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Persistent drop in confidence following US recommended pause of Ad26.COVID-19 vaccine administration

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A B S T R A C T

The Janssen COVID-19 vaccine came to market in February 2021 as the first non-mRNA and first single-dose formula approved for use in the US. In April 2021, a temporary pause was recommended for the vaccine after the discovery of rare but serious post-vaccination side-effects. We fielded a large-scale nationally representative survey (n = 401,398) on individual confidence in each of the COVID-19 vaccine formulas available in the US before, during, and after this pause. We find widespread loss of confidence in the Janssen vaccine across gender, age, and other demographics, which persisted over time and after lifting of the halt. Despite this drop, overall reasons for remaining unvaccinated were stable and there was a concurrent minor bump in confidence towards other vaccine formulas. This contrast between the persistent reduction in confidence in the Janssen vaccine and the apparent maintenance of the broader campaign’s integrity, highlights the complex dynamics and downstream effects of the pause.

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1. Introduction

On February 27, 2021 the US Food and Drug Administration (FDA) issued an Emergency Use Authorization (EUA) for the Ad26.COV2.S (Janssen) COVID-19 vaccine [1]. The EUA for this single-dose adenovirus vector vaccine followed the previous authorization of two mRNA formulas already being administered throughout the U.S. As the only single-dose COVID-19 vaccine authorized under an EUA, the only vaccine using a previously adapted viral vector design, and the only one not requiring a deep-freezer cold chain when released, the introduction of Janssen promised an avenue to overcome many barriers facing administration of the mRNA formulas [2,3]. This led to rising expectations and messaging that the Janssen vaccine would be key in vaccinating otherwise hard-to-reach populations [4]. However, despite the benefits, the Janssen vaccine rollout faced significant public hesitancy following reports of rare but serious adverse events [2].

On April 13, 2021, after approximately 6.8 million doses were administered, the FDA recommended providers temporarily pause administering the Janssen’s vaccine while awaiting safety data in a decision supported by US Centers for Disease Control and Prevention’s (CDC) Advisory Committee on Immunization Practices (ACIP) [1]. The directive came in response to reports of 6 patients who developed a rare side effect of Cerebral Venous Sinus Thrombosis (CVST), a serious clotting condition that has also been observed with the ChAdOx1 (Oxford/AstraZeneca) SARS-CoV-2 adenovirus vector vaccine [1]. A subsequent examination found 12 cases of vaccine-related CVST in the US, all presenting in white women under the age of 60, approximately 1–2 weeks following vaccination [1]. Despite the clinical seriousness of the symptoms, the ACIP found that the adverse events were extremely rare (with a reporting rate of 7.0 per million in the highest risk sub-population and lower in other sub-populations). The ACIP therefore voted to lift the pause on April 23 and recommended resuming the vaccine for all eligible people, accompanied by a warning highlighting this rare but serious side effect and careful safety monitoring [5].

As with many COVID-19 related events, the investigation of the rare complications associated with the Janssen vaccine was the subject of significant media attention in the US that likely influenced opinions of the vaccine [6]. Following the events of April
2021, the uptake of Janssen doses in the US significantly slowed, a drop-off that persisted long after the ACIP lifted their recommended pause [2]. Here we present results from a previously validated large-scale survey in the United States of individual confidence in the multiple SARS-CoV-2 vaccine formulas over time. This survey was first fielded early after the Janssen EUA and was able to capture trends in US confidence in the vaccine prior to, during, and following the ACIP recommended halt. This unique survey design also allows for querying individual reasons for remaining unvaccinated and comparing Janssen-specific preferences to over-all sentiments.

2. Methods

The OutbreaksNearMe and Momentive joint serial cross-sectional survey was delivered continuously to (n = 401,398) US individuals aged 13–100 on the SurveyMonkey web platform between March 8 and July 3, 2021. End-page river sampling techniques (previously described [7] and validated [8]) were utilized to collect a nationally representative sample of respondents. In brief, individuals would enter the SurveyMonkey platform to complete unrelated surveys (e.g., for their university, employment, etc.). After completing their original survey, random individuals were presented with our voluntary COVID-19 research survey. Approximately 11 % of individuals who were presented with the survey clicked to open it and approximately 60 % who completed the first question (“how are you feeling?”) finished the survey. Targeting people who entered the SurveyMonkey platform for a variety of purposes resulted in a demographically diverse sample.

