

Opinions on Mandatory COVID Vaccinations of United States Healthcare Workers and Educators-In Cross sectional survey Social Media Users are in Favor

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Abstract

In the midst of the COVID pandemic, many persons protested to face masks, lock-downs and restrictions on movements. Mandatory vaccinations for healthcare workers also caused protests and some walkouts. As subvariants of COVID-19 will continue to emerge, it is important to assess the opinion of mandatory vaccinations for individuals who come into close contact with the public such as healthcare worker, educators and coaches. Such assessments could be used in policy-making to decrease vaccine hesitancy among these individuals and the general public. Between 9 May, 2021 to 1 February, 2022 a questionnaire probing the experience with COVID and attitude to COVID getting the COVID vaccine was sent to across 59 social media channels. The data from self-administered questionnaire was analyzed for the response to the question "Should COVID-19 Vaccination be Mandatory?". The response had three categories coded as (0=No, 1=yes-now immediately, 2=yes-only after full Food and Drug Administration (FDA) approval) for seven specific subgroups, all healthcare workers, educators and coaches, four age groups as well as pregnant people. We conducted a confirmatory analysis with bivariate and multinomial logistic regression with predictors sex, age groups, race/ethnicity, marital status, creed, medical practice. Associations were assessed at with odds-ratio and 95% confidence intervals. Significant associations excluded. In multinomial model with 22,198 respondents, women objected more to immediate vaccinations than men, but both were equal on waiting for federal approval. Age category showed more acceptance of immediate vaccinations going from youngest to oldest. Most ethnic minorities were substantially more in favor of vaccinations than Caucasians. The exceptions were native Americans/Pacific Islander who substantially objected to mandatory vaccinations. All creeds were more in favor of vaccinations than christians. This was especially so for unbelievers. All healthcare workers regardless of type of practice were more in favor of immediate vaccinations than respondents not in healthcare. This suggests that efforts to promote COVID vaccinations would benefit from addressing the concerns of women, Native Americans and Pacific Islanders to increase participation by persons in these groups.

Keywords: COVID; Healthcare workers; Vaccinations; Social media

Introduction

The mutation of the COVID-19 virus is a concern to scientists and governmental bodies because the waves of variant surges elude the attainment of herd immunity [1-3]. The effect of COVID-19 on the lives and livelihood has been substantial. For example, in a 2019 report by the US Bureau of Labor Statistics (BLS) COVID-19 was (in thousands) 10.8 cases. This increased to 428.7 in 2020 and dropped substantially to 269.6 in 2021. In terms of the lost to the overall economy, the 2020 full-time equivalent of work lost was 209.8 cases per 10,000 [4]. The effects stem from the immediate infections as well as its sequelae. These follow on effects have been dubbed Long COVID and gravely affects the US economy. The BLS reported days away from work for the private sector health care and social assistance were 151,410 in 2019, 447,890 in 2020 and 276,600 in 2021 which is many factors larger than it was in 2019. In addition estimates for the whole country instead of the single private sector category, Bach (2022) estimated 4 million people were out of work from long COVID [5]. Another challenge of the vaccines is demonstrated reduced efficacy as the virus mutates [6]. The number of boosters affect the duration of immunity. Recent investigations show that three boosters or previous infection and two boosters produce the longest immunity [7]. The CDC tracker reports that small changes in the vaccine has efficacy on the emerging variants [8]. Since the new variants seem to require three shots for lasting immunity, it is essential to assess the attitudes persons to accept the vaccinations. The expression of the attitude is termed pandemic fatigue with exclamations such as "I am SO done with COVID-19" [9]. The World Health Organization (WHO) defines pandemic fatigue as "demotivation to follow recommended protective behaviours, emerging gradually over time and affected by a number of emotions, experiences and perceptions". The WHO recommended four strategies to keep the population invigorated with the protective behaviors for COVID. They were (1)

Understand people (2) Allow people to live their lives (3) Engage people as part of the solution and (4) Acknowledge and address the hardship people experience. Moreover, they recommended five principles that policy communications should strive to follow. (1) Be transparent by sharing reasons behind restrictions and any changes made to them, and by acknowledging the limits of science and government (2) Strive for the highest possible level of fairness in recommendations and restrictions (3) Be as consistent as possible in messages and actions, and avoid conflicting measures (4) Coordinate to avoid mixed messages across experts and spokespeople and (5) Strive for predictability in unpredictable circumstances, for example, by using objective criteria for restrictions and any changes made to them [10]. When these strategies and principles were deployed, the jurisdictions achieved desirable outcomes. For example, San Francisco County had lower illness and deaths by age, ethnicity, and disadvantaged communities than the state of California as a whole. This is noteworthy given that California had low COVID-19 mortality compared to several neighboring states. Considering deaths per 100,00 in California was 68.7 in 2020 and 99.9 in 2021. In contrast, to Arizona at 87.6 (in 2020) and 139.5 (in 2021), Nevada at 88.4 (in 2020) and 141.6 (in 2021) and New Mexico at 106.2

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(in 2020) and 136.3 (in 2021) [11].

San Francisco County used four main principles. Table 1 compares the San Francisco approach with the principles/strategy recommended by the WHO [10,12].

San Francisco County	World Health Organization
Aggressive reduction measures to protect populations at risk for severe disease	Strive for the highest possible level of fairness in recommendations and restrictions
Prioritization of resources in neighborhoods highly affected by COVID-19	
Timely and adaptive data-driven policy making	Strive for predictability in unpredictable circumstances
Exploiting of partnerships and public trust	Engage people as part of the solution

Table 1: Comparison of principles between San Francisco County and the world health organization.

In contrast, states that did not attempt the recommendations or actively opposed them experienced excess morbidity and mortality rates. Arizona, Florida, and Ohio had excess deaths. Both states were actively in defiance of recommendations. The governor of Florida actively inveighed against the vaccines. The death rate of 3,984 per million put the state as the 10th worse in the world (if Florida were a country) [13]. This is supported by findings of low vaccination rates in Florida and Texas [14]. An additional complexity is the finding that Republican partisanship was associated with higher mortality in Florida and Ohio. In fact, the excess deaths were even more pronounced after vaccines became available to all adults [15].

