSOs were the least infected 4(17%).

Of those who got COVID-19 infection, 115(89%) were vaccinated compared to 144(78%) who were not infected (p=0.016). However, there was no significant difference between those who had experienced a COVID-19-related death or infection in their family (p=0.118) and friend's circle (p=0.481) (Table-1).

Personal safety 202(74%) followed by the perception of official requirement 162(59%) were the prime reasons for getting vaccinated. The delaying group cited the desire for more convincing safety and efficacy data regarding the available vaccines, or a better vaccine as the prime, while the group refusing vaccination outright had multiple reasons, but no respondent cited religious

Table-1: Demographics and vaccination status.

Characteristics	Total	Vaccinated	Not Vaccinated	Hesitant	Refused
Gender (P value = 0.001)					
Male	156 (47%)	132 (92%)	11 (7.6%)	7 (5%)	4 (3%)
Female	175 (53%)	132 (75%)	43 (25%)	39 (22%)	4 (2%)
Age (P value = 0.001)					
Below 30	183 (55%)	138 (75%)	45 (25%)	40 (22%)	5 (3%)
30 - 40	93 (28%)	82 (88%)	11 (12%)	8 (9%)	3 (3%)
41 - 50	26 (8%)	26 (100%)	0	0	0
50 - 60	22 (7%)	22 (100%)	0	0	0
Above 60	7 (2%)	6 (86%)	1 (14%)	1 (14%)	0
Occupational Group (P value = 0.00)					
Physicians	94 (28%)	79 (84%)	15 (16%)	11 (12%)	4 (4%)
Consultant	39 (12%)	36 (92%)	3 (8%)	1 (3%)	2 (5%)
Trainee	55 (17%)	43 (78%)	12 (22%)	10 (18%)	2 (4%)
Nurse/ Nursing Assistant	95 (29%)	88 (93%)	7 (7%)	6 (6%)	1 (1%)
Technologist/ Technician	118 (36%)	96 (81%)	22 (19%)	19 (16%)	3 (2.5%)
Medical Social Officer (MSO)	24 (7%)	11 (46%)	13 (54%)	13 (54%)	0
Suffered from COVID-19 (P value = 0.016)					
Yes	130 (39%)	115 (88.5%)	15 (11.5%)	13 (10%)	2 (1.5%)
No	184 (56%)	144 (78%)	40 (22%)	34 (18%)	6 (3%)
Don't Know	17 (5%)	15 (88%)	2 (12%)	2 (12%)	0
COVID-19 in Friends and Family (P value = 0.481)					
Yes	166 (50%)	139 (84%)	27 (16%)	23 (14%)	4 (2%)
No	147 (44%)	119 (81%)	28 (19%)	24 (16%)	4 (3%)
Don't Know	18 (5%)	16 (89%)	2 (11%)	2 (11%)	0
COVID-19 related death in Friends and Family (P value = 0.118)					
Yes	74 (22%)	65 (88%)	9 (12%)	7 (9%)	2 (3%)
No	246 (74%)	198 (80.5%)	48 (19.5%)	42 (17%)	6 (2%)
Don't Know	11 (3%)	11 (100%)	0	0	0

COVID-19: Coronavirus disease 2019.

Table-2: Reasons for getting or delaying/refusing vaccination.

Reasons for Getting Vaccinated	Percentage (Respondents)
For Self-Safety	203 (74%)
Order by Superiors/Official Requirement	162 (59%)
For Others' Safety	159 (58%)
Freely Available	94 (34%)
Social Conformity	70 (26%)
Reasons for Delaying Vaccination	
Waiting for data on vaccine's efficacy and side effects	25 (51%)
Waiting for Better Vaccine	16 (33%)
Pregnant or Breastfeeding	14 (28.5%)
Trouble/Hassle involved in the Process	8 (16%)
Contra-indicatory Medical Condition	2 (4%)
Reasons for Refusing Vaccination	
Low perception of danger	3 (37.5%)
Fear of losing fertility/virility	3 (37.5%)
Influence of Family Elders	2 (25%)
Bad reaction of COVID-19 vaccine in friends or family	2 (25%)
No need for the vaccine, as already been infected with COVID-19	2 (25%)
Influence of social media	1 (12.5%)
Lack of trust in government	1 (12.5%)
Lack of information	1 (12.5%)
Fear of DNA alteration	1 (12.5%)
Belief in other better alternatives of vaccine	1 (12.5%)

COVID-19: Coronavirus disease 2019, DNA: Deoxyribonucleic acid.

inhibitions or social media as the reason behind their vaccine choice (Table-2).

