# Factors associated with COVID-19 vaccine trust and hesitancy among adults with chronic conditions

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ABSTRACT

In a survey of older adults at higher risk for COVID-19 complications, we sought to describe expectations of trust in the safety and efficacy of a future COVID-19 vaccine, and level of hesitancy about receiving it. We also assessed whether these expectations were associated with known or suspected contributors to vaccine hesitancy, disparities in vaccine receipt, and potential targets for public health outreach.

From May 1–22, 2020, we performed telephone surveys of 601 older adults with chronic conditions in metro Chicago about their COVID-19 experiences and levels of vaccine trust and hesitancy. All participants previously completed assessments of demographics, health status, health literacy and activation. Bivariate associations were performed using t-tests or one-way ANOVA, and multivariate analyses using least square means.

Younger age (<60), Black race, greater complacency about contracting COVID-19, and lower confidence in state or local government were associated with significantly lower trust in a vaccine's safety and efficacy. Black race and greater complacency about contracting COVID-19 were associated with a significantly greater vaccine hesitancy. Amongst Black participants, vaccine hesitancy varied significantly by confidence in the federal government.

Trust and hesitancy regarding a future COVID-19 vaccine were associated with age, race, complacency regarding contracting COVID-19, and confidence in government response to the pandemic, but not education, health literacy or activation. Therefore, efforts to vaccinate higher risk older adults must aim not only to educate and provide vaccine access, but engender trust in the vaccine development process and vaccination strategies at both the federal and the local level.

## 1. Introduction

Vaccine hesitancy, the delay in acceptance or refusal of vaccines despite their availability, is a persistent global problem, affecting both routine vaccination programs as well as those deployed to combat epidemics (MacDonald, 2015). As vaccine hesitancy is multifactorial and context-specific, addressing it is particularly complex. The causative factors range from large-scale, contextual influences – such as culture, politics, and socioeconomics – to population or individual level factors – such as confidence in a vaccine's efficacy and complacency about vaccine-preventable illness (MacDonald, 2015). In the United States, vaccine hesitancy amongst adults is also significantly associated with race (Lu et al., 2014; Lu et al., 2015; Lu et al., 2017).

Although there are no racial disparities for receipt of most childhood vaccines in the US, there are persistent disparities for both routine adult vaccination (i.e. seasonal influenza, tetanus, pneumococcal, human papilloma virus, and zoster) and epidemic vaccinations, which cannot be explained by confounding factors such as age or access (Lu et al., 2015; Hebert et al., 2005). During the 2009 H1N1 pandemic, for example, racial disparities in vaccine receipt developed despite active government policies to make vaccines free of cost and available at alternative vaccination sites outside of physicians' offices, as well as numerous community-based outreach efforts (Uscher-Pines et al., 2011). The underlying causes of these disparities appear to depend on trust (both general and vaccine-specific trust), as well as psychosocial factors such as risk perception and vaccine knowledge (Freimuth et al., 2017).

A large, nationally representative survey of Americans conducted prior to the approval and public availability of a COVID-19 vaccine found that 31% of respondents were hesitant about being vaccinated and another 20% would refuse vaccination outright (Research AP-NCfPA, 2020). A follow-up survey four months later unfortunately found an even greater degree of hesitancy, with as many as 49% of respondents saying they would definitely or probably not be vaccinated if a vaccine were available today (Tyson and Funk, 2020). As with other vaccines, there are already signs of racial and ethnic disparities in attitudes towards a potential COVID-19 vaccine, with only 25% of Black compared to 37% of Hispanic and 56% of White respondents stating that they plan to be vaccinated if a vaccine becomes available (Research AP-NCfPA, 2020). If this proportion of hesitant Americans holds or continues to grow, it could not only prevent attempts to achieve herd immunity through vaccination, but also worsen existing disparities in both COVID-19 infection rates, morbidity, and mortality.

In a telephone-based survey following a cohort of older adults with chronic conditions who are thus at higher risk for adverse consequences from COVID-19 infection, we sought to describe adults' expectations of trust in the safety and efficacy of a future COVID-19 vaccine, and their level of hesitancy about receiving it when as soon as it becomes available. We also sought to assess whether these expectations were associated with known or suspected contributors to vaccine hesitancy, disparities in vaccine receipt, and potential targets for public health outreach, including 1) demographic factors, such as age, race and ethnicity, 2) socioeconomic and insurance factors, 3) health, health literacy, and health activation, 4) COVID-19 experiences and personal assessments of the risk or threat of the pandemic, as well as confidence in the government response to the COVID-19 pandemic.

