ASSOCIATION BETWEEN COVID-19 RELATED DISTRESS AND UPTAKE OF INFLUENZA AND COVID-19 VACCINES: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: It is well-known that exposure to significant distress such as the current pandemic and the restrictions that accompanied it, can be associated with negative psychological effects and adoption of new protective behaviors. Moreover, influenza vaccination uptake had always been lower than 50% in the U.S. This research aims to describe an association between the COVID-19-related distress and increase in the influenza vaccine uptake.

Methods: This is a cross-sectional study of 201 respondents. An online self-administered questionnaire was distributed between January 2021-March 2021. The COVID-19 psychosocial and practical experience scales from the university of Miami were used to assess sample distress. The primary outcome was uptake of influenza vaccine. The secondary outcome was uptake of COVID-19/ and or intention to receive COVID-19 vaccine. An open-ended question was used to assess barriers and facilitators of vaccination in general. Basic statistics were computed, and bivariate and multivariate logistic regression analyses were used to describe the vaccine uptake associations. Content analysis was used for the qualitative analysis of the open-ended question.

Results: COVID-19 specific distress (Emotional and Physical Reactions), OR: 2.15, 95% CI: 1.17 – 3.95, financial hardship, OR: 6, 95% CI: 1.32 – 26, prior influenza vaccination, OR: 125, 95% CI: 25 – 630 and uptake of COVID-19 vaccine, OR: 26.72, 95% CI: 4 – 196 were significantly associated with uptake of influenza vaccine. As for the uptake of COVID-19 vaccine, it was associated with prior influenza vaccination, OR: 5.22, 95% CI: 1.9 – 14.2, perceived benefits, OR: 0.56, 95% CI: 0.32- 0.98, and perceived stress management, OR: 3.48, 95% CI: 1.38 – 8.80. Finally, the most common barriers to vaccination in general were concerns about safety and side effects, access and availability, and lack of trust in the healthcare system. While the facilitators were prevention, protection, and care on the individual, community, and societal levels.

Conclusion: In conclusion, focusing on multi-level interventions to promote vaccination is the cornerstone for successful distribution and uptake of vaccines. Understanding the specific type of distress related to the COVID-19 pandemic that is deriving vaccination uptake is an important step to identify the impact of pandemic distress and deepen understanding of behavior towards vaccination for future interventions that address uptake of vaccination.

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INTRODUCTION

Viruses that cause respiratory illnesses vary in origin and cause a wide-range of symptoms. However, they are similar to each other in the way they are transmitted and the way they can be prevented. Although it is well-known that standard precautions are important and essential in controlling infections in general (1), vaccination remains the most effective in preventing vaccine-preventable infections (2).

Influenza Virus Burden and Influenza Vaccine Effectiveness

According to the Center for Disease Control (CDC), in 2019-2020 season, Influenza virus caused 18,000,000 medical visits, 400,000 hospitalizations, and 22,000 deaths in the United States (3). Influenza vaccination is recommended for everyone who is 6 months and older (4). Influenza vaccine is an effective tool to prevent influenza infection, hospitalization, and death (4). In 2019-2020 influenza season, influenza vaccination prevented 7.5 million influenza illnesses, 3.7 million influenza-associated medical visits, 105,000 influenza-associated hospitalizations, and 6,300 influenza-associated deaths (4).

Moreover, one study evaluated the estimated number of influenza cases averted by vaccination over six seasons across all age groups and found that it was 13,599,931 (95% CI 8,001,525- 22,806,782) (5). This was in addition to an estimated number of hospitalizations related to influenza that was averted by vaccination which was 112,875 (95% CI 65,036 – 191,540) (5).

Furthermore, it is well-known that the most vulnerable age groups to influenza infection complications are elderly people (65 + years) and immunocompromised individuals (6,7). A meta-analysis and a systematic review extensively looked into the influenza vaccine effectiveness and safety among immunocompromised patients, and concluded that immunocompromised individuals should be receiving the influenza vaccination (8). The same recommendation is for elderly people as they are at high risk for influenza

complications as per the CDC (7). Influenza vaccine effectiveness depends on the match of the vaccine components and the circulating viruses in the specific season, if they were well-matched the vaccine effectiveness can range from 40% to 60% among overall population (4).

Influenza Vaccine Uptake and Coverage

There is an accumulating evidence in two large systematic reviews which shows that despite influenza vaccinations availability, there is still low uptake rates both globally and in the United States across all populations including those who are at higher risk of influenza-related complications (9–11). For instance, a study that was conducted in Australia found that despite the presence of at least one risk factor for severe influenza in 54% of the participants, 60% of the total study participants did not receive influenza vaccine (10). Remarkably, most of the study participants did not have worry perception about influenza (10). Additionally, this low uptake was even reported among those who have chronic respiratory conditions such as asthma and bronchitis (44%) (12).

The overall influenza vaccination coverage among those who are 18 years and older in the United States in 2019-2020 season was 48.4%. According to the CDC, a time trend from 2010 until 2020 showed a plateau of influenza vaccine coverage rate that ranged from 40% and never exceeding 48.4% (13). Furthermore, there was a slight increase by 3 percentage points (48.4%) in 2019-2020 influenza season in vaccination rates among adults compared to previous seasons (13). However, the time trend of the overall influenza vaccination coverage rate across all age groups have been in the same range since 2010 until 2020 which is 40-48% only (13). One of the methods used to estimate these rates is through random digit dialing (telephone survey and interviews), and these are based on N=286,116 subjects (13).

Although the influenza vaccination coverage rates of adults (18 years and older) across different races were almost in the same range, there was significant disparities among Hispanic adults (38.3%) and non-Hispanic black adults (41.2%) who had lower flu

vaccination coverage than non-Hispanic white adults (52.8%) (13). Moreover, there was age disparities, as those who were 65 years and older were having the highest influenza vaccination coverage rates steadily since 2010, ranging from 66-70% (13). This could be due to high perception of risk among this age group.

This low uptake could be explained by 'Vaccine hesitancy' which is highly driven by complex behavioral factors that vary according to different contexts (14). Several studies tried to associate different theories of behavior to predict vaccination intention and to use these theories to increase immunization in general, ultimately through attitude change (15–18). Some of these studies applied the Theory of Planned Behavior, others used Protection Theory, while others used Self-Efficacy Theory (15–18). Most of these studies concluded that perception of threat, perceived severity, and the perceived benefits of vaccination as good predictors of intention, while other studies attributed high vaccination intention to health, emotional, social and environmental consequences (15–18).

Influenza Vaccine Uptake Facilitators and Barriers

Many studies rigorously addressed the barriers and facilitators for the uptake of influenza vaccination. A systematic review of more than 470 studies conducted in the American and European regions, reported various barriers to influenza vaccination these studies were among healthcare personnel, general public, and high risk groups (19). Some barriers included: low risk perception, lower normative influence, low self-efficacy (lack of perceived behavioral control), attitude (not believing in vaccine effectiveness or distrust of authorities). Other contextual barriers were cost, health provider influence, and access (geographical, political or economic) (19). Some sociodemographic variables were reported frequently, yet with inconsistent evidence as predictors of influenza vaccine uptake such as gender and age.

