Short communication

Couples and COVID-19 vaccination: Frequency and reasons for discordance

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ABSTRACT

The purpose of this study was to determine the frequency of concordance and discordance in the COVID-19 vaccination status of intimate couples. Partners are well known to influence each other's health behaviors, but previous reports of couples' COVID-19 vaccination status were not found. Among 1305 respondents to an on-line survey who were living with their partners, couples' COVID-19 vaccination status was 15.63% discordant and 84.37% concordant. Different potentially modifiable reasons for being unvaccinated were emphasized by unvaccinated participants with vaccinated partners and by vaccinated participants with unvaccinated partners. This study provides an estimate of the proportion of couples with discordant COVID-19 vaccine status. The development of tailored, scalable interventions potentially involving the partner might increase the COVID-19 vaccine concordance rate.

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1. Introduction

Worldwide, there have been over 5.5 M deaths attributed to the novel coronavirus SARS-CoV-2 (COVID-19) as of mid-January 2022 [1]. Vaccination decreases the likelihood of COVID-19 infection [2] – more than previous COVID-2 infection [3] -- and if infected, decreases the seriousness of the illness and likelihood of death [2].

Most adults are, have been, or will be in intimate relationships. Only 20% of adults over 40 years of age say they have never been in a relationship [4]. Intimate relationships are fundamental social networks and potent sources of social norms, which are attitudes and behaviors perceived as typical.

A substantial literature on couple concordance exists for health behaviors such as alcohol intake [5,6], sleep duration [7], and physical activity [7–9]. The mobilizing effects of being part of a couple extend to voting: couples are more likely to vote than singles [10]. Couples' similarities have been attributed to assortative mating, the contributions of shared environments, and partners directly influencing each other's behavior [11].

Despite significant couple concordance, discordant health behaviors present opportunities for the partner with healthier behaviors to influence the partner with unhealthier behaviors. For example, the percentages of discordant couples in the UK's Household Longitudinal Study were: 28% for binge drinking; 21%

for low fruit/vegetable consumption; and 35% for low physical activity [5].

No reports of couple concordance regarding COVID-19 vaccination could be located. The purpose of this study was to quantify COVID-19 vaccination couple concordance and discordance and to assess reasons for being unvaccinated among discordant couples. The research questions were: what proportion of couples are discordant for COVID-19 vaccination and what are the most important reasons for being unvaccinated among discordant couples?

2. Methods

2.1. Procedures and participants

CloudResearch was used to manage participant recruitment through the Mechanical Turk (MTurk) platform and to enhance data quality [12]. Participants were selected who had completed at least 100 Human Intelligence Tasks (HITs) on MTurk and had a greater than 95% approval rate on previous HITs. US internet protocol (IP) addresses were verified and submissions from duplicate IP addresses were blocked. Only CloudResearch "approved participants" were used who have a higher degree of vetting including evidence of attending to and engaging in previous tasks. Data were collected using Qualtrics on October 12–714, 2021.

Potential participants were screened in three phases: first, several age and relationship status questions were asked so the

participants might not deduce the inclusion and exclusion criteria. Inclusion criteria were 18 years of age or older, in an intimate/romantic relationship for 6 months or longer and living with their partner. The couples had cohabited during the period of vaccine availability: COVID-19 vaccines were available to all adults in the United States on or before April 19, 2021 [13]. Second, participants who met these criteria reported their and their partner's COVID-19 vaccination status as both vaccinated, both unvaccinated, or one but not both vaccinated. Status as vaccinated was defined as partially or fully vaccinated. Third, participants in discordant couples who consented rated reasons for being unvaccinated and provided demographic information.

2.2. Measures

Reasons for being unvaccinated. A parsimonious set of 10 potentially modifiable reasons for being unvaccinated were identified from the literature [14]. These reasons are listed in Table 1. Unvaccinated participants in discordant couples rated their own reasons for being unvaccinated, which were stated in the first person, e.g., "I don't like needles" (see Table 1). Vaccinated participants in discordant couples rated their partner's reasons for being unvaccinated. The wording was altered accordingly, e.g., "My partner doesn't like needles." Participants rated reasons' importance by moving sliders along a range of 0 (not at all important) to 10 (extremely important). There also was an "Other" category: participants could add a reason that was not among those queried. An attention check question also was included.