## 2. Methods

The Chicago COVID-19 Comorbidities (C3) Survey is a longitudinal, telephone-based study conducted among older, community-dwelling adults in Chicago, IL (Wolf et al., 2020). Data utilized for these analyses are from Wave 3 surveys collected from May 1 – 22, 2020. Therefore, these data were collected during the first local peak of COVID-19 cases in Chicago (May 12, 2020), and during statewide stay-at-home orders (March 20 – May 29, 2020), when Illinoisans were exposed to public health messaging and policies regarding the pandemic.

*Study Participants.* Participants for the C3 Survey are active in one of four ongoing National Institutes of Health-funded studies led by our research team and have been described in our prior publications (Wolf et al., 2020). Eligibility criteria varied by NIH parent study (O'Conor et al., 2019; Wolf et al., 2012; Bailey et al., 2017), but all included older adults with one or more chronic conditions who were receiving care from one of five academic or two community health centers in metropolitan Chicago, IL (Wolf et al., 2020). Three of the four studies recruited only English-speaking adults, and one recruited both English and Spanish-speaking (Bailey et al., 2017). All studies excluded those with severe, uncorrectable vision, hearing or cognitive impairments that would preclude study participation or consent.

*Research Protocol.* Our research staff contacted participants via telephone and invited them to complete a brief, interviewer-administered survey about COVID-19. Participant responses were recorded using REDCap survey software. Surveys were generally completed in <20 min and participants received a $10 gift certificate per survey wave.

*Patient characteristics.* As part of the parent NIH studies, participants completed standardized assessments demographics (e.g. age, sex, race or ethnicity, education level, English proficiency), health status (self-reported number of chronic conditions), health literacy skills (Newest Vital Sign) (Weiss et al., 2005), and health activation (Consumer Health Activation Index) (Wolf et al., 2018).

*COVID-19 Experiences.* Patients reported whether they or someone they knew had known (confirmed) or suspected COVID-19 (yes/no), the degree to which they were worried that they or someone they know could contract COVID-19 (not at all, a little, somewhat, or very worried), and how often they felt nervous or stressed due to COVID-19 (never, some, most or all of the time).

*Confidence in the Government Response.* Participants rated their confidence in both the state and local governments' and the federal government's ability to prevent further outbreak of COVID-19 (not at all, a little, somewhat, or very confident).

*COVID-19 Vaccine Trust and Hesitancy.* Participants reported their agreement on a scale of 0–10 (with 10 being the greatest agreement) with the following two statements regarding expectations of a future COVID-19 vaccine: "I trust that any future coronavirus vaccine will be safe and effective" and "I will be vaccinated for the coronavirus as soon as a vaccine becomes available."

*Statistical Analyses.* Descriptive statistics (means with standard deviations and percentage frequencies) were calculated for all patient characteristics and survey responses. Associations between vaccine trust and hesitancy and patient characteristics, COVID-19 experiences, and confidence in the government were evaluated in bivariate analyses using t-tests or one-way ANOVA, as appropriate. We then calculated least square means (LSM) with 95% Confidence Intervals for outcomes of vaccine trust and hesitancy adjusted for variables significant associated with these outcomes (age, race/ethnicity, poverty level, education, confidence in state or local government), and additional variables pertinent to the study aim, including an interaction term for race/ethnicity and confidence in the federal government. Statistical analyses were performed using Stata/SE, version 15 (StataCorp).

## 3. Results

In all, 601 participants completed the survey, of whom 66% were 60 years of age or older, with a mean age of 62. The majority (62%) were female, 29% identified as Black and 21% Hispanic. The majority were retired or not working, with incomes above the poverty line (72%). Half of participants were college-educated, and approximately the same proportion had adequate health literacy (56%) and health activation (52%). Over half (61%) were living with three or more chronic health conditions (Table 1).