Several additional factors are present that could influence the uptake of vaccination a new variant such as EG.5.1 (XBB.1.9.2.5.1) 8 or another novel pathogen currently aliased as Disease X [16]. For example, the experience of the trauma and tragedy of the morbidity and mortality might reduce future resistance than the recent aggression of the pandemic.

Therefore, the success of San Francisco County, California as well as other jurisdictions that kept morbidity and mortality low during the pandemic suggests that the effect of future variants can be reduced [12, 17]. As in all large populations, all locations would contain individuals of various ideologies and party affiliations.

This investigation examines the effects of knowledge, attitudes, and behaviors to determine which factors are amenable to the protective behaviors for controlling spread of COVID-19.

Materials and Methods

Informed consent

This is a voluntary survey and informed consent was obtained from all subjects and/or their legal guardian(s).

Data availability statement

All Raw data is uploaded as supplementary file. All data generated or analyzed during this study are included in this published article and its supplementary information files.

IRB approval

The study was approved by the Institutional Review Board (IRB) committee at Cedars Sinai Medical Center. The study methods were

performed in accordance with the relevant guidelines and regulations established by Cedars Sinai Medical Center.

Between 9 May, 2021 to 1 February, 2022 a questionnaire probing the experience with COVID and attitude to COVID getting the COVID vaccine was sent to across 59 social media channels. The questionnaire was administered online by surveymonkey® [18].

The primary outcome was response to the question “Should COVID-19 Vaccination be Mandatory?” for seven specific subgroups.

Subgroup 1: “Should COVID-19 Vaccination be Mandatory for All Healthcare Workers?”

Subgroup 2: “Should COVID-19 Vaccination be Mandatory for Educators and Coaches?”

Subgroup 3: “Should COVID-19 Vaccination be Mandatory for ages 0-11?”

Subgroup 4: “Should COVID-19 Vaccination be Mandatory for ages 12-15?”

Subgroup 5: “Should COVID-19 Vaccination be Mandatory for ages 16-17?”

Subgroup 6: “Should COVID-19 Vaccination be Mandatory for ages ≥ 18?”

Subgroup 7: “Should COVID-19 Vaccination be Mandatory for the Pregnant?”

This report examines the relationships of two items with the responses.

Subgroup 1: “Should COVID-19 Vaccination be Mandatory for All Healthcare Workers?”

Subgroup 2: “Should COVID-19 Vaccination be Mandatory for Educators and Coaches?”

0=No

1=Yes-now immediately

2=Yes-only after full FDA approval

3=Other (please specify)

This used analysis of single variables against the subgroups 1 and 2 outcomes (no, yes-now immediately, yes-only after full FDA approval) as well as constructing models multi-variable models. The test statistics was the Chi-square with the alpha ≤0.05 as a statistically significant value. In the multivariable models, the outcomes were expressed as odds-ratios to make explicit each level of the predictor. We also showed 95% confidence interval of the odds-ratio. If the 95% confidence interval contained 1.0 the level was not statistically significant. In building the model observations with missing values were deleted. The healthcare workers had 110 (0.53%) missing responses. The responses for educators and coaches did not have any missing values. The other factors in the analysis were demographics as well as experience and opinions with COVID and long COVID. All the variables were collected as categorical. The category with the largest number of responses was set as the comparison or reference category. Sex was categorized as “Male and Female” and had 342 (1.66%) missing values. The probe also asked for opinion about COVID vaccine and pregnancy. For example, “What sex are you; and if female your thoughts on pregnancy and COVID vaccination?” with responses such as “Female-will not get COVID Vaccine while pregnant”. The opinion was used to validate the first part of the probe. For example, respondents

were definitively female if they were pregnant, post-partum or post-menopausal regardless of gender (e.g., non-binary). Race/ethnicity had 82 (0.4%) missing values. Small cells were combined for stability of the model. Therefore, Native American, Pacific Islanders and “other” were combined into one category. Age was obtained as age categories. This analysis restricted respondents to adults (i.e., 18-25, 66-75). Creed is taken to capture every belief (or non-belief). Jewish, Buddhist, Hindu and Muslim were combined into a single category 2,636 (12.79%). The types of medical practice were categorized into hospital (for hospital and county or state hospital) academic/research (for Academic hospital or medical research only) and other (for other, multi-specialty physician group, solo medical practice and other). As this is a confirmatory analysis rather than an exploratory analysis, predictors were kept in the model regardless of statistical significance for main effects. We chose to perform a joint test on sex because fewer women than men stated they planned to get COVID vaccines [19]. Interactions were examined for sex and the other predictors (sex*race, sex*agecat_num, sex*marital, sex*creed, sex*practice) and were not statistically significant and were excluded from the model. This attitude might reflect different opinions of mandatory vaccines for healthcare workers. The strength of association indicates where interventions can be used to change attitude or behavior. We selected half of the respondents (uniform random) to construct the model and half to test the model. The constructed model was consistent when run against the test data. We ran the final model with the entire data set using a Generalized Logit Model (GLM). In both the joint test and the GLM, the response categories were contrasted against the “No” reference category (Table 2).

Respondent characteristics	Frequency	Percent
Healthcare workers		
Missing	110	0.5
No	6,443	31.3
Yes-now immediately	9,410	45.7
Yes-only after full FDA approval	4,642	22.5
Educators, coaches, etc.		
No	6,975	33.9
Yes-now immediately	8,662	42
Yes-only after full FDA approval	4,968	24.1
Sex		
Missing	342	1.7
Female	9,028	43.8
Male	11,235	54.5
Race/ethnicity		
Missing	82	0.4
White Caucasian	12,239	59.4
African American	3,049	14.8
Asian	1,906	9.3

Latino	1,776	8.6
NA_PI, other	1,553	7.5
Age category		
18-25	2,901	14.1
26-35	4,374	21.2
36-45	4,477	21.7
46-55	3,924	19
56-65	3,342	16.2
66-75	1,587	7.7
Marital status		
Missing	82	0.4
Married	7,015	34.1
Married with children	6,091	29.6
Married No children	4,809	23.3
Single, other	2,608	12.7
Creed		
Missing	82	0.4
Christian	11,228	54.5
Unbeliever	3,773	18.3
Jewish, Buddhist, Hindu, Muslim	2,636	12.8
Other	2,886	14
Medical practice		
Not in health care	8,794	42.7
Hospital	3,878	18.8
Single specialty physician group	2,360	11.5
Academic/research	2,705	13.1
Other	2,868	13.9
Total	20,605	100

Table 2: Characteristics of respondents.