Although these barriers were similar between seasonal and pandemic influenza, for pandemic influenza, more barriers were prominent such as: complacency including:

decreased worry about the disease, low perceived risk of the disease, decreased severity of the disease, and decreased susceptibility to getting the disease (19). Furthermore, lack of confidence, decreased trust in authorities., decreased perceived vaccine effectiveness, decreased perceived subjective norm, increased worry about the safety of the vaccine, and increased negative attitude towards the vaccine (19).

In contrast, some facilitators of influenza vaccination uptake were reported in many studies including believing that the vaccine is a beneficial preventive tool and pursuing vaccination for the social benefit (herd immunity) (19). In addition to prior behavior, uptake of other vaccines such as pneumococcal vaccine in elderly and chronically ill individuals was also associated with uptake of Influenza vaccine (19).

COVID-19 Burden

In addition to the annual seasonal influenza burden, the current COVID-19 pandemic which is caused by SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) virus exerted an additional burden, as it affected 83.1 million, 70.4 millions of those were symptomatic, and 4.1 million hospitalized, it also led to 482,536 deaths since January 21, 2020 in the United states alone (20). Globally, it has caused 109,690,062 cases and led to 2,419,172 deaths (21). As COVID-19 is still under extensive research and studying, and knowing that the infection causes a mild to moderate illness in the majority of cases, it had been reported that those who are at high risk for serious complications and possibly death are those who have medical conditions (heart disease, diabetes, or lung disease) and those who are of older age, researchers are still conducting studies to identify more risk factors for severe COVID-19 illness (22).

COVID-19 Vaccine

Several COVID-19 vaccines are under development and some of them have been authorized by the Food and Drug Administration (FDA) (23,24). The Advisory Committee

on Immunization Practices (ACIP) reviews all the available data and makes their recommendation regarding who receives the vaccine first based on ethical principles (24). In December 2020 the ACIP recommended offering COVID-19 vaccine in a phased-in manner or pattern, prioritizing risk groups according to scientific evidence and considering ethical principles to allocate vaccination (25). Initially, in phase 1a the ACIP recommended that COVID-19 should be offered to healthcare workers and long-term care facility residents, in phase 1b to those who are 75 years and older, frontline essential workers (non-healthcare), and in phase 1c to those who are between 65-74 years old, and those who are 16-64 years with high-risk medical conditions, and essential workers not included in the phase 1b (25).

Research on COVID-19 is flourishing, and many researchers were interested in intention to vaccinate worldwide, even before COVID-19 vaccines availability (18,26–32). Research done in the U.S. and in other countries (United Kingdom, France, Australia, New Zealand, and many other countries) showed a wide range of intentions towards COVID-19 vaccination (18,26–32).

Exposure to Pandemic-related Distress and Behavioral Changes

It is well-known that exposure to significant distress such as the current pandemic and the restrictions that accompanied it can be associated with negative psychological effects such as depression, anxiety, irritability, insomnia, symptoms of post-traumatic stress, and emotional exhaustion (33–40). These effects are due to the pandemic itself and due to the added pressure of quarantine and restrictions that are related to the COVID-19 pandemic (33). More importantly, it becomes even more dire when this extensive distress leads to negative behavioral changes or uptake due to fear of infection, social isolation, financial insecurity, and limited access to basic supplies (33).

Studies reported that the COVID-19 pandemic caused increased alcohol drinking and suicide rates among individuals who were unable to engage in health-protective behaviors

(40). Even though perception of moderate threat can facilitate adoption of positive health-protective behaviors, some people react differently and engage in negative self-destructive behaviors (34). Also, low perceived threat might not motivate individuals to change any behavior. This was a prominent barrier for influenza vaccination uptake (41).

Many studies were published in 2020, reporting the negative and positive psychological and behavioral consequences of the current pandemic and the related restrictions (quarantine) (33–40). For example, a study that was conducted in Spain reported that families relationships improved due to the closeness and proximity of family members (33). Similarly, a study in New York among HCW, found that the most frequently reported new behaviors and perspectives were: stress reduction behaviors (exercise, meditation, talk therapy, and faith-based practices), optimism and sense of purpose, and seeking mental wellness (37).

During the H1N1 pandemic, there was a study which associated the pandemic with uptake of the vaccine and one or more behavioral change (42). Where 60% of participants were accepting the H1N1 vaccine and were undertaking more than one behavioral change due to the pandemic, adjusted OR: 1.8, 95%CI: 1.2-2.5, P-value: 0.003 (42). Moreover, a study that was conducted in the United States in 2013 demonstrated a sharp rise in vaccination coverage in 2010 influenza season following the 2009 pandemic (5).

Prior Behavior Towards Influenza Vaccine as a Predictor for Future Vaccination Uptake

Several studies and a systematic review concluded that prior behavior towards vaccination is significantly associated with future vaccination intentions (43–47). For instance, in a case-control study that was conducted among cancer patients, those who received influenza vaccine for the past 10 years and intended to vaccinate during the study were 77.5% vs. 32% (unvaccinated) OR 7.1 (95% CI 5.2-9.8) (44).

Moreover, during the H1N1 pandemic, the vaccination for both the seasonal influenza vaccine and the H1N1 vaccine uptake were higher among those who had previous positive behavior towards vaccination in general 66.7% vs. 20.3%, OR 7.9, (95% CI 5.7–10.8) and 32% vs. 8.4%, OR 5.2, (95% CI 3.4–7.8) respectively (44). Another study in Japan also reported that intention to vaccinate against influenza was associated with having been vaccinated in the previous year OR 3.81 (95% CI 3.75–3.86) (46).

Moreover, the majority of participants who reported intention to receive an influenza vaccination also reported receiving an influenza vaccination in the previous year (50.9%), including receipt of an influenza vaccination in the past year [odds ratio (OR) = 6.21, $P < 0.001$] (47).

Intentions to Vaccination against Influenza

Many studies looked into seasonal influenza vaccination intention and reported a wide range of results (16,46–51). For instance, in the U.K. those who intended to vaccinate against seasonal influenza constituted 48.2%, in Japan 25.4%, in Hong Kong 31.3%, in the U.S one study reported 33.8% and another study reported 67% (16,46–49). It is quite recognizable that there is a wide vairiation in intentions to vaccination that depends on the time, context, health condition, behavior, and other factors. Further research also revealed that sometiems intentions do not necessarily align with behavior, which indicates the complexity and depth of vaccination intentions and behavior towards vaccination (52).

Intentions to Vaccination against COVID-19

Many studies were published in 2020 to determine the future uptake of COVID-19, most of these studies were conducted before the availability of the vaccine. For instance, intentions ranged from 86% in the UK, U.S reaching up to 72%, 75% in France among healthcare workers, 60.5% in Australia, and 74% in New Zealand (18,26–32). Studies conducted in the U.S. were consistent in having high intentions to vaccinate, reaching up to 72% (26,31).