We asked respondents to anonymously self-report demographics, vaccination status, and an assorted set of questions on pandemic-related attitudes/behaviors (full survey [9]). Survey weights were calculated from respondents’ self-reported demographics and US Census targets. We weighted for age, gender, race, education, geography, occupation, and political ideology. Previous analyses have shown that the resulting weighted population from this survey approximated that of the U.S. population [7], although our web survey likely overrepresents individuals with access to the internet which we were unable to account for via our sampling methods or weighting.

To understand confidence in each formula, we ask all self-reported unvaccinated individuals, if they planned to get vaccinated and if so, “which vaccine would you be willing to receive (select all that apply).” Participants selected from: “Moderna COVID Vaccine,” “Pfizer/BioNTech COVID Vaccine,” “Johnson & Johnson COVID Vaccine,” and “None of the Above.” We labeled those who selected any of the three available formulas as “unvaccinated but willing.” The survey-weighted proportion that indicated they would be willing to receive each vaccine formula was calculated for each two-day period to reduce daily noise. Unvaccinated individuals were additionally prompted with, “why are you unsure about getting / not planning to get the COVID-19 vaccine? (select all that apply)” and 13 options. We compare these answers for seven-day periods prior (April 4–10, 2021), during (April 15–21, 2021), following (April 24–30, 2021), and two months after (June 15–21, 2021) the ACIP halt. We also compared these answers among those that were willing to get at least one mRNA vaccine, but not Janssen (“Janssen hesitant”), and vice-versa (“mRNA hesitant”). Confidence intervals (95 %) accounting for design effects were also calculated.

3. Results

Across the study period, the minority (n = 131,293, 32.7 %) of respondents reported being unvaccinated. Of these, over half (n = 73,899, 56.2 %) expressed willingness to receive a COVID-19 vaccine. Over time, as more of the unvaccinated population got vaccinated, the proportion of the remaining unvaccinated respondents expressing willingness to receive any COVID-19 vaccine decreased (Fig. 1A). Through April 2021, all three vaccine formulations held relatively similar willingness levels, with acceptance of the Janssen single-dose vaccine being slightly higher than either of the two mRNA formulas and acceptance of Pfizer slightly outpacing the Moderna vaccine. The marginal preference for the Janssen vaccine was held despite widespread publication [10] of its lower vaccine efficacy, potentially due to the appeal of only needing a single-dose.

Reports of adverse reactions began circulating in the days prior to the ACIP pause and a small number of local sites were shut down in response [11]. Concurrently, the Janssen vaccine experienced a mild drop (Fig. 1B, purple) in willingness-to-receive (from 58 % on April 7–8 to 52 % on April 11–12, the two days prior to the halt). A more dramatic 18 percentage point decline to 34 % willingness-to-receive occurred immediately following the pause, a number that continued to slide to 24 % in the following days. Importantly, in July 2021, over two months after the ACIP halt was lifted, this number continued to oscillate around 24 %. During the period in which the Janssen vaccine confidence decreased, both the Pfizer (Fig. 1A, blue) and Moderna (Fig. 1A, orange) vaccines experienced small temporary jumps in willingness-to-receive and results began to suggest a clear preference for the Pfizer vaccine. We also consistently see a pattern of a sharp drop in Janssen vaccine preference across gender (Fig. 2), age (Supplemental Figure 1), education (Supplemental Figure 2), and political affiliation (Fig. 3). When stratifying by age, we see the largest drop (31.8 points) in the 45–59 age group and the smallest in those over 60 (7.8 point drop), although willingness to receive the Janssen vaccine was already trending downwards in the latter group prior to the halt. The visible drop in willingness to receive the Janssen vaccine also uniformly persists over the study period in all the demographic strata, although the confidence intervals become wide in subgroups with smaller samples (e.g. unvaccinated individuals over 60).