Results

The current survey data range is 9 May, 2021 to 1 February, 2022. The self-administered survey was *via* social media. This project sent out 30,000 surveys with 22,198 (73%) responses. This report includes 20,605 respondents with complete data. We did not find any significant differences between the excluded responders and those kept in the analysis. The respondents were in favor of mandatory vaccines for healthcare workers (14,062, 68%) and mandatory vaccination for educators/coaches (13,630, 66%). The respondents were predominantly white male, married, had children, and were Christians between the ages of 26 and 55. Most of the respondents had children and were not in health care themselves (Tables 3 and 4).

Characteristics	No	PCT	Yes-now immediately	PCT	Yes-only after full FDA approval	PCT	Total	Chi-square	p-value
Sex									
Female	2,828	31.5	4,186	46.6	1,967	21.9	8,981	-	-
Male	3,479	31.1	5,083	45.5	2,614	23.4	11,176	6.4	0.04
Race/ethnicity									
White Caucasian	4,096	34	5,550	46.1	2,406	20	12,052	-	-
African American	841	27.9	1,275	42.4	894	29.7	3,010	-	-
Asian	260	13.9	1,112	59.3	504	26.9	1,876	-	-
Latino	465	26.5	805	45.9	485	27.6	1,755	-	-
NA_Pi, other	645	44.1	527	36	292	19.9	1,464	594	<.0001
Age category									
18-25	781	27.4	1,221	42.8	850	29.8	2,852	-	-
26-35	1,298	30.2	1,915	44.5	1,090	25.3	4,303	-	-
36-45	1,475	33.7	1,895	43.3	1,010	23.1	4,380	-	-
46-55	1,371	35.8	1,674	43.7	788	20.6	3,833	-	-
56-65	996	30.6	1,670	51.4	586	18	3,252	-	-
66-75	386	25.1	894	58.2	257	16.7	1,537	311.9	<.0001
Marital status									
Married	2,312	33.6	3,230	46.9	1,347	19.6	6,889	-	-
Children	1,906	31.9	2,762	46.2	1,308	21.9	5,976	-	-
No child	1,227	25.9	2,220	46.9	1,290	27.2	4,737	-	-
Single, other	862	33.7	1,057	41.4	636	24.9	2,555	160.2	<.0001
Creed									
Christian	4,168	37.7	4,346	39.3	2,551	23.1	11,065	-	-
Unbeliever	567	15.3	2,317	62.4	832	22.4	3,716	-	-
Jewish, Buddhist, Hindu, Muslim	593	23	1,497	58	492	19.1	2,582	-	-
Other	979	35	1,109	39.7	706	25.3	2,794	986.8	<.0001
Medical practice									
Not in health care	3,022	34.9	3,494	40.3	2,145	24.8	8,661	-	-
Hospital	1,232	32.6	1,732	45.9	812	21.5	3,776	-	-
Single specialty physician group	720	31.4	1,112	48.5	463	20.2	2,295	-	-
Academic/ research	495	18.9	1,553	59.2	577	22	2,625	-	-
Other	838	29.9	1,378	49.2	584	20.9	2,800	371.3	<.0001
All	6,307	-	-	-	9,269		20,157	-	-

Table 3: Opinion on mandatory vaccinations of healthcare workers.

Characteristics	No	PCT	Yes-now immediately	PCT	Yes-only after full FDA approval	PCT	Total	Chi-Square	p-value
Sex									
Female	3159	35	3829	42.4	2040	22.6	9028	-	-
Male	3671	32.7	4701	41.8	2863	25.5	11235	25.6	<.0001
Race/ethnicity									
White Caucasian	4574	37.8	5013	41.4	2527	20.9	12114	-	-
African American	819	27.1	1234	40.8	968	32	3021	-	-
Asian	275	14.6	1031	54.8	577	30.6	1883	-	-
Latino	484	27.5	767	43.5	511	29	1762	-	-
NA_PI, other	678	45.7	485	32.7	320	21.6	1483	703.8	<.0001
Age category									
18-25	828	28.9	1122	39.2	913	31.9	2863	-	-
26-35	1398	32.3	1711	39.6	1215	28.1	4324	-	-
36-45	1610	36.6	1730	39.3	1063	24.1	4403	-	-
46-55	1483	38.4	1544	40	830	21.5	3857	-	-
56-65	1098	33.6	1568	47.9	605	18.5	3271	-	-
66-75	413	26.7	855	55.3	277	17.9	1545	384.5	<.0001
Marital status									
Married	2531	36.6	2982	43.1	1407	20.3	6920	-	-
Children	2130	35.4	2517	41.8	1368	22.7	6015	-	-
No children	1313	27.6	2019	42.4	1427	30	4759	-	-
Single, other	856	33.3	1012	39.4	701	27.3	2569	207.1	<.0001
Creed									
Christian	4540	40.8	3980	35.8	2603	23.4	11123	-	-
Unbeliever	663	17.8	2102	56.3	970	26	3735	-	-
Jewish, Buddhist, Hindu, Muslim	600	23.2	1404	54.3	584	22.6	2588	-	-
Other	1027	36.5	1044	37.1	746	26.5	2817	961	<.0001
Medical practice									
Not in health care	3214	36.9	3310	38	2178	25	8702	-	-
Hospital	1334	35.1	1567	41.2	901	23.7	3802	-	-
Single specialty physician group	823	35.7	982	42.5	503	21.8	2308	-	-
Academic/ research	580	22	1380	52.3	677	25.7	2637	-	-
Other	879	31.2	1291	45.9	644	22.9	2814	269.6	<.0001
All	6830	-	8530	-	4903	-	20263	-	-

Table 4: Opinion on mandatory vaccinations of educator, coaches, etc.