Participants reported perceiving the threat of COVID-19 as 9 out of 10, and half had a personal contact with known (confirmed) or suspected infection. Seventy-three percent of participants reported being somewhat or very confident in their state or local government's ability to prevent further outbreak, whereas only 31% were similarly confident in the federal government.

*Vaccine Trust.* In bivariate analyses, younger age (<60), Black race, lower educational attainment, reporting less worry that they or someone they know could contract COVID-19 (greater complacency), and lower confidence in state or local government response were associated with having less trust in the safety and efficacy of a future COVID-19 vaccine (Table 1). Health literacy and health activation were not associated with trust in the safety and efficacy of a future vaccine. After adjusting for other significant variables, the same variables, with the exception of educational attainment remained associated with less trust in a future vaccine's safety and efficacy (Table 2).

*Vaccine Hesitancy.* Younger age (<60), Black race, income below the poverty level, lower educational attainment, greater comorbidity, and greater reported complacency about contracting COVID-19 were associated with lower expectation of being vaccinated as soon as vaccine becomes available (i.e. greater vaccine hesitancy) in bivariate analyses (Table 1). In multivariate analyses, Black race and greater reported complacency about contracting COVID-19 remained associated with greater vaccine hesitancy (Table 2). When these analyses were performed accounting for an interaction between Black race and confidence in the federal government, there was also significant association between confidence in the federal government and vaccine hesitancy amongst Black participants. Black participants who reported low

**Table 1**
Participant characteristics and bivariate analyses.

| Variable | Summary Value (N = 601) | Expectation of trust in COVID-19 vaccine safety and efficacy, [a] mean (0-10) | P-value | Expectation of being vaccinated for COVID-19 as soon as a vaccine becomes available, [b] mean (0-10) | P-value |
|---|---|---|---|---|---|
| **Demographics** | | | | | |
| Age Group, % | | | | | |
| <60 | 34.1 | **6.4 (3.0)** | **0.005** | **7.0 (3.4)** | **0.01** |
| ≥60 | 65.9 | **7.1 (2.8)** | | **7.8 (3.2)** | |
| Gender, % | | | | | |
| Male | 38.3 | 7.0 (2.8) | 0.38 | 7.8 (3.1) | 0.12 |
| Female | 61.7 | 6.8 (2.9) | | 7.4 (3.3) | |
| Race, % | | | | | |
| Hispanic/Latinx | 20.6 | **7.1 (2.9)** | **0.01** | **7.8 (3.1)** | **<0.001** |
| Non-H/L White | 47.1 | **7.1 (2.5)** | | **8.3 (2.8)** | |
| Non-H/L Black | 28.7 | **6.4 (3.3)** | | **6.3 (3.6)** | |
| Other | 3.7 | **5.9 (3.4)** | | **6.0 (3.9)** | |
| Limited English Proficiency, % | | | | | |
| Yes | 10.7 | 6.9 (3.0) | 0.91 | 7.7 (3.2) | 0.68 |
| No | 89.4 | 6.9 (2.9) | | 7.5 (3.3) | |
| **Socioeconomic status** | | | | | |
| Living Below Poverty Level, % | | | | | |
| Yes | 28.5 | 6.8 (3.2) | 0.67 | **6.9 (3.5)** | **0.005** |
| No | 71.5 | 6.9 (2.8) | | **7.8 (3.1)** | |
| Health Insurance, % | | | | | |
| Medicare | 16.2 | 7.2 (2.7) | 0.17 | 7.6 (3.3) | 0.10 |
| Medicaid | 12.0 | 6.6 (3.3) | | 7.0 (3.5) | |
| Private | 24.5 | 6.4 (2.9) | | 7.5 (3.2) | |
| Medicare + Private | 31.0 | 7.1 (2.7) | | 8.0 (3.1) | |
| Medicare + Medicaid | 16.3 | 6.9 (3.0) | | 7.0 (3.4) | |
| Highest educational attainment, % | | | | | |
| Grade school | 4.8 | **8.0 (2.4)** | **0.02** | **8.4 (2.5)** | **0.005** |
| High school | 45.1 | **6.6 (3.2)** | | **7.1 (3.5)** | |
| College | 50.1 | **7.0 (2.6)** | | **7.9 (3.1)** | |
| Employment Status, % | | | | | |
| Working for Pay | 26.5 | 6.6 (2.9) | 0.20 | 7.4 (3.3) | 0.55 |
| Not Working (Retired/ Unemployed) | 73.5 | 7.0 (2.9) | | 7.6 (3.2) | |
| **Health** | | | | | |
| Health Literacy, % | | | | | |
| Low | 22.1 | 7.0 (3.3) | 0.43 | 7.3 (3.5) | 0.06 |
| Marginal | 22.3 | 6.6 (3.2) | | 7.1 (3.5) | |
| Adequate | 55.6 | 6.9 (2.6) | | 7.8 (3.0) | |
| Health Activation, % | | | | | |
| Low | 47.6 | 6.7 (2.9) | 0.13 | 7.6 (3.2) | 0.58 |
| Marginal/Adequate | 52.4 | 7.1 (2.9) | | 7.4 (3.4) | |
| Number of Chronic Conditions, % | | | | | |
| 1-2 | 38.9 | 7.0 (2.8) | 0.27 | **7.9 (3.1)** | **0.02** |
| 3 or more | 61.1 | 6.8 (2.9) | | **7.3 (3.4)** | |
| **COVID-19** | | | | | |
| Perceived threat that COVID-19 will become (mean on 0-10 scale) | 9.3 (1.3) | – | 0.06 | – | **0.04** |
| Current or previous infection | | | | | |
| Yes | 6.8 | 6.6 (3.0) | 0.46 | 7.8 (3.4) | 0.57 |
| No | 93.2 | 6.9 (2.9) | | 7.5 (3.3) | |
| Contact with known or suspected infection | | | | | |
| Yes | 50.1 | 6.8 (2.9) | 0.56 | 7.4 (3.3) | 0.52 |
| No | 49.9 | 6.9 (2.9) | | 7.6 (3.2) | |
| Worry about you or someone you know getting COVID-19, % | | | | | |
| Not at all – A little worried | 33.9 | **6.5 (3.0)** | **0.02** | **6.7 (3.5)** | **<0.001** |
| Somewhat - Very worried | 66.1 | **7.1 (2.8)** | | **7.9 (3.0)** | |