Discussion

Recent times have seen several Emergency Use Authorisation (EUA) vaccines becoming available across the world.[15] Not only is there an expected eagerness among the public to get vaccinated and resume normalcy, as evident by the crowds at vaccination centres, there is also an ill-understood hesitancy among people in getting the jab.

A systematic review from 33 countries showed a worldwide trend of COVID-19 vaccine hesitancy among the general population.[16] The level of hesitancy varied across countries, from as high as 97% in Ecuador, to as low as 24% in Kuwait. The same review also highlighted a varying range of acceptance among HSPs, from 28% in the Democratic Republic of the Congo to 78% in Israel.[16]

A triad epidemiological model has been proposed, taking into consideration environmental, agent, and host factors. In the calculus, "environmental factors" include health policy and social aspects, like media influence, while "agent factors" both vaccine- and disease-specific

include perceptions regarding sensitivity, safety and efficacy of the vaccine. "Host factors" refer to knowledge, past experiences, level of education, and socioeconomic background of the recipients.[17]

The current study focussed on HSPs for three reasons. Firstly, it would be logical to assume that HSPs at the frontline, and having witnessed the ravages of COVID-19 first-hand, would be inclined to seek vaccine protection from the virus at the earliest opportunity. Secondly, they were the first ones to whom the vaccine was made available. Finally, as trained HCPs, they wield influence among the lay public with regard to healthcare-related issues. Their hesitancy is logically prone to enhancing public apprehensions, and adversely affect mass vaccination efforts.

The vast majority of HSPs in the current survey was vaccinated. The provision of vaccines to HSPs at the study site began on February 18, 2021, while data collection for the current study took place in late May and early June 2021, indicating ample opportunity for the HSPs to avail of the facility. Two cohorts, the nurses and consultants, emerged as the most vaccinated groups. Personal safety emerged as the prime motivator, followed by a perception that vaccination was an "official requirement/order by a superior." Even though vaccination was neither mandatory nor enforced at the institutional level, this impression seemed to be pervasive among the staff, especially the nurses. Five respondents from the nurses' group chose to go beyond the limits of our closed-ended questionnaire, and, using the opportunity to vent, wrote down additional comments on the back of the form, alluding to perceived pressure related to getting the jabs. Due to the quantitative nature of this data, it is difficult to say whether this was due to perceived coercion sensed by the junior staff since the senior faculty was vaccinated, or the seniors were being regarded as role models to emulate. A qualitative study will be needed to gain a deeper insight into the apprehensions of the respondents, but was beyond the scope of the current initial-probe study.

Whatever the underlying reason for this perception, it reinforces the impression that measures, like voluntary vaccination, are still not widely accepted in Pakistan.

Except for one respondent, everyone aged >40 years had been vaccinated. Even that one person was not an outright refuser. Old age appears as a positive determinant of vaccination, with younger respondents appearing more resistant. This is an alarming finding since the larger workforce is younger, and, hence, more vulnerable to infection. This is in contrast to a previous study conducted in Pakistan where younger HSPs seemed more accepting, at least before the rollout began.[18] A reason for this difference might be a greater propensity of infections among the older respondents which was a statistically significant positive influencer towards the jab.

About a third of the hesitant women mentioned pregnancy or lactation as the reason to delay vaccination. One reason for hesitancy in this group could be because regulators had initially barred this category from vaccination, and only subsequently revised the guidelines after reviewing fresh data and allowed this cohort to get vaccinated. This underlines the importance of including pregnant and lactating women in clinical trials earlier on, once initial safety and efficacy are established.

Mistrust in the available vaccine's safety and efficacy data was an important reason for hesitancy in the current study. Half of the women and all of the men in the hesitant group wanted to wait for convincing results or a better vaccine. Earlier research from Pakistan also found similar concerns contributing towards hesitancy.[19]

An online research (available in preprint) conducted from December 2020 to February 2021 in Pakistan, before the vaccines became available locally, surveyed a broader cohort of 5,000 HSPs and medical students, with 70% respondents willing for vaccination, but, unlike our findings, a higher acceptance was found in younger population and women.[18] The reason most quoted by hesitant women in the study,[18] as was the case in the current study, was based on doubts on the available vaccine's effectiveness. In the preprint study, men were hesitant based on a perception of immunity because of prior COVID-19 infections, indicating misplaced confidence, unsupported so far by data, that any extent of previous exposure to COVID-19 virus provides long-term safety.[18] In contrast, the current study showed prior COVID-19 infection as a positive determinant for vaccination.