Prior Pandemic Vaccination Intentions

During the previous H1N1 influenza pandemic, many studies investigated the uptake of H1N1 influenza vaccination and other looked into the uptake of seasonal influenza vaccination too in the aftermath of the pandemic. For instance, in Ireland a cross-sectional study on university students showed that 63.5% of the students intended to receive the H1N1 vaccine during the pandemic (53). Moreover, a study on multiethnic Asian population revealed that 70% of the participants were willing to be vaccinated against the 2009 H1N1 influenza (54).

The most common factor related to vaccination uptake during H1N1 pandemic were the degree of threat experienced and perceptions of vaccination as an effective coping strategy, while low risk perception and lack of trust in the vaccine safety was associated with non-uptake (43). In the U.S. the trend of intentions to vaccinate against H1N1 was initially high and then started to decrease as the pandemic progressed (55). This could be related to high-risk perception in the beginning of a pandemic which wears off as time goes by.

Intention to Vaccination against Both Seasonal and Pandemic Influenza

Another study in Canada assessed seasonal influenza uptake two years after the H1N1 pandemic and found that seasonal influenza vaccine uptake was 57% , the most common reason for vaccinating was perceived risk and for protection (56). Another study in Canada assessed uptake of seasonal influenza vaccine among healthcare workers in the midst of the H1N1 pandemic and found that 82% intended to vaccinate for the next season against seasonal influenza (57).

Moreover, according to one systematic review prior behavior towards seasonal influenza vaccination was a strong influence of future intentions, even with regards to pandemic influenza (H1N1) (43).

In the U.S. on more than 2000 multiracial adult population a study reported that 18% received H1N1 vaccine and 8% intended to within a month (58). Furthermore, this study in the U.S. compared the uptake of both seasonal influenza and pandemic H1N1 influenza vaccine, it found that the uptake of seasonal influenza vaccine was 39% compared to 20% for pandemic H1N1 influenza vaccine (59). This finding was attributed to concerns about the safety of the H1N1 pandemic vaccine at the time (59).

Vaccinating against influenza this season 2020-2021 is extremely important due to the presence of COVID-19 pandemic, which could lead to increased burden and strain on the healthcare system and more widespread of both infections. This is especially true given influenza vaccine averts infection rates and is effective when it matches the circulating strains (13). As it has been reported that influenza vaccine uptake with the current COVID-19 pandemic leads to reduction in the odds of testing positive for COVID-19 by 24% and reduction in length of hospital stay, hospitalization and requirement of mechanical ventilation (60).

Specific Aims

This study's primary specific aim is to examine the relationship between distress related to COVID-19 pandemic and the uptake of influenza vaccine for 2020-2021 season (what is assumed to be a behavioral change from the norm, which is low rate of uptake of IV). Secondary aims are: 1) Examining the relationship between distress related to COVID-19 pandemic and uptake of/ and /or intentions to receive COVID-19 vaccine. 2) Examining the relationship between prior influenza vaccination and intentions to receive influenza vaccine and the coronavirus vaccine. 3) Examining the relationship between presence of cancer history with intentions to receive vaccination in general. 4) Describing the influencers (barriers and facilitators) on vaccination uptake in general.

METHODS

A cross-sectional design was used to investigate the association between COVID-19 related distress with uptake of influenza vaccinations for 2020-2021 season. We hypothesized that vaccination uptake would be associated with: COVID-19 psychosocial distress, prior vaccination history, and prior cancer diagnosis (being high risk to severe influenza).

Measures

The questionnaire included questions about: demographics, age, gender, race, marital status, education level, income), the main covariates in the form of scales 'COVID-19 psychosocial and practical experience scales' that was developed by the University of Miami experts (61). These scales were subcategorized into COVID-19 specific distress (emotional and physical reactions), healthcare disruptions and concerns, disruption to daily activities and social interactions, financial hardship, perceived benefits, functional and social support, and perceived stress management (ability to manage stress).

Each subscale included multiple statements that were answered in the form of 5-point Likert scale with an additional 'Not Applicable (NA)' option. Each answer was ranging from 1 = 'strongly disagree' to 5= 'strongly agree'. Reverse coding was done for the following subscales: perceived benefits, functional and social support, and perceived stress management (ability to manage stress).

The final score with a range of 1 to 5 was composed of the mean of all subscale items with valid values. Higher values in the final score represent a higher level of distress. Internal consistency and reliability was calculated using Cronbach's alpha coefficient for all the COVID-19 psychosocial and practical experiences scales Alpha= 0.79. Reliability for total scale was acceptable at ($\alpha > 0.70$). The explanatory variables for both the influenza and COVID-19 models, were COVID-19 psychosocial and practical experiences scales, prior vaccination, and relevant demographics (age, gender, race, education, and income).

Outcomes

The primary outcome was uptake of influenza vaccine for 2020-2021 season and the secondary outcomes were intention to receive COVID-19 vaccine and/or uptake of COVID-19 vaccine. These questions were in the form of 5-point Likert scale ranging from definitely would to definitely would not and an additional option of 'I have already received the vaccine'. Since the questionnaire was distributed in January which is during the influenza season, many people had been vaccinated already for influenza and the COVID-19 vaccine was also being distributed. Thus, the response for the outcome questions was grouped in a way that reflects intention to vaccination and receiving the vaccination as 'yes' and vice versa.

Procedures

Responses were re-classified into two categories in order to be applicable for logistic regression. For the influenza vaccine uptake question and the COVID-19 vaccine intention and/or uptake question, those who answered "definitely would", "probably would", and "I have already received the vaccine", were labeled as recipient of vaccines (Yes for uptake). While those who answered "definitely would not", "probably would not", and "unsure" were labeled as non-recipient of vaccines (No for uptake).

The other covariates focused on prior experiences with influenza vaccination, cancer status, the influence of the pandemic on vaccination intention in general. Finally, responses to a free-text open-ended question about factors that most influence their vaccination decision in general was used to determine barriers and facilitators.

The content and thematic analyses were done using deductive and latent approach, the theoretical framework that the analysis was based on was the social-ecological model to better understand the various factors that would influence the vaccination behavior (facilitators) and those that would not (barriers). This model will also help in demonstrating

how these factors interact at different levels, in order to facilitate the uptake of vaccines in general (58).

Initially, similar words were coded and labeled, then these codes were grouped under different themes which were related to each other. The barriers were in the form of concerns of respondents and the facilitators were in the form of benefits.

Power and Sample Size

The primary aim of this study which is determining the relationship between distress related to COVID-19 pandemic and uptake of influenza vaccine for 2020-2021 season was powered to detect statistically significant results with alpha level of 0.05, power of 80%, a range of assumed effect sizes were used for those expected to vaccinate against influenza given the current pandemic distress from 60% to 70% based on previous research that were done during and after the H1N1 pandemic (53,54,54–56,58,59,62). Since the proportion of people who received vaccination last season 2019-2020 in the U.S. was 48%, this was assumed to be the null hypothesis, and it was assumed that the expected proportion of people who would vaccinate against influenza under the pressure of the pandemic to increase more than 65%, which yielded a sample of 211 respondents. The sample size was calculated using G.power, table 1 shows multiple effect size estimates with odds ratio, and estimated sample sizes (63).