Bivariate analysis

In considering their opinions within categories, we see differences in opinions. For example, women appeared slightly more disposed to immediate vaccinations for healthcare workers than men were. While both held similar opinions of no mandatory vaccinations (31%) slightly more women than men favored ‘now immediately’ at 47% and 46%, respectively. However, both groups were less inclined to wait for federal approval, women were slightly less willing to wait than men as shown by the 22% vs 23%. Although, the differences were slight, they were statistically significant with a Chi-square=6.4 and p-value=0.04. A similar pattern occurred for educators/coaches in that both sexes were disposed to ‘now immediately’ for mandatory vaccinations. A notable difference is women were more inclined than men to prefer no mandatory vaccinations for educators/coaches. (35% vs 33%, respectively). While both felt the same about ‘now immediately’ (42%), men were more likely to wait for approval from the federal government (23% for women and 26% for men). The Chi-square indicates a great departure from the Chi-square distribution Chi-square=26, p-value<0.0001. Race/ethnicity showed dramatic differences of opinions for mandatory vaccinations for healthcare workers and mandatory vaccination for educators/coaches. Asians were approximately 4.5 times more likely of say ‘now immediately’ (59%) than to disapprove of mandatory vaccinations (14%).

In addition, only 14% of Asians disapproved of mandatory vaccinations for healthcare workers. This percent was more than 2.5 times less than that of White Caucasians (34%) and two times less than African Americans (28%). Interestingly, Native American, Pacific Islander and others were the most strongly against mandatory vaccinations (44%) and the lowest for ‘now immediately’ (36%) and waiting for federal approval (20%). The Chi-square=594, pvalue ≤

0.0001. The pattern was very similar for mandatory vaccinations for educators, coaches etc. where the Chi-square=703.8, p-value ≤ 0.0001. Age category displayed two dose-response effects as we go from 18 to 25 on ‘now immediately’ and waiting for federal approval. For the former the opinions went from 43% up to 58% and down from 30% down to 17%, respectively. The departure resulted in Chi-square=312, p-value ≤ 0.0001. Again, the pattern was similar on educators, coaches etc. Chi-square=385, p-value<0.0001.

Considering healthcare workers and marital status, single respondents with no children, were similar to married and those respondents with children, but less inclined to support ‘now immediately’ (41% vs at least 46%). Like the other categories, this group were less likely to wait for federal approval (25%). A similar pattern existed for educators, coaches, etc. where single respondents was 39% while the other categories were at least 42%. The Chi-square=207, p-value<0.0001.

Mandatory vaccinations for healthcare workers showed atheist/agnostic were the least inclined to disapprove (15%) and most inclined to ‘now immediately’ (62%) and for waiting for federal approval (56%) Table 5. The next most fervent group (Jewish, Buddhist, Hindu, Muslim) who were the second least likely to disprove (23%) as well as ‘now immediately’ (58%) but the least likely to wait for federal approval (19%) with Chi-square=987, p-value ≤ 0.0001 (Table 5).

For mandatory vaccination of educators/coaches, the pattern held with atheist/agnostic having 18%, 56% and 26% for the categories disapproved, now immediately and waiting for federal approval, respectively Table 6. While for the mixed faith group they were 23%, 54% and 23%, for the same categories, respectively with Chi-square=961, p-value<0.0001 (Table 6).

Parameter	Healthcare worker	Estimate	SE	Chi-Sq	p-value	STD Est
Intercept	Yes-now immediately	-0.51	0.05	86.09	<.0001	-
Intercept	Yes-only after full FDA approval	-0.88	0.06	193.1	<.0001	-
Female	Yes-now immediately	-0.13	0.04	13.91	0.0002	-0.04
Female	Yes-only after full FDA approval	-0.08	0.04	3.82	0.05	-0.02
African American	Yes-now immediately	0.38	0.05	49.78	<.0001	0.08
African American	Yes-only after full FDA approval	0.58	0.06	95.5	<.0001	0.11
Asian	Yes-now immediately	1.01	0.08	177.09	<.0001	0.16
Asian	Yes-only after full FDA approval	1.1	0.08	171.04	<.0001	0.18
Latino	Yes-now immediately	0.46	0.07	48.62	<.0001	0.07
Latino	Yes-only after full FDA approval	0.54	0.07	53.31	<.0001	0.08
NA_PI, other	Yes-now immediately	-0.54	0.07	65.23	<.0001	-0.08
NA_PI, other	Yes-only after full FDA approval	-0.3	0.08	15.34	<.0001	-0.04
18-25	Yes-now immediately	0.08	0.07	1.33	0.248	0.01
18-25	Yes-only after full FDA approval	0.21	0.07	8.97	0.003	0.04

26-35	Yes-now immediately	0.01	0.05	0.03	0.86	0.002
26-35	Yes-only after full FDA approval	0.08	0.06	1.57	0.21	0.02
46-55	Yes-now immediately	0.11	0.05	4.07	0.04	0.02
46-55	Yes-only after full FDA approval	-0.05	0.06	0.69	0.41	-0.01
56-65	Yes-now immediately	0.52	0.06	86.72	<.0001	0.11
56-65	Yes-only after full FDA approval	0.07	0.07	1.16	0.28	0.01
66-75	Yes-now immediately	0.87	0.07	136.29	<.0001	0.13
66-75	Yes-only after full FDA approval	0.24	0.09	6.83	0.01	0.04
Married with children	Yes-now immediately	0.01	0.04	0.06	0.81	0.003
Married with children	Yes-only after full FDA approval	0.14	0.05	7.83	0.01	0.04
Married with no children	Yes-now immediately	0.27	0.05	27.02	<.0001	0.06
Married with no children	Yes-only after full FDA approval	0.34	0.06	33.66	<.0001	0.08
Single, other	Yes-now immediately	-0.05	0.06	0.64	0.42	-0.01
Single, other	Yes-only after full FDA approval	0.1	0.07	2.09	0.15	0.02
Jewish, Buddhist, Hindu, Muslim	Yes-now immediately	0.73	0.06	168.3	<.0001	0.14
Jewish, Buddhist, Hindu, Muslim	Yes-only after full FDA approval	0.16	0.07	5.29	0.02	0.03
Other	Yes-now immediately	0.17	0.05	10.61	0.001	0.03
Other	Yes-only after full FDA approval	0.12	0.06	4.08	0.04	0.02
Unbeliever	Yes-now immediately	1.4	0.05	692.89	<.0001	0.3
Unbeliever	Yes-only after full FDA approval	0.88	0.06	205.37	<.0001	0.19
Academic/research	Yes-now immediately	0.97	0.06	259.05	<.0001	0.18
Academic/research	Yes-only after full FDA approval	0.51	0.07	53.51	<.0001	0.09
Hospital	Yes-now immediately	0.24	0.05	26.45	<.0001	0.05
Hospital	Yes-only after full FDA approval	-0.02	0.06	0.19	0.67	-0.01
Other	Yes-now immediately	0.31	0.05	34.92	<.0001	0.06
Other	Yes-only after full FDA approval	-0.02	0.06	0.15	0.7	-0.005
Single specialty physician group	Yes-now immediately	0.29	0.06	25.38	<.0001	0.05
Single specialty physician group	Yes-only after full FDA approval	0.01	0.07	0.01	0.94	0.001