Demographic information. Participants were asked to report their age, race/ethnicity, gender, and their partner's gender.

2.3. Analyses

Couples' vaccine concordance and discordance rates and demographic information regarding participants in discordant couples were summarized descriptively. A multivariable logistic regression was performed to identify reasons that differed between the two types of discordant couples, after conducting logistic regression diagnostics for multicollinearity and influential cases (Cook's D and Mahalanobis' Distance (MD)). The model first entered age, non-Hispanic White race/ethnicity, and gender as a block because these variables have been associated with vaccine uptake [14]. Next, the 10 reasons' ratings were entered as a second block. A test of the overall multivariable model after each block was reported in addition to the odds ratios of the difference in the strength of each reason for the two types of discordant couples (participant vaccinated but partner unvaccinated; participant unvaccinated but partner vaccinated) with 95% confidence intervals for the odds ratios and probability values. The Benjamini-Hochberg [15] procedure was applied, assuming a 5% false discovery rate: p values less than the critical value based on this procedure were identified. Sensitivity analyses were conducted by comparing the results of nine repetitions of the logistic regression, omitting each predictor in turn.

3. Results

3.1. Participants

There were 2251 potential participants who accessed the survey and 946 were excluded for the following reasons: did not

Table 1
Reasons for not getting a vaccine among discordant couples.

	Participant Unvaccinated, Partner Vaccinated (n = 71)	Participant Vaccinated, Partner Unvaccinated (n = 120)	Logistic Regression[a] (n = 182)
Predictor Variables	*M* (*SD*)	*M* (*SD*)	OR (95% CI), *p* value
Demographics:			
Age	38.03 (9.23)	39.68 (11.37)	1.02 (0.98–1.05) *p* = 0.378
Non-Hispanic White (=0)	77.46% (*n* = 55)	80.83% (*n* = 97)	1.17 (0.47–2.92) *p* = 0.734
Female Gender (=0)	54.93% (*n* = 39)	56.67% (*n* = 68)	0.93 (0.44–1.94) *p* = 0.842
Reasons:			
The shot isn't safe	5.66 (3.21)	6.17 (3.23)	1.06 (0.52–2.05), *p* = .875
I don't know enough about it	5.46 (3.83)	4.75 (3.57)	0.55 (0.34–0.88), *p* = .013
The shot isn't necessary	4.80 (3.74)	5.79 (3.41)	2.10 (1.16–3.78), *p* = 0.014
The shot will make me sick	4.58 (3.17)	4.99 (3.22)	0.99 (0.57–1.73), *p* = .978
The shot won't work	3.94 (3.35)	4.12 (3.51)	0.58 (0.35–0.99), *p* = .046
I don't like needles	2.48 (3.29)	2.37 (2.84)	1.06 (0.66–1.71), *p* = .809
My religious or spiritual beliefs do not support getting the vaccine	1.03 (2.20)	1.08 (2.43)	0.28 (0.12–0.66), *p* = .004*
A medical condition prevents me from getting it	0.94 (2.29)	1.53 (2.76)	4.24 (1.77–10.14), *p* = .001*
I don't believe COVID-19 is real	0.68 (1.53)	1.74 (2.71)	5.01 (1.93–13.03), *p* < .001*
My doctor or other healthcare provider told me not to get it	0.56 (1.45)	0.96 (2.22)	0.39 (0.14–1.10), *p* = .075

Notes: [a]Variables used in the analysis were log-transformed after adding a constant of 1. *Statistically significant after Benjamini-Hochberg correction [15].

answer the age and relationship status question (*n* = 5, 0.53%), less than 18 years of age (*n* = 8, 0.85%), and among those 18 years or age and older: not in an intimate/romantic relationship (*n* = 605, 63.95%), in a relationship for less than 6 months (not living with the partner, *n* = 88, 9.30%; living with the partner, *n* = 39, 4.12%); in a relationship of 6 months or longer but not living with the partner (*n* = 201, 21.25%).