Snowball sampling was used due to limitations related to COVID-19 pandemic. The data collection started in January 2021 until March 2021. Initially, the questionnaire was shared with Georgetown students who were then asked to forward it to family and friends upon completion, those respondents would then also share the questionnaire with family and friends living in the United States. The eligibility criteria included: adults 18 years and older, living in Washington DC area, all genders and races, cancer patients/survivors and non-cancer subjects, English and Spanish speaking. The survey was published in English and

Spanish (certified translation was done). The survey was published through Qualtrics online platforms. IRB approval was obtained, IRB Number: STUDY00003198. Informed consent was provided to all study participants, all data were deidentified.

Table 1: Sample size calculations, odds ratios and estimated effect size.

Effect Size	Sample Size	OR
0.60	427	1.62
0.61	364	1.69
0.63	272	1.82
0.65	211	2.0
0.70	124	2.53

Statistical Analysis Plan

Descriptive statistics were computed to report means and standard deviation for continuous variables and frequency tables were used to report the categorical variables. Fishers exact test was used to test association of prior vaccination and influenza vaccine uptake and COVID-19 vaccination intention/ uptake.

Bivariate and multivariate logistic regression models were fitted based on binomial outcome of influenza vaccination associations (0 = No, 1 = Yes) and included covariates found to be significant in the bivariate models, odds ratios (OR) with 95% confidence intervals (CI) were reported. As for the free text item: Content and thematic analyses, which synthesizes many theoretical themes that were coded, grouped by the primary investigator and was reviewed by the co-investigator. These codes were used to report facilitators and barriers to vaccinations in order to understand some of the barriers and facilitators against vaccination. All analyses were conducted using SAS 9.4 software (SAS Institute, Cary NC, US).

RESULTS

Sample Characteristics

The total number of participants who completed and submitted the survey was 201. Two hundred from the English version and one from the Spanish version. The low number of the Spanish survey sample could be related to COVID-19 restrictions, and the fact that the survey was shared through a single channel that could lack access to Spanish speaking and Latinx populations. This is indeed limiting the generalizability to Spanish speaking /Hispanic participants. Future research could include partnering with community-based organizations that provide services to Spanish speaking Latinx populations.

The data was collected from January 8 2021 until March 25 2021. Due to the low number of missing items, there was no imputing. Descriptive statistics including means and standard deviation for continuous variables were computed, and frequency tables were generated to demonstrate the basic analysis of the variables as depicted in table 2. The age variable was not normally distributed, it was skewed to the right with an overall median of 31 and interquartile range (IQR) 11. The most dominant gender was females 81% vs males 18%. Sample race/ethnicity was distributed as follows: 43% White, 35% Black or African American, 19% Asian/ Pacific Islander, 5% Arab, 1% American Indian/ Alaskan Native, the remaining were identified as biracial or multiracial. The majority of the sample were single 51% and married 38%.

Most participants reported a high education level, around 82% completed either bachelor's or master's degree. Most of the sample were of those who had more than $75,000 (high income 55%), while those of low income < $10,000 were only 3% of the sample. Although one of this study's aims was examining the relationship between presence of cancer history with uptake of vaccination in general, the cancer survivors/patients in our sample were only 5% which did not allow us to examine this aim. While the uptake of influenza vaccine was

N= 152 (76%) and non-uptake was N=49 (24%). Consecutively, the uptake and/or intention to receive COVID-19 vaccine was N= 171 (85%) and non-uptake or no intention was 30 (15%). There was no statistically significant difference between those who received/ intended to receive and those who did not receive both vaccines.

When respondents were asked whether COVID-19 pandemic influenced their decision to vaccinate against seasonal influenza, 65% answered that it will not influence their decision and 33% answered that it will influence their decision to vaccinate against seasonal influenza, while 2% answered that it will influence their decision not to vaccinate influenza.

COVID-19 Psychosocial and Practical Experiences Scales

Comparison of means of responses of the COVID-19 psychosocial and practical experiences scales stratified by uptake of influenza vaccine and the COVID-19 vaccine are shown in details in table 3 and table 4 respectively. The means distribution differed for each scale as follows. Those which followed a normal distribution were COVID-19 specific distress (emotional and physical reactions) and perceived benefits. The remaining scales did not follow a normal distribution (Healthcare disruptions and concerns, disruption to daily activities and social interactions, financial hardship, functional and social support, and perceived stress management). Independent sample t-test was used for the former and Mann-Whitney U test was used for the latter.

Remarkably, there was a homogenous response between both groups (those who received influenza vaccine and those who did not) and there was no statistically significant difference between them for both vaccines. For COVID-19 emotional and physical reactions responses stratified by influenza vaccine uptake, most of the responses were in agreement with the statements that demonstrate worry, anxiety, sadness, depression, social isolation and loneliness. Most of the responses in the healthcare disruptions and concerns scale, indicated little medical care disruption. Nonetheless, in the disruption to daily activities and social

interactions, most of the responses were in agreement with most of the statements, as in they had difficulty performing their daily routine or work tasks.

Moreover, the respondents overtly responded in disagreement with any financial hardship statement, as they did not experience any financial difficulties, or failed to support their families and obtain basic needs (food, personal care product), 120/201(60%) were adequately covered with medical insurance. The perceived benefits responses were positive and in agreement with all the items that revolved around having deeper appreciation for life, connecting with family and friends, being more grateful and accepting. This was also clear in the functional and social support responses, where respondents have had family support, both financially and emotionally, and have provided help to others, by listening to their problems. Finally, most of the sample were able to manage their stress by being able to practice relaxation (deep breathing, meditation) and caring for themselves.

Prior Influenza Vaccination and Uptake of Influenza Vaccine and COVID-19 Vaccine

The association of prior influenza vaccination in 2019-2020 season with the uptake of seasonal influenza vaccine and COVID-19 vaccination was tested by using Fisher exact test. Both vaccines uptake resulted in a statistically significant difference, P-value <.0001 for influenza vaccine uptake and 0.001 for COVID-19 vaccine uptake/intentions. For the seasonal influenza vaccine and prior influenza vaccine the OR= 46.5 (95% CI 16.75- 129.5). Whereas for the COVID-19 vaccination intention and/or uptake association with prior influenza vaccine OR= 4 (95% CI 1.75 – 8.98). Detailed values are demonstrated in table 5 and table 6.

Bivariate and Multivariate Logistic Regression

The bivariate and multivariate analyses for both vaccines' uptake and intentions are shown in table 7 and table 8, where the outcome variables was uptake of influenza vaccine and uptake or intention to vaccinate against COVID-19. After reclassifying the outcome question

responses into yes=1 and no=0, all the relevant variables that would confound our results were entered in the logistic regression model as bivariates to assess unadjusted associations and as a set of variables in the multivariate regression models for each vaccine uptake/intention separately.

Influenza Vaccine Uptake Associations

Two separate sets of models were fit to analyze bivariate and multivariate associations for the uptake/intention of both vaccines. The first set of models were for influenza vaccine uptake and the second ones were for COVID-19 vaccine uptake. Each of these models were fitted with different independent variables to identify the best model.