All individuals unwilling to get a COVID-19 vaccine were asked their reasons for foregoing vaccination. Most people (over 55 % across each cross-section) indicated the vaccines were too new and did not have enough testing (Table 1). This theme matched other commonly endorsed answers including concern about side effects (47 %), lack of trust in government (48 %) / healthcare systems (39 %), and politics playing too large of a role in the process (44 %). The percentage of respondents endorsing each reason was compared for each cross-section to measure aggregate trends. Here we find that the events of the ACIP pause seemed to have little impact in the endorsement of select responses, with minimal changes seen over time. Expectedly, the percentage of respondents who reported already having COVID-19 increased (3.3 percentage points) and the percentage of respondents who worried the vaccine will cause COVID-19 decreased (4.9 percentage points) over time. Stated reasons for currently foregoing COVID-19 vaccination were consistent among unvaccinated individuals who were hesitant to receive one type of vaccine formula, but not another (Supplemental Table 1). Notably, those who were mRNA hesitant were more likely to endorse every cited reason except for concerns about side effects and previous COVID-19 infection, which led in the Janssen hesitant group.

4. Discussion

Low COVID-19 vaccine confidence in the US remains a significant barrier to full vaccine uptake. The reasons for low confidence are complex and differ from person to person [12]. Here we present
data from a large-scale US web survey that shows a sizable drop in the percentage of unvaccinated individuals who were willing to receive the Janssen vaccine following the April 2021 adverse events and the ACIP recommended halt. We find that this drop has persisted for months and that the Janssen vaccine continues to be the least favored option of the three COVID-19 vaccines avail-

Fig. 1. Willingness to receive COVID-19 vaccine by formula. Willingness to receive the Janssen (purple), Moderna (Orange), and Pfizer (Blue) vaccines according to large-scale internet survey (n = 401,398) fielded between March 8, 2021 and July 3, 2021. Point estimates shown in diamonds with vertical colored lines representing 95 % confidence intervals. Results presented for all unvaccinated respondents (A, left, N = 131,304) and all unvaccinated respondents who said they would be willing to receive at least one of the three available formulas (B, right, N = 73,899). Vertical annotations for the date of the ACIP issued halt of Janssen administration (April 13, 2021) and the date the halt was lifted (April 23, 2021). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Fig. 2. Willingness to receive each COVID-19 vaccine formula by gender. Willingness to receive the Janssen (purple), Moderna (Orange), and Pfizer (Blue) vaccines according to large-scale internet survey (n = 401,398) fielded between March 8, 2021 and July 3, 2021. Point estimates shown in diamonds with vertical colored lines representing 95 % confidence intervals. Results presented for all unvaccinated respondents who said they would be willing to receive at least one of the three available formulas. Vertical annotations for the date of the ACIP issued halt of Janssen administration (April 13, 2021) and the date the halt was lifted (April 23, 2021). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
able under an EUA. This finding holds across all demographics analyzed including both studied genders and all studied ages, despite the increased risk being principally in women under 60. Notably, despite the hyper-politicization of COVID-19 vaccination [13], it also holds across self-reported US political party affiliation. These widespread consequences highlight the need for targeted messaging and were realized in the absence of CDC guidance explicitly targeting high risk women [14]. The broad and persistent rejection of the Janssen vaccine also fits with our understanding of how sensationalism of adverse events can cause dramatic and long-tailed hesitation, even when individual risks are minimal [15].

The Janssen vaccine associated adverse events and resulting halt played a large role in altering preferences, but our data suggest there was minimal change in overall reasons for low vaccine confidence and minimal increase in respondents expressing concerns about side effects, although Janssen hesitant individuals did express higher levels of concern than those who were mRNA hesitant. Interestingly, the two mRNA formulas did receive a small bump in interest coinciding with the drop in willingness-to-receive the Janssen vaccine. Together, these findings may signal that while people lost confidence in the Janssen vaccine these events did not alter their perception of the US vaccination process. Instead, the pause may have caused them to switch formula preferences. This may imply that COVID-19 vaccination can be understood as two serial decisions: first the choice to receive the vaccine and second the specific formula. However, this may also be an artifact of survey design leading respondents to choose their current favorite of the three options.