Pakistan government vaccine rollout had primarily relied on Chinese vaccines Cansino, Sinovac and Sinopharm. These vaccines were provided free of cost by the government and, later, the government mandated it. The lack of trust in the efficacy and safety of available vaccines in the current study is also reflected in the Gallup Pakistan survey on doctors, where only 9% were willing to get the Chinese vaccines. The survey found that about half of the respondents preferred Pfizer and AstraZeneca vaccines over the available ones.[13] The quality of Chinese products, in general, has been called to question in other published studies from Pakistan and elsewhere,[20,21] reflecting an already established basis as a major cause of hesitancy

unmasked in the current study.

Religious inhibitions have often been implicated in several crucial medical and public health initiatives, a case in point being the unfortunate pseudo-religious propaganda against polio vaccination.[22] Similar misinformation using religion as a tool was also being anticipated as a potential hurdle in a successful COVID-19 vaccination programme in Pakistan before the rollout.[23] Interestingly, none of the unvaccinated respondents in the current survey mentioned any religiously motivated inhibitions. One reason for this can be respondents' modified responses to conform to acceptable norms, described as social desirability bias.

Following the vaccine rollout, a major concern for hesitancy was the vaccine's impact on fertility. Studies have observed increasing internet search queries regarding the COVID-19 vaccine's impact on fertility.[24] Other studies focussing on healthcare workers also highlight fertility-related concerns as a major reason for hesitancy.[25] However, in the current study, only 3 of the 8 refusers mentioned the perceived "impacts on fertility" as a reason to refuse vaccination.

In the current survey, MSOs and technologists were among the least vaccinated groups. Their main reason for not getting vaccinated was reportedly being unconvinced regarding safety and efficacy data. It is curious that while these groups, with limited broad biomedical training, had scientific reservations, senior physicians, the most vaccinated group in the study, did not. Perhaps social media, readily accessible to all, though unacknowledged by the respondents in the survey, was actually influencing the decisions, with science and pseudo-science permeating subconsciously into decision-making regarding vaccination, especially among the younger respondents. Social media has been considered an important factor in vaccine hesitancy in Pakistan, and 55% of physicians in the Gallup Pakistan survey reported social media to be their source of COVID-19 vaccine-related information.[26] While none of the respondents in the current survey mentioned any impact of social media on their choice to get vaccinated or not, it is unlikely that the ceaseless information bombardment through various social media platforms would not have influenced them.

A surprising finding in the current study was the medical trainees/residents being the second least vaccinated cohort. While they would be expected to have scientifically sound knowledge, perhaps younger age and fewer personal infections may have led to this behaviour.

The current study has a few limitations. It was conducted at a single centre and comprised only HSPs. A multi-centre study comparing the behaviour of the HSPs with that of the general population could have led to a better understanding of vaccine hesitancy scenario. Also, a qualitative study would throw further light on the subject, but that was beyond the scope of the current study.

Conclusion

A lack of trust in the safety and efficacy data of the available Chinese vaccines emerged as a factor inducing hesitancy. The resistance of younger respondents, especially trainee physicians, was a finding of concern since they form the backbone of the health system in the country. What will work in the long term is actual evidence-based acceptance of the benefits of any intervention. In order to gain confidence in the vaccine, it is critical that all tiers of HSPs are educated and kept updated about data pertaining to its safety and efficacy aspects. No cohort, however, educated and well trained, is immune from misconceptions and only a well-planned and focussed educational strategy can be effective in making the vaccine rollout efforts yield dividends.

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References

1. Omer SB, Yildirim I, Forman HP. Herd Immunity and Implications for COVID-19 Control. JAMA. 2020; 324:2095.
2. Saad-Roy CM, Wagner CE, Baker RE, Morris SE, Farrar J, Graham AL, et al. Immune life history, vaccination, and the dynamics of COVID-19 over the next 5 years. Science. 2020; 370:811-8.
3. Neagu M. The bumpy road to achieve herd immunity in COVID-19. J Immunoassay Immunochem. 2020; 41:928-45.
4. Reiter PL, Pennell ML, Katz ML. Acceptability of a COVID-19 vaccine among adults in the United States: How many people would get vaccinated? Vaccine. 2020; 38:6500-7.
5. Lee C, Whetten K, Omer S, Pan W, Salmon D. Hurdles to herd immunity: Distrust of government and vaccine refusal in the US, 2002-2003. Vaccine. 2016; 34:3972-8.
6. MacDonald NE, SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: Definition, scope and determinants. Vaccine. 2015; 33:4161-4.
7. The World Health Report 2006. Working together for health. World Health Organization. [Online] 2006 [Cited 2021 Jun 22]. Available from URL: https://www.who.int/workforcealliance/knowledge/resources/whreport_2006/en/.
8. Karafillakis E, Dinca I, Apfel F, Cecconi S, Wűrz A, Takacs J, et al. Vaccine hesitancy among healthcare workers in Europe: A qualitative study. Vaccine. 2016 Sep 22;34(41):5013–20.
9. Tomljenovic M, Petrovic G, Antoljak N, Hansen L. Vaccination attitudes, beliefs and behaviours among primary health care workers in northern Croatia. Vaccine. 2021; 39:738-45.
10. Grech V, Gauci C, Agius S. Withdrawn: Vaccine hesitancy among Maltese Healthcare workers toward influenza and novel COVID-19 vaccination. Early Hum Dev [Online] 2020 [Cited 2021 June 19].