For the influenza vaccine uptake models, the bivariate analyses (model 1) showed that the only statistically significant independent variables were intention/uptake of COVID-19 vaccine, OR: 9.79, 95% CI: 4.15 – 23.09 and prior influenza vaccination, OR: 46.56, 95% CI: 16.70-129.50. Those who intended to vaccinate against COVID-19 vaccine were almost 10 times more likely to receive seasonal influenza vaccine for 2020-2021 season. Adjusting for the uptake of the other vaccine was assumed to be associated with the uptake of influenza vaccine, as in many studies there were associations of uptake of influenza vaccine with other vaccines for example uptake of pneumococcal vaccine being associated with uptake of influenza vaccine in more than one study (19). Those who received prior influenza vaccine for 2019-2020 season were almost 47 times more likely to receive the 2020-2021 seasonal influenza vaccine. This result is in accordance with previous literature (43–47).

Also, each COVID-19 psychosocial and practical experiences scales association with uptake of influenza vaccine were tested separately in the bivariate analysis and yielded non-significant odds ratios initially.

Moreover, different models were fit to analyze multivariate associations. In model 2, each scale of the COVID-19 psychosocial and practical experiences scales was modeled separately

with all the relevant demographic variables (age, gender, race, education, income). There was no statistically significant odds ratio in this model also.

However, in model 3 where all the variables in model 1 and 2 (age, gender, race, education, income, all the COVID-19 psychosocial and practical experiences scales were entered forming one model, the only statistically significant association was COVID-19 specific distress (emotional and physical reactions) scale, OR: 2.15, 95% CI: 1.17 – 3.95. which indicates that those who suffered more emotional and physical distress due to COVID-19 were 2 times more likely to receive influenza vaccine for 2020-2021 season.

Further analysis was conducted to assess COVID-19 Psychosocial And Practical Experiences Scales adjusting only for each scale in model 4. In this model COVID-19 Specific Distress (emotional and physical reactions) remained statistically significant, OR: 1.87, 95% CI: 1.10-3.23.

Finally, model 5 all the COVID-19 psychosocial and practical experiences scales were analyzed along with the statistically significant variables from all the previous models which were prior influenza vaccination and uptake of COVID-19, this model yielded positive association of uptake of COVID-19 vaccine, OR: 26.72, 95% CI: 4 – 196, prior influenza vaccination, OR: 125, 95% CI: 25 – 630, and financial hardship, OR: 6, 95% CI: 1.32 – 26.

COVID-19 Vaccine Uptake Associations

In the bivariate analysis for COVID-19 uptake/intention model (model 1), the only statistically significant independent variables were uptake of influenza vaccine, OR: 9.79, 95% CI: 4.15 – 23.09 and prior influenza vaccination, OR: 3.96, 95% CI: 1.74 – 8.98. Similar to the influenza vaccine uptake model. Vaccinating against seasonal influenza was positively associated with uptake of COVID-19 vaccine and the prior influenza vaccination was positively associated with uptake of COVID-19 vaccine, which is in accordance with previous studies. Similarly, each COVID-19 psychosocial and practical experiences scales

association with uptake of COVID-19 vaccine were tested in the bivariate analysis and yielded non-significant odds ratios.

Different models were fit to analyze multivariate associations for COVID-19 vaccine uptake/intentions. In model 2, each scale of the COVID-19 psychosocial and practical experiences scales was fitted with all the relevant demographic variables (age, gender, race, education, income). There were no statistically significant associations. Nevertheless, in model 3 where all the variables in model 1 and 2 were entered with all the scales COVID-19 Specific Distress (emotional and physical reactions) was positively associated with the uptake of COVID-19 vaccine, OR: 2.40, 95% CI: 1.10 – 5.25. This is similar to the previous result in the influenza vaccine uptake models. Furthermore, perceived stress management was also positively associated with the uptake of COVID-19 vaccine, OR: 2.66, 95% CI: 1.15 – 6.13. This indicates that those who suffered distress related to COVID-19 and those who were able to manage their stress adequately were more than 2 times likely to receive COVID-19 vaccine.

Further analysis was conducted to assess COVID-19 psychosocial and practical experiences scales with uptake of COVID-19 vaccine adjusting only for each scale in model 4. In this model perceived benefits and perceived stress management were associated with uptake of COVID-19 vaccine, OR: 0.56, 95% CI: 0.32- 0.98, OR:3.38, 95% CI: 1.34 – 8.57 respectively. Perceived benefits was inversely related, those who had more perception of benefits were 44% less likely to receive the COVID-19 vaccine. While those who had better stress management were 3 times more likely to receive the COVID-19 vaccine.

Finally, model 5 all the COVID-19 psychosocial and practical experiences scales were analyzed along with the statistically significant variables from the previous models which were prior influenza vaccination. The only two statistically significant associations were prior

influenza vaccination OR: 5.22 (1.9 – 14.2) and perceived stress management OR: 3.48, 95% CI: 1.38 – 8.80.

Qualitative Analysis

As for the qualitative data analysis for the open-ended question the missing responses were 6%. This questions was not targeting specific vaccine, it was more of a general question. However, most of the responses were perceived as if the question was about COVID-19 vaccine. Most of the sample showed good knowledge and trust in scientific evidence. Whereas, very few responses demonstrated misconceptions or knowledge gaps. For instance this response "Whether or not it was affordable" and "Lack of trust for pharmaceutical industry/ greed, DNA alterations". Furthermore, the most frequent barriers to vaccination in general were: concerns about safety and side effects, logistics, access and availability, cost, lack of trust in the healthcare system, and perception of limited evidence on vaccine development. For instance this was one of the responses that reported barriers to COVID-19 vaccine "COVID-19 vaccines were developed very quickly without the usual time allotted for clinical trials. I am unsure of the long-term safety"

In contrast, the facilitators based on the social ecological model, involved the first level (the individual) of the facilitating factors towards vaccination are beliefs and awareness of vaccine effectiveness and its benefit to one's health in preventing infections, this was the most common answer. Risk perception of acquiring COVID-19 and acquiring immunity against it were also facilitators at the individual level.

While the second level (relationship) was the positive behavior of the respondents towards vaccination being influenced by their families and loved ones to protect them from infections, especially that there was recurring response of having immunocompromised family members who needed protection from infections. For example, this response was seen more frequently than other responses "The desire to protect myself and my family from the virus".

As for the third level (community), decrease burden on healthcare and prioritizing vulnerable population to received vaccination first. Many of the responses focused on vaccination being mandatory by workplace or for travel which impacts their positive behavior towards vaccination.

The fourth level (societal) involved vaccination being a norm as it is the key to return back to normal life without social distancing and self-quarantine. “I believe in herd immunity, and there are several people in my home who are immune compromised including myself. Caring about one’s and community’s health was frequently seen among responses such as “Any protection from any infectious disease I believe to be beneficial for me”.

Finally, the majority of responses mentioned that they were influenced to receive vaccination to benefit the public in general. This is also comparable to what was reported in a systematic review of 470 studies, where 29 of them concluded that social benefit was a strong influence on influenza vaccine uptake (19).