Table 5: Adjusted model for healthcare workers.

Parameter	Educators, coaches, etc.	Est	SE	Chi-Sq	p-value	STD Est
Intercept	Yes-now immediately	-0.68	0.05	155.73	<.0001	-
Intercept	Yes-only after full FDA approval	-1.02	0.06	272.59	<.0001	-
Female	Yes-now immediately	-0.19	0.04	27.73	<.0001	-0.05
Female	Yes-only after full FDA approval	-0.19	0.04	22.58	<.0001	-0.05
African American	Yes-now immediately	0.61	0.05	123.04	<.0001	0.12
African American	Yes-only after full FDA approval	0.75	0.06	162.19	<.0001	0.15
Asian	Yes-now immediately	1.1	0.07	218.71	<.0001	0.18
Asian	Yes-only after full FDA approval	1.18	0.08	215.81	<.0001	0.19
Latino	Yes-now immediately	0.61	0.07	84.76	<.0001	0.09
Latino	Yes-only after full FDA approval	0.6	0.07	70.77	<.0001	0.09
NA_Pi, other	Yes-now immediately	-0.46	0.07	47.58	<.0001	-0.07
NA_Pi, other	Yes-only after full FDA approval	-0.25	0.08	10.74	0.001	-0.04
18-25	Yes-now immediately	0.02	0.07	0.06	0.8	0.003
18-25	Yes-only after full FDA approval	0.18	0.07	6.59	0.01	0.03
26-35	Yes-now immediately	-0.03	0.05	0.39	0.53	-0.01
26-35	Yes-only after full FDA approval	0.1	0.06	3.23	0.07	0.02
46-55	Yes-now immediately	0.14	0.05	6.64	0.01	0.03
46-55	Yes-only after full FDA approval	-0.01	0.06	0.03	0.85	0
56-65	Yes-now immediately	0.57	0.06	105.82	<.0001	0.12
56-65	Yes-only after full FDA approval	0.1	0.07	2.21	0.14	0.02
66-75	Yes-now immediately	0.97	0.07	173.39	<.0001	0.14
66-75	Yes-only after full FDA approval	0.36	0.09	15.45	<.0001	0.05
Married with children	Yes-now immediately	-0.004	0.04	0.01	0.93	-0.001
Married with children	Yes-only after full FDA approval	0.11	0.05	5.25	0.02	0.03
Married with no children	Yes-now immediately	0.27	0.05	27.15	<.0001	0.06
Married with no children	Yes-only after full FDA approval	0.42	0.06	53.78	<.0001	0.1
Single, other	Yes-now immediately	0.04	0.06	0.43	0.51	0.01

Single, other	Yes-only after full FDA approval	0.21	0.07	10.36	0.001	0.04
Jewish, Buddhist, Hindu, Muslim	Yes-now immediately	0.85	0.06	223.65	<.0001	0.16
Jewish, Buddhist, Hindu, Muslim	Yes-only after full FDA approval	0.37	0.07	30.2	<.0001	0.07
Other	Yes-now immediately	0.2	0.05	14.83	0.0001	0.04
Other	Yes-only after full FDA approval	0.16	0.06	7.93	0.005	0.03
Unbeliever	Yes-now immediately	1.37	0.05	706.64	<.0001	0.29
Unbeliever	Yes-only after full FDA approval	0.97	0.06	282.26	<.0001	0.21
Academic/research	Yes-now immediately	0.82	0.06	193.95	<.0001	0.15
Academic/research	Yes-only after full FDA approval	0.57	0.07	73.99	<.0001	0.11
Hospital	Yes-now immediately	0.18	0.05	14.74	0.0001	0.04
Hospital	Yes-only after full FDA approval	0.06	0.05	1.3	0.25	0.01
Other	Yes-now immediately	0.29	0.05	30.57	<.0001	0.06
Other	Yes-only after full FDA approval	0.06	0.06	1.05	0.3	0.01
Single specialty physician group	Yes-now immediately	0.16	0.06	7.76	0.01	0.03
Single specialty physician group	Yes-only after full FDA approval	0.05	0.07	0.55	0.46	0.01

Table 6: Adjusted model for educators, coaches, etc.

In considering mandatory vaccinations for healthcare workers and medical practice status, the respondents in academic or research settings had the lowest disapproval (19%) and the highest 'now immediately' (59%). Respondents not in health care had the highest disapproval (35%) and lowest 'now immediately' (40%) with Chi-square=371, p-value<0.0001. As has been the case before, the opinions on educator and coaches. was similar at disapproval (22%) and 'now immediately' (52%) while not in health care had the highest disapproval (37%) and lowest 'now immediately' (38%) with Chi-square=270, p-value<0.0001.