*(continued on next page)*

**Table 1** (*continued*)

| Variable | Summary Value (N = 601) | Expectation of trust in COVID-19 vaccine safety and efficacy, [a] mean (0-10) | P-value | Expectation of being vaccinated for COVID-19 as soon as a vaccine becomes available, [b] mean (0-10) | P-value |
|---|---|---|---|---|---|
| Over the past week, feeling nervous or stressed due to COVID-19, % | | | | | |
|     Never – Some of the time | 81.4 | 6.9 (2.9) | 0.51 | 7.5 (3.3) | 0.89 |
|     Most – All of the time | 18.6 | 6.7 (2.8) | | 7.5 (3.3) | |
| Confident in state or local government to prevent further outbreak | | | | | |
|     Not at all – A little | 27.2 | **6.2 (3.1)** | **<0.001** | 7.2 (3.4) | 0.13 |
|     Somewhat - Very | 72.8 | **7.1 (2.8)** | | 7.6 (3.2) | |
| Confident federal government to prevent further outbreak | | | | | |
|     Not at all – A little | 68.6 | 6.8 (2.8) | 0.38 | 7.6 (3.2) | 0.77 |
|     Somewhat – Very | 31.4 | 7.0 (3.0) | | 7.5 (3.3) | |

a. Agreement with the statement "I trust that any future coronavirus vaccine will be safe and effective."
b. Agreement with the statement "I will be vaccinated for the coronavirus as soon as a vaccine becomes available."

confidence in the federal government reported significantly lower expectation of being vaccinated as soon as a vaccine becomes available (LSM 5.9) compared to all Hispanic (LSM 7.6, p = 0.001) and Non-Hispanic white (LSM 8.2, p < 0.001) participants. There were no such differences in vaccine hesitancy between Blacks participants who reported confidence in the federal government and participants from other racial groups.