DISCUSSION

This study aimed to examine the relationship between distress related to COVID-19 pandemic and the uptake of influenza vaccine for 2020-2021 season (what is assumed to be a behavioral change from the norm, which is low rate of uptake of influenza vaccine). Also, aimed to examine the relationship between distress related to COVID-19 pandemic and uptake of /intentions to receive COVID-19 vaccine. Finally, examine the relationship between prior influenza vaccination and uptake of influenza vaccine.

Our results did not associate any of the demographic factors mentioned in the literature with uptake of influenza vaccine. For instance, during the H1N1 pandemic, a national survey in the U.S. showed that uptake of H1N1 vaccine was associated with older age, higher income, higher education, and prior influenza vaccination (55). There was no statistically significant association between any of the demographic variables and uptake of vaccines per se in our results, this could be explained by the sample characteristics being limited to those of high income, high education, and prior receipt of influenza vaccine.

The results showed that of all the COVID-19 psychosocial and practical experiences scales, financial hardship and COVID-19 specific distress (emotional and physical reactions) were the most statistically significant factors in deriving uptake of influenza vaccine.

Similarly, in the COVID-19 vaccine intentions/uptake model the most statistically significant scales were COVID-19 specific distress (emotional and physical reactions), perceived benefits and perceived stress management. The other scales did not yield statistically significant associations, this could be due to a possibly lower minimal effect size than the one proposed (< 65%) which would require a larger sample size, further sampling could yield a more prompt and a clearer conclusion.

From the sample characteristics. We found that the majority received both vaccines, the majority did not suffer from financial hardship, or disruption to daily activities and other

distresses. Furthermore, the majority of the sample were of high income level. These factors are relevant to the conclusion of this research, as these results might not be generalizable to those facing more significant financial hardship from the pandemic, or those with greater disruption to their lives.

According to the CDC the weighted percentage of intentions to receive COVID-19 vaccine in September 2020 was 59.3% and the uptake (weighted percentage) of influenza vaccine for 2020-2021 was 59% (64). This shows somewhat higher uptake of both vaccines. Nonetheless, this finding is not similar to the previous H1N1 pandemic, when there was initially high intention to vaccination around 50% that declined over time steadily (55). This occurred in September 2009, even though there was sharp rise in disease activity and spread concurrently the intentions to vaccinate against H1N1 were declining (55). It was reported that this was due to low perceived risk of acquiring H1N1 and dying from it at that time (55).

Moreover, the timing of data collection was in early 2021, after vaccination availability. This could have impacted the results, as vaccine availability could have brought hope for the end of the pandemic and alleviated and underestimated the actual distress experienced. Also, the data collection was almost one year since the pandemic, this time period could be enough for respondents/people to adjust, adapt, and receive adequate support to the current distress.

Regarding the other aims, the results showed that prior influenza vaccination was strongly associated with uptake of both influenza and COVID-19 vaccines. Which is in accordance with previous literature (43–47).

In addition, the results were also similar to previous literature in uptake of influenza vaccine being associated with uptake of other vaccines, in this study the uptake of influenza vaccine was positively associated with uptake of COVID-19 vaccine too. This was also reported in a systematic review where uptake of influenza vaccine was associated with uptake of other vaccines such as pneumococcal vaccine (19).

As stated before, intention to vaccination and vaccination uptake is bound to time, context, complex beliefs and behaviors (43,65). Previous pandemic and the distress accompanying the current pandemic could be determinant of uptake of protective behaviors such as vaccinating against seasonal influenza and COVID-19 pandemic. This was reflected in the open-ended question, where the most prominent theme was prevention, protection, and care on the individual, community, and societal level. While the most common barriers were concerns about safety and side effects, logistics, access and availability, cost, lack of trust in the healthcare system, and perception of limited evidence on testing the vaccine.

These results were comparable to many studies that looked into the same question. Low risk perception of getting infected with COVID-19 and lack of trust in vaccines' safety and side effects or in other words believing that there was inadequate testing of the vaccine and that it was rushed into being distributed (43).

LIMITATIONS

This study was limited by the method of sampling, as it was using a non-probabilistic sampling due to the current restrictions of the pandemic, this could limit the representativeness of our study sample. Moreover, we cannot infer causality or temporality from cross-sectional study design per se. The study can represent the sample's uptake/intentions at this point in time only. Unfortunately due to COVID-19 restrictions, in person survey distribution was not possible, thus the sample was mainly capturing those of high income and education (socioeconomic status). This limited the generalizability to the whole population.

CONCLUSION

This study found that uptake of influenza vaccine and intention/uptake of COVID-19 vaccine for season 2020-2021 was very high in this sample. The most influential COVID-19 psychosocial and practical experience scale on influenza vaccine uptake were COVID-19 specific distress (emotional and physical reactions) and financial hardship. As for the intention/uptake of COVID-19, the most influential scales were COVID-19 specific distress (emotional and physical reactions), perceived benefits and perceived stress management. Prior vaccination and uptake of COVID-19 vaccine were also significantly associated with uptake of influenza vaccine.

In conclusion, focusing on multi-level interventions to promote vaccination is the cornerstone for successful distribution and uptake of vaccines. Understanding the specific type of distress related to the COVID-19 pandemic that is deriving vaccination uptake is an important step to identify the impact of pandemic distress and deepen understanding of behavior towards vaccination for future interventions that address uptake of vaccination.

APPENDIX: TABLES

Table 2: Sample characteristics stratified by uptake of influenza vaccine N= 201.

		Received Influenza vaccine N= 152 (76%)	**Did not Receive influenza vaccine N=49 (24%)**	**P-value**
Age	N, Median, (IQR) Min-Max	152, 31 (12) 19-71 years	49, 32 (11) 22-60 years	0.961*
Categorical Variables		**N %**	**N %**	**P-value**
Gender	Male	29 (14%)	7 (3.5%)	0.228
	Female	123 (61%)	41 (20%)	
Race	Black /African American	50 (25%)	20 (10%)	0.081
	White	70 (35%)	15 (7.5%)	
	American-Indian/ Alaskan Native	1 (0.5%)	0	
	Asian/ Pacific Islander	14 (7%)	5 (2.5%)	
	Arab	5 (2.5%)	4 (2%)	
	Biracial	7 (3.5%)	0	
	Multiracial	1 (0.5%)	2 (1%)	
	Other	4 (2%)	3 (1.5%)	
Marital status	Single, Never Married	80 (40%)	23 (11%)	0.798
	Married	57 (28%)	20 (10%)	
	Divorced	4 (2%)	2 (1%)	
	separated	2 (1%)	1 (0.5%)	
	Widowed	1 (0.5%)	0	
	Have a partner, Live as married	8 (4%)	1 (0.5%)	
Education	High school diploma or equivalent (e.g. GED)	2 (1%)	0	0.187
	Some college, no degree	5 (2.5%)	2 (1%)	
	Associate Degree (e.g. AA, AS)	2 (1%)	1 (0.5%)	
	Bachelor's Degree (e.g. BA, BS)	62 (31%)	18 (9%)	
	Master's Degree (e.g. MA, MS, MEd)	63 (31%)	21 (10.5%)	
	Professional Degree (e.g. MD, DDS, DVM)	10 (5%)	0	
	Doctorate (e.g. PhD, EdD)	8 (4%)	6 (3%)	
Income	Less than $10,000	3 (1.5%)	3 (1.5%)	0.160
	$10,000-$34,999	14 (7%)	2 (1%)	
	$35,000-$49,999	11 (5.5%)	7 (3.5%)	
	$50,000-$74,999	27 (13.4 %)	13 (6.5%)	
	$75,000 or more	88 (44%)	21 (10.5%)	
	Refused	3 (1.5%)	1 (0.5%)	
	Don't know	6 (3%)	2 (1%)	
Cancer status	Yes	6 (3%)	4 (2%)	0.262
	No	146 (73%)	45 (22%)	

*Statistical significance was determined using Mann-Whitney U test for the age variable. All the other categorical variables' P-values were determined using Fishers exact test.