Available from: URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7528734/

11. Kwok KO, Li KK, Wei WI, Tang A, Wong SYS, Lee SS. Influenza vaccine uptake, COVID-19 vaccination intention and vaccine hesitancy among nurses: A survey. Int J Nurs Stud. 2021; 114:103854.
12. Nearly Half of Frontline Healthcare Workers Not Vaccinated: Survey. [Online] [Cited 2021 June 22]. Available from: URL: http://www.medscape.com/viewarticle/947813
13. Gallup Pakistan. National Survey of Potential Acceptance of COVID-19 Vaccines in healthcare workers [Online] [Cited 2021 January 15]. Available from: URL: https://gallup.com.pk/post/31521
14. Report of the SAGE Working Group on Vaccine. World Health Organization. [Online] [Cited 2021 June 17]. Available from: URL: http://www.who.int/immunization/sage/meetings/2014/october/SAGE_working_group_revised_report_vaccine_hesitancy.pdf
15. Sharfstein J. What Is Emergency Use Authorization? [Internet]. Johns Hopkins: Bloomberg School of Public Health. [Online] [Cited 2021 July 25]. Available from: URL: https://www.jhsph.edu/covid-19/articles/what-is-emergency-use-authorization.html
16. Sallam M. COVID-19 Vaccine Hesitancy Worldwide: A Concise Systematic Review of Vaccine Acceptance Rates. [Online] [Cited 2021 August 15]. Available from: URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7920465/
17. Gowda C, Dempsey AF. The rise (and fall?) of parental vaccine hesitancy. Hum VaccinImmunother. 2013; 9:1755-62.
18. Acceptance of COVID-19 Vaccine in Pakistan Among Health Care Workers. [Online] [Cited 2021 June 15]. Available from: URL: https://www.medrxiv.org/content/10.1101/2021.02.23.21252271v1
19. Asad S, Qureshi J, Shah T, Zafar B. Economic Vulnerability Assessment January 2021: Round 3 Findings. [Online] [Cited 2021 June 15]. Available from: URL: https://www.cerp.org.pk/news/economic-vulnerability-assessment-january-2021
20. Khan LM, Ahmed R. A Comparative Study of Consumer Perception of Product Quality: Chinese versus Non-Chinese Products. [Online] 2016 [Cited 2021 June 29]. Available from: URL: https://journals.iobmresearch.com/index.php/PJETS/article/view/698
21. Uyar A. A Study on Consumers' Perception About Chinese Products and Their Willingness to Buy. IJOESS. 2018; 9:1121-43.
22. Hussain SF, Boyle P, Patel P, Sullivan R. Eradicating polio in Pakistan: an analysis of the challenges and solutions to this security and health issue. Global Health. 2016; 12:63.
23. Khan YH, Mallhi TH, Alotaibi NH, Alzarea AI, Alanazi AS, Tanveer N, et al. Threat of COVID-19 Vaccine Hesitancy in Pakistan: The Need for Measures to Neutralize Misleading Narratives. Am J Trop Med Hyg. 2020; 103:603-4.
24. Diaz P, Reddy P, Ramasahayam R, Kuchakulla M, Ramasamy R. COVID-19 vaccine hesitancy linked to increased internet search queries for side effects on fertility potential in the initial rollout phase following Emergency Use Authorization. Andrologia. 2021; e14156.
25. Berry SD, Johnson KS, Myles L, Herndon L, Montoya A, Fashaw S, et al. Lessons learned from frontline skilled nursing facility staff regarding COVID-19 vaccine hesitancy. J Am Geriatr Soc. 2021; 69:1140-6.
26. Maryam, Hajira. Pakistan: Conspiracy theories hamper COVID vaccine drive | DW. [Online] [Cited 2021 June 22]. Available from: URL: https://www.dw.com/en/pakistan-conspiracy-theories-hamper-covid-vaccine-drive/a-56853397