3.2. Rates of vaccine concordance and discordance

There were 1305 participants who reported they were 18 years of age or older and were living with their partner for 6 months or more. Of these, 6 did not answer the vaccination status question. Of the remaining 1299 respondents, there were 1096 (84.37%) vaccine concordant couples: 822 (63.28%) reported both partners were vaccinated and 274 who reported both partners were unvaccinated (21.09%). There were 203 (15.63%) vaccine discordant couples: 124 who reported they were vaccinated but their partner was not (9.55%) and 79 who reported they were unvaccinated but their partner was vaccinated (6.08%).

3.3. COVID-19 vaccine discordant couples

Of the 203 participants in vaccine discordant couples, 6 discontinued the survey and another 6 failed the attention check. The results below focus on the remaining 191 participants. These participants averaged 39.07 years of age (*SD* = 10.63, range 19–80), 56.02% female (44.98% male; 0% non-binary/other gender), and 93.19% heterosexual (6.81% same or non-binary/other gender partner). Most participants (79.58%) were non-Hispanic White (8.38% non-Hispanic Black; 4.19% each non-Hispanic Asian and Hispanic/Latino; 3.14% multiethnic/multiracial; 0.52% non-Hispanic Native American/Indigenous). The participants included proportionally more people of non-Hispanic White race/ethnicity and more females over 18 than the U.S. population, which was 60.1% and 51.3%, respectively [16,17].

Vaccinated and unvaccinated respondents did not differ in terms of age (*t*(189) = -1.04, *p* = .299), gender (χ^2(1) = 0.55, *p* = .815), sexual orientation (Fisher's Exact test *p* = .770), or race/ethnicity as Black, Indigenous, and people of color versus non-Hispanic White (χ^2(1) = 0.31, *p* = .577).

3.4. Reasons for non-vaccination among discordant couples

The 10 reasons for being unvaccinated are listed in Table 1, in order of most to least important among unvaccinated participants whose partners were vaccinated. Concern about the safety of the vaccine was rated as the most important reason for not obtaining the COVID-19 vaccine. Among unvaccinated participants whose partners were vaccinated, lack of knowledge about the vaccine was the second most important reason for being unvaccinated. Vaccinated participants rated lack of vaccine necessity as the second most important reason that their partner was unvaccinated.

Eight unvaccinated respondents wrote in other reasons why they were unvaccinated, including: "already had COVID," "I am not afraid of COVID," "I have natural immunity." Eight vaccinated respondents wrote in other reasons why their partners were unvaccinated, including: "anti-vaxxer," "he's stubborn," "the government is overstepping its bounds," "this (is) a way the government is tracking us."

Diagnostics and transformations preceded a logistic regression comparing unvaccinated persons' reasons based on their own or their vaccinated partners' views. Significant skew led to adding a constant of one to all reason ratings, followed by a log transformation. No significant multicollinearity was found: all variance inflation factors values were less than 2.0, which is well below the

suggested threshold of 5 [18]. Eight influential cases exceeded size-adjusted Cook's D values [19], and one case met criteria for high leverage [20]. These nine cases were deleted from the analysis. The overall model with the first block of demographic covariates was not significant: χ^2 (3) = 1.31, *p* = .726, Nagelkerke R^2 = 0.01. The second overall model with the ten reasons was significant: χ^2 (13) = 47.61, *p* < .001, Nagelkerke R^2 = 0.32 (R^2 change = 0.31). As shown in the right-most column in Table 1, vaccinated participants rated beliefs of COVID-19 not being real and medical contraindications as more important reasons that their partners were unvaccinated, and religious beliefs as less important reasons, than unvaccinated participants rated about themselves. Sensitivity analyses found that the models continued to be statistically significant, with the lowest overall Nagelkerke R^2s of 0.22 associated with the deletion of the belief of COVID-19 not being real or of medical contraindications.

4. Discussion

No previous reports of couples' COVID-19 vaccination status could be located. This report estimated the proportion of cohabiting couples who are concordant and discordant for COVID-19 vaccination, finding that most couples were concordant (63% both vaccinated and 21% both unvaccinated) but 16% were discordant. The number of vaccinated respondents in the sample – 822 in concordant couples and 124 in discordant couples, or 72.8% – was consistent with another report that 72% of adults had received one or more doses of vaccine in the same month [21].