Table 3: Distribution of mean scores among respondents of the COVID-19 psychosocial and practical experiences scales stratified by uptake of influenza vaccine N=201.

COVID-19 psychosocial and practical experiences scales	**Received influenza vaccine (N=152)** N, Mean (SD) Min-Max	**Did not Receive influenza vaccine (N=49)** N,Mean (SD) Min-Max	**P-value**	**Total Missing count**
COVID-19sspecific distress (Emotional and Physical Reactions)	N=139 3.19 (0.77) 0.3 – 4.5	N=44 3.10 (0.82) 1.5-4.8	0.409*	18
Healthcare disruptions and concerns	N =141 1.26 (0.57) 0 - 3.5	N= 43 1.29 (0.70) 0.5-3.75	0.817	17
Disruption to daily activities and Social interactions	N=149 2.69 (0.75) 1 - 4.5	N=46 2.86 (0.72) 1.66 – 4.3	0.262	6
Perceived benefits	N=149 2.09 (0.89) 0 – 4.4	N=46 2.07 (0.82) 0.8 - 5	0.878*	6
Financial Hardship	N=133 1.76 (0.67) 0.8- 4.7	N=42 1.63 (0.81) 0 – 4.17	0.371	26
Functional Social Support	N=150 1.91 (0.83) 0.5 - 5	N=46 1.98 (0.83) 0.25 - 5	0.593	5
Perceived Stress Management	N=149 2.14 (0.64) 0 – 4.8	N= 46 2.16 (0.74) 0.4- 4.2	0.914	6

* Emotional and Physical Reactions and Perceived benefits P-values were determined using independent sample t-test. The

other items' P-values were determined using Mann-Whitney U test.

Table 4: Distribution of mean responses of the pandemic scales stratified by uptake of COVID-19 vaccines N= 201.

COVID-19 psychosocial and practical experiences scales	Intended to and/or Received COVID-19 vaccine (N=171) 85% N, Mean (SD) Min-Max	Did not receive/ or intend to receive COVID-19 (N=30) 15% N, Mean (SD) Min-Max	P-value	Total Missing count
COVID-19 specific distress (Emotional and Physical Reactions)	N=157 3.19 (0.79) 0.3- 4.7	N=26 3.10 (0.71) 1.8- 4.16	0.469*	18
Healthcare disruptions and concerns	N =158 1.23 (0.58) 0 - 3.7	N= 26 1.46 (0.66) 0.5-3.5	0.089	17
Disruption to daily activities and Social interactions	N=167 2.7 (0.74) 1 - 4.5	N=28 2.61 (0.81) 1.16 – 4	0.416	6
Perceived benefits	N=167 2.04 (0.86) 0 – 5	N=28 2.38 (0.82) 0.8 – 4.4	0.059*	6
Financial Hardship	N=150 1.70 (0.68) 0- 4.16	N=25 1.90 (0.82) 0.16 – 4.16	0.119	26
Functional Social Support	N=168 1.91 (0.84) 0.25 - 5	N=28 2.1 (0.79) 0.75 - 5	0.288	5
Perceived Stress Management	N=167 2.17 (0.63) 0 – 4.2	N= 28 2.02 (0.87) 0.4- 4.8	0.101	6

* Emotional and Physical Reactions and Perceived benefits P-values were determined using independent sample t-test. The other items' P-values were determined using Mann-Whitney U test.

Table 5: Association of prior influenza vaccination and uptake of seasonal influenza vaccine using Fisher exact test N=200.

		Influenza vaccine uptake		Total %	OR 95% CI	P-value
		Yes N%	No N%			
Prior Influenza Vaccination in 2019-2020 season	Yes N %	127 (63%)	24 (12%)	151 (76%)	46.5 (16.75-129-.5)	<.0001
	No N %	5 (2.5%)	44 (22%)	49 (25%)		
Total		132 (66%)	68 (34%)	200 (100%)		

*Missing values=1.

Table 6: Association of prior influenza vaccination and uptake of COVID-19 vaccine using Fisher exact test N=200.

		COVID-19 vaccine uptake		Total %	OR 95% CI	P-value
		Yes N%	No N%			
Prior Influenza Vaccination In 2019-2020 season	Yes N %	121 (61%)	11 (6%)	132 (66%)	4 (1.75- 8.98)	0.001
	No N %	50 (25%)	18 (9%)	68 (34%)		
Total		171 (85%)	29 (15%)	200 (100%)		

*Missing values=1.

Table 7: Results of bivariate and multivariate logistic regression of all the relevant independent variables and uptake of influenza vaccine: 0= No, 1= Yes; odds ratios (95% confidence intervals) are displayed, N=201 (Yes (Y) =152 No (N) =49).

Independent Variable	Total N Y for uptake N for non-uptake	Model 1 (Unadjusted) OR and 95% CI	Model 2 Adjusted OR and 95% CI	Model 3 Adjusted OR and 95% CI	Model 4 Adjusted OR and 95% CI	Model 5 Adjusted OR and 95% CI
Age	201 (Y=152 N=49)	1.01 (0.97 – 1.04)	1.00 (0.95 -1.06)	1.00 (0.96 – 1.04)	-	-
Gender	201 (Y=152 N=49)	0.569 (0.26-1.22)	0.48 (0.15 -1.50)	0.51 (0.20 – 1.26)	-	-
Race	201 (Y=152 N=49)	1.01 (0.66-1.55)	0.85 (0.46 – 1.50)	1.51 (0.87 – 2.60)	-	-
Education level	201 (Y=152 N=49)	0.92 (0.68 – 1.25)	0.85 (0.54 – 1.30)	0.83 (0.57 – 1.20)	-	-
Income	201 (Y=152 N=49)	1.16 (0.90-1.5)	1.43 (1.0 – 2.10)	1.41 (1.01 – 1.94)	-	-
Uptake of COVID-19 Vaccine	201 (Y=152 N=49)	9.79 (4.15 – 23.09) *	-	-	-	26.72 (4 – 196)*
Prior influenza vaccination	200 (Y=151 N=49)	46.56 (16.7- 129.5)*	-	-	-	125 (25 – 630)*
COVID-19 Specific Distress (Emotional and Physical Reactions)	183 (Y=139 N=44)	1.19 (0.78 – 1.84)	1.26 (0.80– 2.0)	2.15 (1.17 – 3.95)*	1.87 (1.10 – 3.23)*	1.37 (0.50 – 3.8)
Healthcare disruptions	184 (Y=141 N=43)	0.91 (0.52 – 1.59)	0.91 (0.52 – 1.60)	0.67 (0.33 – 1.36)	0.70 (0.35 – 1.41)	0.83 (0.28 – 2.5)
Disruption to daily activities and social interactions	195 (Y=149 N=46)	0.74 (0.47 – 1.15)	0.71 (0.45 – 1.14)	0.59 (0.33 - 1.10)	0.66 (0.39 – 1.12)	0.41 (0.15 – 1.1)
Perceived benefits	195 (Y=149 N=46)	1.03 (0.71 – 1.51)	1.06 (0.71 – 1.6)	1.37 (0.83 – 2.26)	1.17 (0.76 – 1.81)	1.60 (0.78 – 3.3)
Financial Hardship	175(Y=133 N=42)	1.30 (0.78 – 2.18)	1.42 (0.84 – 2.4)	2.13 (0.97 – 4.63)	1.94 (0.95 – 3.98)	6 (1.32 – 26)*
Functional Social Support	196 (Y=150 N=46)	0.90 (0.61 – 1.34)	0.92 (0.61 – 1.37)	0.65 (0.36 – 1.18)	0.68 (0.37 – 1.23)	0.45 (0.16 – 1.23)
Perceived Stress Management	195 (Y=149 N=46)	0.94 (0.58 – 1.55)	1.02 (0.62 – 1.67)	0.88 (0.45 – 1.70)	0.84 (0.44 – 1.59)	0.73 (0.21 – 2.6)