Adjusted model

The model of the healthcare workers used 20,157 (97.8%). The reference level was the disapproval of mandatory vaccinations ('No'=6,307 (31.3%). The largest preference was for immediate vaccination (9,269 (46%)) and after federal approval (4,581 (22.7%)). Using the R-square, the model explained 10.2% of the variance in the choices. The global null hypothesis that all the coefficients were zero was rejected the Chi-square=2175.9, p-value <0.0001. The type III analysis showed the global hypothesis of null for the variables were statistically significant. The multinomial logistic regression compared the responses of women vs men (reference) for immediate vaccinations. The result was women were less inclined to immediate vaccinations than men. The association decreased by 13%, p-value=0.0002 going from men to women. The Odds-Ratio and 95% Confidence Interval

(OR, CI) were 0.88 (0.82, 0.94). In contrast, women were not different than men in waiting for federal approval. The association decreased by 8%, p-value=0.05. The odds-ratio and confidence interval for this value included 1.0, that is OR, CI 0.92 (0.85, 1.0). Race/Ethnicity showed a dramatic difference. The relative log odds were higher for most groups of people of color vs White Caucasians. The largest increase was for Asians, 1.01 and 1.10 for 'now immediately' and waiting for government approval, respectively. The only group that had lower relative log odds was Native Americans and Pacific Islanders which decreased for 'now immediately' by 0.54 and federal approval 0.30. Age category had small relative log odds for most categories compared to the reference group (36 to 45). Similarly, marital status had mostly small relative log odds. In contrast, non-christians had dramatically higher relative log odds compared to Christians. Specifically, Atheist/agnostics increased by 1.40 and 0.88 for 'now immediately' and federal approval, respectively. The second largest increase in relative log odds was the group of Jewish, Buddhist, Hindu and Muslim respondents. The increases were 0.73 and 0.16 for 'now immediately' and waiting for federal approval, respectively. Finally, compared to not working in health care, respondents in academic/research roles showed the largest relative log odds at 0.97 and 0.51 for 'now immediately' and waiting for federal approval, respectively. Notably, the other groups showed strong relative log odds for 'now immediately', but no difference from respondents not working in health care for waiting for federal approval (Tables 7 and 8).

Effect	Category	Healthcare workers		
		Point Est	95% Confidence limits	
Female vs Male	Yes-now immediately	0.88	0.82	0.94
Female vs Male	Yes-only after full FDA approval	0.92	0.85	1
African American vs White Caucasian	Yes-now immediately	1.47	1.32	1.63
African American vs White Caucasian	Yes-only after full FDA approval	1.79	1.59	2.01
Asian vs White Caucasian	Yes-now immediately	2.74	2.36	3.18
Asian vs White Caucasian	Yes-only after full FDA approval	2.99	2.54	3.52
Latino vs White Caucasian	Yes-now immediately	1.59	1.39	1.81
Latino vs White Caucasian	Yes-only after full FDA approval	1.71	1.48	1.97
NA_PI, other vs White Caucasian	Yes-now immediately	0.59	0.51	0.67
NA_PI, other vs White Caucasian	Yes-only after full FDA approval	0.74	0.63	0.86
18-25 vs 36-45	Yes-now immediately	1.08	0.95	1.23
18-25 vs 36-45	Yes-only after full FDA approval	1.24	1.08	1.43
26-35 vs 36-45	Yes-now immediately	1.01	0.91	1.12
26-35 vs 36-45	Yes-only after full FDA approval	1.08	0.96	1.21
46-55 vs 36-45	Yes-now immediately	1.11	1	1.24
46-55 vs 36-45	Yes-only after full FDA approval	0.95	0.84	1.07
56-65 vs 36-45	Yes-now immediately	1.69	1.51	1.89
56-65 vs 36-45	Yes-only after full FDA approval	1.08	0.94	1.23
66-75 vs 36-45	Yes-now immediately	2.39	2.06	2.76
66-75 vs 36-45	Yes-only after full FDA approval	1.28	1.06	1.53
Children vs Married	Yes-now immediately	1.01	0.93	1.1
Children vs Married	Yes-only after full FDA approval	1.15	1.04	1.28
No children vs Married	Yes-now immediately	1.31	1.18	1.45
No children vs Married	Yes-only after full FDA approval	1.41	1.26	1.58
Single, other vs Married	Yes-now immediately	0.95	0.85	1.07
Single, other vs Married	Yes-only after full FDA approval	1.1	0.97	1.26
Jewish, Buddhist, Hindu, Muslim vs Christian	Yes-now immediately	2.08	1.86	2.33
Jewish, Buddhist, Hindu, Muslim vs Christian	Yes-only after full FDA approval	1.17	1.02	1.35
Other vs Christian	Yes-now immediately	1.18	1.07	1.31
Other vs Christian	Yes-only after full FDA approval	1.12	1	1.26
Unbeliever vs Christian	Yes-now immediately	4.07	3.66	4.51
Unbeliever vs Christian	Yes-only after full FDA approval	2.42	2.14	2.73

Academic/research vs Not in health care	Yes-now immediately	2.65	2.35	2.98
Academic/research vs Not in health care	Yes-only after full FDA approval	1.67	1.45	1.91
Hospital vs Not in health care	Yes-now immediately	1.28	1.16	1.4
Hospital vs Not in health care	Yes-only after full FDA approval	0.98	0.88	1.09
Other vs Not in health care	Yes-now immediately	1.37	1.23	1.52
Other vs Not in health care	Yes-only after full FDA approval	0.98	0.86	1.1
Single specialty physician group vs Not in health care	Yes-now immediately	1.34	1.2	1.5
Single specialty physician group vs Not in health care	Yes-only after full FDA approval	1.01	0.88	1.15

Table 7: Multinomial logistic regression of opinions of mandatory vaccinations (Healthcare workers).