Reasons for being unvaccinated were examined among discordant couples: concern about vaccine safety was the most important reason. Other highly rated reasons included lack of knowledge about the vaccine; lack of its necessity; and concerns about becoming sick after the vaccine. Reasons for being unvaccinated included potentially modifiable ideas, such as conspiracy beliefs or that previous COVID-19 infection conveys immunity, and potentially modifiable conditions, such as injection fear [14].

Among discordant couples, vaccinated individuals rated their partners' reasons for being unvaccinated differently than unvaccinated individuals rated their own reasons. These differences were significant for ideas that COVID-19 isn't real, medical contraindications, and religious beliefs. Vaccinated individuals rated COVID-19 validity and medical contraindications more strongly and religious beliefs less strongly as reasons why their partners were unvaccinated than did unvaccinated individuals themselves. The reasons for differences in the strength of these ratings are unknown. One possibility is the phenomenon of actor-observer bias: stronger discrepancies in the reasons for one's own and others' behavior are associated with intimate relationships and with situational reasons external to the person [22], consistent with these results. Another possibility is that vaccinated individuals' higher ratings reflect their concern about their unvaccinated partners' inaccurate beliefs about COVID and about contraindicated medical conditions; vaccinated partners may be motivated to help their unvaccinated partners overcome their hesitance. It would be clinically meaningful for the public's health if even a small portion of discordant couples became both vaccinated. Unvaccinated respondents rated religious beliefs more strongly than did their partners, which could reflect couples' infrequent conversations about religion [23,24] or that religious exemptions for vaccination mandates are often invalidated by others [25].

Intimate relationships are potent sources of social norms. COVID-19 vaccination social norms in social networks are associated with COVID-19 vaccine intentions [26,27]. Social norms-based interventions exist, e.g., for alcohol use and relationship distress [28,29]. Such strategies could be extended to discordant cou-

ples and COVID-19 vaccination: one vaccinated partner could be a positive starting point for corrective information about the uptake of vaccination. Intimate relationships often have high levels of mutual trust. Trust, e.g., in political institutions, has emerged as an important factor in COVID-19 prevention adherence [30]. An area for future research is the interaction between vaccine status and relationship trust and satisfaction: partners' social influence may be greater in satisfied, compared to unsatisfied, relationships. Other issues that may contribute to negative beliefs about COVID-19 and vaccination would also need to be assessed and addressed, such as biased information processing strategies (e.g., confirmation bias) and limited science literacy [31].

This study investigated the novel question of couple concordance and discordance in COVID-19 vaccine status. However, there were several limitations of the study that suggest useful directions for future research. First, this study did not collect data on some previously identified demographic variables associated with vaccination, such as education and income levels [14]. Their addition to the model would be a more rigorous test of the contributions of reasons for non-vaccination. Second, the sample was comprised of relatively more women and non-Hispanic Whites than the population, consistent with who is more willing to participate in online surveys [32]. There are complex associations between gender, COVID-19 concern, and vaccination status. As of mid-January 2022, men (and non-Hispanic Whites and Blacks) were less likely to have had at least one dose of vaccine compared to their proportions in the U.S. population [33]. It should be noted that these data are dynamic: for example, a large increase in those of Hispanic/Latino ethnicity had initiated vaccination in the previous 14 days [33]. Men with sexist (or 'macho') beliefs express lower levels of COVID-19 concern, engage in less preventive behavior, and more likely to contract COVID-19 [34]. Had there been more men in the sample, reasons for being unvaccinated may have been rated higher. Third, future research could also examine participants' reasons *for* being vaccinated, which could identify a subset of those who may not have wanted to be vaccinated but did so as a condition of employment, for example. Fourth, it is possible that dyads were discordant before they became couples and changed or maintained their status, but this possibility was not investigated in this survey.

5. Conclusion

This study found discordant COVID-19 vaccination status among 16% of cohabiting couples. The unvaccinated partner in discordant couples be mobilized to become vaccinated because of the vaccinated partner's presence. Social norms-based interventions could be used to provide personalized information to correct misperceptions and misinformation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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