All the COVID-19 psychosocial and practical experiences scales were ranging from 0-5, with higher values indicating more distress. Reverse coding for perceived benefits, perceived stress management, and functional social support.

*Denotes a statistically significant association.

The missing values were removed from the logistic regression model.

Model 1: unadjusted (bivariate) logistic regression of all the relevant variables and uptake of influenza.

Model 2: Multivariate logistic regression for uptake of influenza vaccine and COVID- psychosocial and practical experiences scales adjusting for relevant demographics separately.

Model 3: Multivariate logistic regression for uptake of influenza vaccine and COVID-19 psychosocial and practical experiences scales adjusting for relevant demographics and all the COVID-19 distress Scales.

Model 4: Multivariate logistic regression for uptake of influenza vaccine and COVID-19 distress scales adjusting for COVID-19 distress Scales only.

Model 5: Multivariate logistic regression for uptake of influenza vaccine and COVID-19 psychosocial and practical experiences scales adjusting for prior vaccination and uptake of COVID-19 vaccine.

Table 8: Results of bivariate and multivariate logistic regression of all the relevant independent variables and uptake of COVID-19 vaccine : 0= No, 1= Yes; odds ratios (95% confidence intervals) are displayed, N = 195 (Yes (Y)= 171 No (N)= 30).

Independent Variable /scale	Total N Yes for uptake No for non-uptake	Model 1 Unadjusted OR and 95% CI	Model 2 Adjusted OR and 95% CI	Model 3 Adjusted OR and 95% CI	Model 4 Adjusted OR and 95% CI	Model 5 Adjusted OR and 95% CI
Age	201 (Y=171 N=30)	1.01 (0.92 – 1.05)	1.02 (0.97 – 1.07)	1.02 (0.95 – 1.07)	-	-
Gender	201 (Y=171 N=30)	0.69 (0.29 – 1.61)	0.71 (0.27 – 1.86)	0.70 (0.19 – 3.8)	-	-
Race	201 (Y=171 N=30)	1.48 (0.86 – 2.53)	1.56 (0.87 – 2.84)	3.22 (1.25 – 6.4)	-	-
Education	201 (Y=171 N=30)	1.04 (0.72 – 1.50)	0.96 (0.63 – 1.46)	0.84 (0.49 - 1.36)	-	-
Income	201 (Y=171 N=30)	1.24 (0.92 – 1.67)	1.29 (0.90 – 1.82)	1.43 (0.94 – 2.34)	-	-
Uptake of IV	201 (Y=171 N=30)	9.79 (4.15 – 23.09)*	-	-	-	-
Prior influenza vaccination	200 (Y=171 N=29)	3.96 (1.74 – 8.98)*	-	-	-	5.22 (1.9 – 14.2)*
COVID-19 Specific Distress (Emotional and Physical Reactions)	183 (Y=157 N=27)	1.21 (0.72 – 2.03)	1.32 (0.75 – 2.34)	2.40 (1.10 – 5.25)*	1.64 (0.83 – 3.24)	1.37 (0.67 – 2.80)
Healthcare disruptions and concerns	184 (Y=158 N=28)	0.57 (0.31 – 1.10)	0.56 (0.28– 1.08)	0.49 (0.22 – 1.01)	0.59 (0.27 – 1.27)	0.69 (0.32 – 1.53)
Disruption to daily activities and social interactions	195 (Y=167 N=28)	1.29 (0.75 – 2.23)	1.14 (0.64– 2.01)	1.01 (0.47 – 2.16)	1.41 (0.72 – 2.77)	1.49 (0.72 - 3.11)
Perceived benefits	195 (Y=167 N=28)	0.65 (0.41 – 1.02)	0.66 (0.40 – 1.10)	0.66 (0.33 – 1.29)	0.56 (0.32- 0.98)*	0.57 (0.31 – 1.04)
Financial Hardship	175 (Y=150 N=25)	0.69 (0.38 – 1.21)	0.75 (0.42 – 1.37)	0.75 (0.29 – 1.92)	0.69 (0.28 – 1.72)	0.67 (0.26 -1.75)
Functional Social Support	N=196 Y=168 N=28	0.77 (0.49 – 1.22)	0.82 (0.51 – 1.32)	0.69 (0.32 – 1.47)	0.70 (0.34 – 1.44)	0.66 (0.31– 1.40)
Perceived Stress Management	201 (Y=149 N=46)	0.94 (0.58 – 1.55)	1.49 (0.82 – 2.69)	2.66 (1.15 – 6.13)*	2.60 (1.13 – 6.02)*	3.48 (1.38 – 8.80)*

All the COVID- psychosocial and practical experiences scales were ranging from 0-5, with higher values indicating more distress. Reverse coding for perceived benefits, perceived stress management, and functional social support.
*Denotes a statistically significant association.
All the missing values were removed from the logistic regression model.
Model 1: unadjusted (bivariate) logistic regression of all the relevant demographic variables and uptake of COVID-19 vaccine.
Model 2: Multivariate logistic regression for uptake of COVID-19 vaccine COVID- psychosocial and practical experiences scales adjusting for relevant demographics separately.
Model 3: Multivariate logistic regression for uptake of COVID-19 vaccine and COVID-19 psychosocial and practical experiences scales adjusting for relevant demographics all the COVID-19 psychosocial and practical experiences scales.
Model 4: Multivariate logistic regression for uptake of COVID-19 vaccine and COVID-19 psychosocial and practical experiences scales adjusting for the subscales only.
Model 5: Multivariate logistic regression for uptake of COVID-19 vaccine and COVID-19 psychosocial and practical experiences scales adjusting for prior influenza vaccination and other subscales.

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