There are several limitations to this study. Although the survey design used an innovative sampling technique and population-based weights to proxy the demographics of the U.S. it is possible that there may be selection bias within each demographic subgroup in who was willing to fill out a survey on COVID-19. The click-through rate of approximately 11 % and completion rate of approximately 60 % means that those who filled out the survey were a minority relative to those presented with the survey and

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**Table 1**

| Reasons for Foregoing COVID-19 Vaccine Prior to ACIP Halt | During Halt | Following Halt | Two-Months Later |
|----------------------------------------------------------|-------------|----------------|-----------------|
| They are too new / not enough testing (%)                | 57.6 ± 2.8  | 59.3 ± 2.5     | 55.7 ± 2.7      | 55.3 ± 3.3      |
| Concern about side effects (%)                          | 49.7 ± 2.9  | 51.4 ± 2.6     | 48.6 ± 2.7      | 47.3 ± 3.4      |
| Lack of trust in government (%)                         | 49.0 ± 2.8  | 52.4 ± 2.6     | 48.7 ± 2.7      | 49.5 ± 3.4      |
| Politics has played too much of a role in the vaccine development process (%) | 46.7 ± 2.8 | 46.6 ± 2.6 | 44.4 ± 2.7 | 44.1 ± 3.3 |
| I think that the risk from the vaccine is greater than the risk of a COVID-19 infection (%) | 42.2 ± 2.8 | 45.0 ± 2.5 | 42.7 ± 2.7 | 44.2 ± 3.3 |
| Lack of trust in scientists/healthcare system (%)       | 40.6 ± 2.8  | 41.6 ± 2.5     | 39.6 ± 2.7      | 39.9 ± 3.3      |
| COVID Threat is exaggerated (%)                         | 33.8 ± 2.7  | 35.2 ± 2.4     | 32.4 ± 2.6      | 31.1 ± 3.1      |
| I do not think I am at risk of getting sick from COVID-19 (%) | 24.6 ± 2.4 | 21.2 ± 2.1    | 23.9 ± 2.3      | 23.1 ± 2.7      |
| Never get any vaccine (%)                               | 23.4 ± 2.4  | 22.9 ± 2.2     | 23.4 ± 2.3      | 19.7 ± 2.7      |
| Already had COVID (%)                                   | 15.3 ± 2.0  | 15.2 ± 1.8     | 15.8 ± 2.0      | 18.6 ± 2.6      |
| I am worried that I may get COVID-19 from the vaccine (%) | 14.3 ± 2.0  | 12.1 ± 1.7     | 11.4 ± 1.7      | 9.4 ± 2.0       |
| Something else (%)                                       | 12.4 ± 1.8  | 11.6 ± 1.6     | 12.2 ± 1.8      | 15.5 ± 2.4      |
| Vaccine is not recommended for someone with my health history (%) | 7.7 ± 1.5  | 6.9 ± 1.3 | 7.8 ± 1.5 | 10.2 ± 2.0 |

1April 4–10, 2021, N = 8,575
2April 15–21, 2021, N = 6,886
3April 24–30, 2021, N = 9,434
4June 15–20, 2021, N = 3,793

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![Fig. 3. Willingness to receive each COVID-19 vaccine formula by political affiliation. Willingness to receive the Janssen (purple), Moderna (Orange), and Pfizer (Blue) vaccines according to large-scale internet survey (n = 401,398) fielded between March 8, 2021 and July 3, 2021. Point estimates shown in diamonds with vertical colored lines representing 95% confidence intervals. Results presented for all unvaccinated respondents who said they would be willing to receive at least one of the three available formulas. Vertical annotations for the date of the ACIP issued halt of Janssen administration (April 13, 2021) and the date the halt was lifted (April 23, 2021). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)](image-url)
their answers may not be representative of public. Having access to the internet was a pre-requisite to receiving the survey and the results systematically exclude those with poor broadband access whose attitudes towards COVID-19 vaccination likely differ from internet users. Additionally, we did not account for individuals who may be interested in getting a COVID-19 vaccine with a formula other than the three available in the U.S. during the study period.

The decision to initiate and then release a pause of the Janssen COVID-19 vaccine may have ultimately reduced confidence in the Janssen vaccine but simultaneously prevented further erosion of the public’s trust in the greater COVID-19 vaccination campaign. Further research is needed to understand how messages are communicated and their cascading effects on provider preferences, population perceptions, and future vaccine regiment (e.g. boosters, mix-and-matching) desirability.

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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Disclosures

The authors have no conflicts of interest to declare.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.vaccine.2022.11.035.

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