Effect	Category	Educators, Coaches		
		Point Est	95% Confidence limits	
Female vs Male	Yes-now immediately	0.83	0.77	0.89
Female vs Male	Yes-only after full FDA approval	0.83	0.77	0.89
African American vs White Caucasian	Yes-now immediately	1.84	1.65	2.05
African American vs White Caucasian	Yes-only after full FDA approval	2.11	1.88	2.37
Asian vs White Caucasian	Yes-now immediately	3.01	2.6	3.49
Asian vs White Caucasian	Yes-only after full FDA approval	3.27	2.79	3.82
Latino vs White Caucasian	Yes-now immediately	1.83	1.61	2.09
Latino vs White Caucasian	Yes-only after full FDA approval	1.83	1.59	2.11
NA_PI, Other vs White Caucasian	Yes-now immediately	0.63	0.55	0.72
NA_PI, Other vs White Caucasian	Yes-only after full FDA approval	0.78	0.68	0.91
18-25 vs 36-45	Yes-now immediately	1.02	0.89	1.16
18-25 vs 36-45	Yes-only after full FDA approval	1.2	1.04	1.37
26-35 vs 36-45	Yes-now immediately	0.97	0.87	1.07
26-35 vs 36-45	Yes-only after full FDA approval	1.11	0.99	1.25
46-55 vs 36-45	Yes-now immediately	1.15	1.03	1.27
46-55 vs 36-45	Yes-only after full FDA approval	0.99	0.88	1.11
56-65 vs 36-45	Yes-now immediately	1.78	1.59	1.98
56-65 vs 36-45	Yes-only after full FDA approval	1.1	0.97	1.26
66-75 vs 36-45	Yes-now immediately	2.64	2.29	3.05
66-75 vs 36-45	Yes-only after full FDA approval	1.43	1.2	1.7
Children vs Married	Yes-now immediately	1	0.92	1.08
Children vs Married	Yes-only after full FDA approval	1.12	1.02	1.24
No children vs Married	Yes-now immediately	1.31	1.18	1.45

No children vs Married	Yes-only after full FDA approval	1.52	1.36	1.7
Single, other vs Married	Yes-now immediately	1.04	0.93	1.17
Single, other vs Married	Yes-only after full FDA approval	1.23	1.09	1.4
Jewish, Buddhist, Hindu, Muslim vs Christian	Yes-now immediately	2.34	2.09	2.61
Jewish, Buddhist, Hindu, Muslim vs Christian	Yes-only after full FDA approval	1.44	1.27	1.65
Other vs Christian	Yes-now immediately	1.22	1.1	1.35
Other vs Christian	Yes-only after full FDA approval	1.17	1.05	1.31
Unbeliever vs Christian	Yes-now immediately	3.92	3.54	4.33
Unbeliever vs Christian	Yes-only after full FDA approval	2.65	2.36	2.96
Academic/Research vs Not in health care	Yes-now immediately	2.27	2.02	2.54
Academic/Research vs Not in health care	Yes-only after full FDA approval	1.76	1.55	2.01
Hospital vs Not in health care	Yes-now immediately	1.2	1.09	1.32
Hospital vs Not in health care	Yes-only after full FDA approval	1.06	0.96	1.18
Other vs Not in health care	Yes-now immediately	1.34	1.21	1.49
Other vs Not in health care	Yes-only after full FDA approval	1.06	0.95	1.2
Single specialty physician group vs Not in health care	Yes-now immediately	1.17	1.05	1.31
Single specialty physician group vs Not in health care	Yes-only after full FDA approval	1.05	0.92	1.2

Table 8: Multinomial logistic regression of opinions of mandatory vaccinations (educators, coaches).

In considering mandatory vaccinations of educators/coaches, females feel more strongly than considering mandatory vaccinations of healthcare workers. The relative log odds were decreased 0.19 from males to females for both 'now immediately' and waiting for federal approval. The patterns for health care workers were largely replicated for mandatory vaccinations of educators/coaches.

The relative risks are analogous to the odds-ratios in this analysis. The odds ratios are sometimes readily more interpretable than the coefficients in the model. The odds ratio for race/ethnicity shows the group most in favor of mandatory vaccinations healthcare workers and Educators/coaches were Asians with 2.74 (2.36, 3.18) for 'now immediately' and 2.99 (2.54, 3.52) for after federal approval. African Americans were 47% more in favor of mandatory vaccinations. The estimate and 95% confidence limits were 1.47 (1.32, 1.63) for 'now immediately' and 1.79 (1.59, 2.01). Latinos felt similarly, with estimate and 95% confidence limits were 1.59 (1.39, 1.81) for 'now immediately' and 1.71 (1.48, 1.97) for waiting for federal approval. As suggested by the model, the Native Americans and Pacific Islanders were not in favor with point estimates 0.59 (0.51, 0.67) and 0.74 (0.63, 0.86) for 'now immediately' and waiting for FDA approval, respectively. Age category and marital status both have difficult to interpret statistical significance. In contrast, every creed showed statistical significance with the strongest odds ratio and 95% confidence limits, Atheist/agnostic 4.07 (3.66, 4.51) for 'now immediately' and 2.42 (2.14, 2.73) for awaiting FDA approval. By looking at medical practice vs not in health care, the pattern of statistical significance is interpretable. For example, being in academic or research practices both levels were statistically significant with point estimate and 95% confidence limits being 2.65 (2.35, 2.98) for 'now immediately' and 1.67 (1.45, 1.91) for waiting for

FDA approval. The hospital practitioners were 1.28 (1.16, 1.40) for 'now immediately', but not different for not in health care for 0.98 (0.88, 1.09). similarly for Other and single specialty physician group with the odds ratios and 95% being 1.37 (1.23, 1.52) and 0.98 (0.86, 1.10) for 'now immediately' and FDA approval as well as 1.34 (1.20, 1.50) and 1.01 (0.88, 1.15), respectively.

The results for the educators, coaches, etc. show the same pattern as that for healthcare workers.

Discussion

This is a confirmatory study that used an online survey to examine the opinions of respondents to mandatory COVID vaccines for various professions. Here we present results for mandatory vaccination for healthcare workers as well as mandatory vaccination for educators/coaches. The results were analyzed with categorical tables for the individual characteristics of the respondents (predictors) and the categories of the outcome variables (dependent). The dependent and predictors were included in a multinomial model to assess the associations of the predictors. In the unadjusted table, respondents were in favor of immediate mandatory vaccinations (46%) compared to No (31%) and after FDA approval (23%). More than half of the respondents were male (55%). In addition, they were predominantly White Caucasian (59%) and Christian (54%). Since the online groups were medical discussion groups, a substantial number of the respondents were health care professionals (43%).