**4. Discussion**

In a telephone-based survey of older adults Chicago, IL during the first local peak of the COVID-19 pandemic, we found that age, race, complacency about contracting COVID-19, and aspects of confidence in government response to the pandemic were all associated with trust and hesitancy regarding a future COVID-19 vaccine. A minority of participants (31%) were confident in the federal government's ability to prevent further outbreak, and amongst Black participants, lower confidence was associated with significantly lower expectations of receiving a vaccine as soon as it is available. Therefore, vaccine hesitancy varied not only between Black and non-Black participants, but also amongst Black participants depending on confidence in the federal government. Importantly, expectations regarding a future COVID-19 vaccine did not vary by participants' education, health literacy, or health activation.

Older participants and those reporting greater worry (less complacency) about contracting COVID-19 were more likely to report that a future vaccine would be safe and effective. This is consistent with prior literature noting how complacency regarding the threat of an infectious disease results in vaccine hesitancy and lower vaccination rates (MacDonald, 2015). Our finding of an interaction between race and confidence in the government affecting vaccine hesitancy amongst Black participants is also consistent with known racial differences in medical care mistrust, attributable to generational and personal experiences within a larger historical context of racism (Gamble, 1997; Brandon et al., 2005; (U.S.) CfDC). While these complex interactions affecting vaccine hesitancy are not unique to the COVID-19 pandemic, it is critical that they be addressed now given the severity of the racial disparities in COVID-19 health outcomes, as well as the often confusing and politicized messaging regarding COVID-19.

In the US, COVID-19 continues to disproportionately affect minority populations in incidence of infection, hospitalization and mortality rates, with Black Americans continuing to suffer the highest mortality. ((U.S.) CfDC) These serious disparities in outcomes are occurring within a highly polarized political climate, at least in part fueled by an unprecedented level of mis-/disinformation regarding the COVID-19 virus, and the vaccine development and approval process. This "infodemic"

(Zarocostas, 2020) has prompted pharmaceutical and biotechnology companies to publicly pledge to only seek approval for vaccines demonstrated to be safe and effective (Facher, 2020). However, these industry pledges have done little to improve vaccine hesitancy to date (Tyson and Funk, 2020), and our findings suggest that confidence in government plays a significant role in vaccine trust and hesitancy, especially amongst those at highest risk for COVID-19 infection and death. Although factors such as education, health literacy, and health activation are often cited as drivers of racial disparities, we found no association between such factors and vaccine trust and hesitancy (Chaudhry et al., 2011). Therefore, efforts to mitigate racial disparities in vaccination rates - which will be critical in combatting COVID-19 - will likely requiring engaging at-risk populations to build understanding and trust in the government's assurances of vaccine safety and public health messages (Fletcher et al., 2020; Dubé et al., 2015).

Because we surveyed generally older, insured adults with chronic conditions during a local peak in COVID-19 incidence, it is likely that our respondents were less complacent about contracting COVID-19 infection and more sure that they would have access to a future vaccine. As low complacency and adequate vaccine access are both associated with lower vaccine hesitancy, our findings may underestimate vaccine hesitancy, and may therefore not be generalizable to the general population or groups with historically poor access to vaccines or at lower risk of COVID-19 complications. It is also unknown how well a 10-point scale of agreement with the vaccine statements used in our study will correlate with future clinical outcomes, such as receipt of a COVID-19 vaccine. Finally, because of the rapid pace of scientific knowledge, public health messages, and vaccine development, surveys regarding vaccines represent a snapshot in time, and may not predict future attitudes or receipt of vaccine. However, we believe our results add to the understanding provided by larger, more generalizable survey work in that our population is very well characterized, and we were therefore able to consider factors not typically available in national surveys, such as health status confirmed by patients' medical records, health care access, health literacy and health activation. In addition, these findings represent the opinions of adults at greatest risk of COVID-19, namely older adults and those of racial and ethnic minorities, at a time of peak local incidence.