In this sample, both males and females wanted mandatory vaccination for healthcare workers controlling for the other factors. In comparing female to male of the group of "No" mandatory vaccines

for healthcare workers. The Female group significantly favored of “No” mandatory vaccines for healthcare workers when compared to males. But both were similar in waiting for FDA approvals equally. The finding for females could reflect their stated intention to not get the vaccine (compared to males). Zintel, et al., reported that fewer women than men stated they will not get the vaccine. This was across all countries examined and the association was more pronounced for healthcare workers [19]. In this study healthcare workers were 21% and males were 22%. Therefore, this study cannot address intention between the sexes. However, this study adds to the findings that suggest focusing on female opinions and attitudes should be a focus to address vaccine uptake for new variants. Among racial/ethnic groups the associations to mandatory vaccinations were very pronounced while controlling for the other factors. African Americans, Asians, and Latinos were substantially in favor compared to Whites for both immediately and after FDA approval of mandatory vaccination for healthcare workers. These groups were likely aware of the greater burden of COVID in their respective communities compared to White Caucasians [20-22]. Previous research has shown African Americans and Latinos were most likely to test positive and Asian Americans were most likely to end up in the ICU [20]. So persons from these communities were more likely to have witnessed the effects on infected individuals [23], and effects on immediate family members as well as the community [24-27]. Lundberg, et al., reported that in the first year of the outbreak in the US, mortality rates were higher for People of Color (POC) (that is, Hispanic, non-Hispanic African Americans and non-Hispanic American Indian or Alaska Natives) than non-Hispanic Whites [27].

However, during the second year, the disparities were reduced. Unfortunately, the reduction was due to increased deaths among for non-Hispanic Whites [27].

Nevertheless, the initial effect on POC might be associated with the positive attitude to mandatory vaccination. Age categories were associated with favoring mandatory vaccines but were not significantly different from the reference category (36-45) for immediately or after FDA approval. This suggests that attitudes to the COVID vaccines were spread among adults of all ages. Every marital status was clearly of tended toward favoring mandatory vaccines for healthcare workers and most were statistically different from married for immediately and after FDA approval.

These two findings suggest that emphasis need not focus on the age and marital status. We combined several creeds into categories to maintain stability of the model. All creeds were associated with being in favor of mandatory vaccination for healthcare workers. In addition, for both immediately and after FDA approval the association was stronger than that of Christians except for “other” category for after FDA approval. This suggests that policy about vaccine mandates might not have to focus on creed in deliberations. In terms of type of practice, all the associations in favor of vaccine mandates for healthcare workers. Moreover, compared to respondents not in healthcare, practitioners were associated with immediate vaccine mandates.

This finding appears to be at variance with other studies. In reporting a meta-analysis, Zintel, et al., found females in healthcare had fewer intentions of getting the vaccine than men [19]. One possibility for the departure among the respondents in our study is a demonstrated interest in the topic as a consequence of participating in the social media groups. They are stratified by their interest from the pool of healthcare workers. Stratified pools such as these might be advocates for vaccines as the next variants arise.

Political party affiliation also affected vaccine uptake. Wallace,

et al., found excess deaths at the individual level among Republicans than Democrats in Florida and Ohio. The difference was more pronounced after vaccines were available for adults [15]. The leaders of the Republican party were resistant to the recommendations and adamant about keeping open businesses and schools [28]. Mostly States that tend to support the Republicans had the highest mortality rates (per 100,000 in 2021) (Oklahoma, Alabama, Texas, West Virginia, Mississippi, Wyoming, Tennessee, Nevada, Arizona, South Carolina, Kentucky, New Mexico, Georgia, Arkansas, Ohio, Louisiana, Idaho, Florida, Alaska, Montana, North Carolina, Michigan, Indiana, Kansas, Pennsylvania, Missouri) ranging from a high of 158.8 in OK to 100.8 in Missouri (per 100,000). In contrast, Democratic states had the lowest rates in the same year with the highest in California at 99.9 and the lowest was Vermont at 29.5 [11].

However, this study suggests that persons would be more open to vaccinations for the coming variants 6, 8 and a novel disease X [16]. The current administration is firmly behind recommendations to control the outbreaks [29], in contrast to the previous administration [30, 31]. In addition, many ardent persons against vaccines succumbed to COVID and are highlighted on websites dedicated to featuring them and some testifying and encouraging vaccines in their dying breaths [32]. These persons were trusted by vaccine hesitant followers [33, 34]. Jensen, et al., reported that charismatic speeches by governors affected the response to the distancing and stay-at-home recommendations [35]. In addition, framing the choices in terms for finances appear to have an effect of vaccine hesitancy among Republicans [36].

Conclusion

Analysis is cross sectional changes in attitude can change over time. We cannot determine the extent to which COVID vaccines initiated vaccine hesitancy or previous vaccine hesitancy attitudes initiated the resistance to COVID vaccine. However, once the cycle has begun, they start a positive feedback loop to follow or resist recommendations. The demographics in the questionnaire asked for sex not gender. Sex is biological while gender is a social construct that places the respondent in a community that can influence access and affects such as depression or a feeling of isolation. However, the opinion part afforded the respondent with the opportunity to provide gender. A few respondents chose to list non-binary. The responses were not different from the other respondents and were too few to affect the outcomes if gender was probed.

However, the association between COVID and the attitudes to vaccines. Further analysis is needed to disaggregate the effect. Self-selected responders with interest to participate in medical social media discussions. Their attitudes might not be generalizable. However, the data from states suggest that access to social media might provide only a small marginal effect.

Declarations

Informed consent

This research was approved by the Cedars-Sinai Medical Center, Los Angeles, California IRB.

This is a voluntary survey and informed consent was obtained from all subjects and/or their legal guardian(s).

Author contribution

Richard Hector and Calvin Johnson-data analysis and wrote main manuscript text Gabriel Pollock and Micheal Kissen -reviewed the manuscript Roberto Vargas. - data analysis and reviewed the manuscript.

Data availability statement

All Raw data is uploaded as supplementary file. All data generated or analyzed during this study are included in this published article and its supplementary information files.

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