Future COVID-19 vaccination campaigns, which are set to be immense public health and logistical challenges, will be undoubtedly be further complicated by government mistrust and its effects on vaccine hesitancy, disproportionately affecting Black Americans. This survey describes the currently low level of trust in the federal government's response to the pandemic and identifies those who are most likely to be hesitant. It also highlights that educational attainment, health literacy,

**Table 2**
Multivariate analyses.

| Covariates | Expectation of trust in COVID-19 vaccine safety and efficacy, Marginal Means*[a] (95% CI) | P-Value | Expectation of being vaccinated for COVID-19 as soon as a vaccine becomes available, Marginal Means*[b] (95% CI) | P-Value |
|---|---|---|---|---|
| **Age Group, %** | | | | |
| < 60 | **6.24 (5.59,6.89)** | **0.004** | 7.20 (6.48,7.92) | 0.29 |
| ≥ 60 | **7.14 (6.59,7.70)** | | 7.56 (6.96,8.17) | |
| **Race** | | | | |
| Hispanic/Latinx | 6.95 (6.27,7.64) | 0.81 | 7.72 (6.97,8.47) | 0.47 |
| Non-H/L White | 6.86 (6.23,7.50) | REF | 8.03 (7.33,8.73) | REF |
| Non-H/L Black | **6.26 (5.57,6.94)** | **0.05** | **6.39 (5.64,7.14)** | **<0.001** |
| **Living Below Poverty Level, %** | | | | |
| Yes | 6.72 (6.08,7.36) | 0.84 | 7.08 (6.38,7.79) | 0.09 |
| No | 6.66 (6.09,7.23) | | 7.68 (7.05,8.31) | |
| **Highest educational attainment, %** | | | | |
| Grade school | 7.21 (5.99,8.43) | REF | 7.86 (6.52,9.20) | REF |
| High school | 6.32 (5.87,6.77) | 0.16 | 7.04 (6.54,7.53) | 0.41 |
| College | 6.54 (5.98,7.11) | 0.42 | 7.25 (6.62,7.87) | 0.50 |
| **Number of Chronic Conditions** | | | | |
| 1-2 | 6.70 (6.04,7.36) | 0.97 | 7.59 (6.87,8.32) | 0.23 |
| 3 or more | 6.69 (6.14,7.23) | | 7.17 (6.57,7.78) | |
| **Worry about you or someone you know getting COVID-19** | | | | |
| Not at all – A little worried | **6.44 (5.83,7.04)** | **0.05** | **6.87 (6.20,7.54)** | **<0.001** |
| Somewhat - Very worried | **6.95 (6.39,7.50)** | | **7.89 (7.28,8.50)** | |
| **Confident in state or local government to prevent further outbreak** | | | | |
| Not at all – A little | **6.28 (5.61,6.95)** | **0.006** | 7.24 (6.50,7.97) | 0.38 |
| Somewhat - Very | **7.10 (6.59,7.62)** | | 7.52 (6.96,8.09) | |
| **Confident in federal government to prevent further outbreak** | | | | |
| Not at all – A little | 6.65 (6.10,7.21) | 0.79 | 7.33 (6.72,7.94) | 0.74 |
| Somewhat - Very | 6.73 (6.11,7.36) | | 7.43 (6.74,8.12) | |

*Means adjusted for age, race, poverty level, education, trust in state and local government, trust in federal government, parent study, date of interview
a. Agreement with the statement "I trust that any future coronavirus vaccine will be safe and effective."
b. Agreement with the statement "I will be vaccinated for the coronavirus as soon as a vaccine becomes available."

and health activation are not associated with levels of trust or hesitancy regarding a future COVID-19 vaccine, and therefore public health efforts may need to go beyond typical health educational outreach. The findings suggest that to prevent anticipated racial disparities in receipt of a COVID-19 vaccine, the onus is on not only public health agencies and the health care sector, but also on government agencies – from local to federal – to be open and transparent about vaccine development, approval, and distribution processes. There must be concerted efforts to meaningfully engage the most at-risk communities via credible messengers and engender the trust needed to overcome the hesitancies anticipated by these survey results and other historical indices.

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**CRediT authorship contribution statement**

**Marina Arvanitis:** Conceptualization, Data curation, Formal analysis, Writing - original draft, Writing - review & editing. **Lauren Opsasnick:** Conceptualization, Data curation, Formal analysis, Writing - review & editing. **Rachel O'Conor:** . **Laura M. Curtis:** Data curation, Formal analysis, Writing - review & editing. **Chandana Vuyyuru:** Project administration, Resources, Software, Writing - review & editing. **Julia Yoshino Benavente:** Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Writing - review & editing. **Stacy C. Bailey:** Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing - review & editing. **Muriel Jean-Jacques:** Writing - review & editing. **Michael S. Wolf:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Supervision, Writing - review & editing.

**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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