Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Brief Report

COVID-19 vaccination hesitancy among Americans with disabilities aged 18-65: An exploratory analysis

Andrew Myers, MA *, Catherine Ipsen, MA, PhD, Ari Lissau, BA

University of Montana, Rural Institute for Inclusive Communities, Missoula, MT, 59812, USA

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ABSTRACT

Background: It is important for people with disabilities to be vaccinated against COVID-19 because, as a group, they are at increased risk of severe outcomes. While there are multiple vaccines available to prevent COVID-19, a considerable proportion of Americans report some hesitancy to becoming vaccinated, including people with disabilities.
Objective: We conducted a study to explore what factors may contribute to COVID-19 vaccination hesitancy among Americans with disabilities.
Methods: We used Amazon's Mechanical Turk to survey 439 people with disabilities (ages 18+) about their concerns of the COVID-19 disease, vaccines, and hesitancy toward vaccination to learn more about factors that influence vaccination hesitancy. Concerns about vaccines were analyzed as a composite variable representing different dimensions such as: side effects, too new, developed too quickly, influenced by politics, and effectiveness.
Results: Results from a logistic regression indicate that concern about vaccines was the most significant predictor of hesitancy, even after considering demographic, economic, and geographic factors. Concerns about getting COVID-19, getting tested for COVID-19, trust in experts, education, and being a Democrat were negatively associated with hesitancy.
Conclusions: These findings indicate that some groups of individuals may be more vaccination hesitant because they are more concerned about vaccine safety than COVID-19 infection. Public health messaging that focuses on the risks of vaccines relative to the risks of COVID-19 might be one strategy to reduce hesitancy and increase vaccination uptake. Messaging should also be tailored to specific disabilities (i.e. physical, mental, sensory), written in plain language, and disseminated in accessible formats.

Americans account for approximately 18% of the worldwide COVID-19 infections.[1] While vaccinations can reduce the risk, a significant segment of the U.S. population is vaccination hesitant. Hesitancy is particularly concerning for individuals with higher risk for severe outcomes, including many individuals with disabilities who experience high rates of chronic disease, underlying health conditions, increased likelihood of living in a congregate long-term care facility, and older age.[2–4]

To slow the spread of COVID-19, the U.S. Food and Drug Administration (FDA) issued an emergency use authorization for the Pfizer-BioNTech and Moderna COVID-19 vaccines in December 2020.[5,6] The distribution of these vaccines fell primarily to state and local health departments, which resulted in varied vaccination eligibility criteria. Despite risk factors associated with disability, most vaccination plans did not identify disability status as a risk factor.[7]

COVID-19 vaccination hesitancy in the U.S. ranges from 22%[8] to nearly a third of the general population.[9] Hesitancy has been reported to be highest among females, Black adults, Republicans, and rural residents, while lack of hesitancy is higher for people who have been tested for COVID-19, have a college degree, trust expert sources of information, and are concerned about COVID-19.[8–12] One of the primary reasons cited for hesitancy is concern about vaccine safety.[10]

Prior research has described COVID-19 vaccination experiences among the general population, but much of this work excludes disability status. Studies including disability have largely been narrow in geographic scope (i.e. New York state[13]) or based on medical diagnoses as an indicator of disability (i.e. multiple

* Corresponding author. University of Montana Rural Institute, Missoula, MT, 59812, USA.
E-mail address: Andrew.myers@mso.umt.edu (A. Myers).

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sclerosis[14]). Addressing this knowledge gap is critical to ensuring that people with disabilities are considered in current and future vaccination efforts.[15] Understanding which factors impact vaccination hesitancy is critical for crafting health messaging, creating accommodations, and planning and implementing vaccination programs.

We conducted a study to explore what factors may contribute to COVID-19 vaccination hesitancy among people with disabilities across the U.S. Based on prior studies, we hypothesized that females, Black adults, rural residents, Republicans, and concerns about the safety of vaccines would be positively associated with COVID-19 vaccination hesitancy, while trust in experts, having a college degree, getting tested for COVID-19, and concerns about getting sick from COVID-19 would be negatively associated.

Methods

Procedures

We recruited 439 people with disabilities from 47 U.S. states via Amazon's Mechanical Turk (MTurk) to complete an online survey. MTurk is a crowdsourced marketplace where requesters post "Human Intelligence Tasks" (HITs) that workers complete for payment. For surveys, screening questions can be used to select a specific population, who are then invited to participate.[16]

A total of 3071 MTurk workers completed a 10-item screening questionnaire, and were paid $.25. Individuals who met screening criteria (i.e., lived in the U.S., self-reported disability, aged 18+) were recruited to complete the survey and were paid a $3.00 bonus. All data were collected between February 11–28, 2021, approximately two months after the Pfizer-BioNTech and Moderna COVID-19 vaccines became available for high-risk individuals (e.g., healthcare workers, residents in long-term care facilities, older adults, some minority groups, and individuals with certain health conditions).

To minimize false reporting, we employed data quality guidance outlined by MTurk researchers, including hidden screening criteria, MTurk approval ratings, and cognitive checks.[17–20] In order to access the screening questionnaire, workers had to meet a 95% approval rating based on past MTurk performance. The screening questionnaire contained two cognitive questions to prevent computer bots from taking the survey. To obscure our target population and reduce response bias, additional screening criteria were included but excluded from data collection. We used two disability screening questions from the National Survey on Health and Disability (NSHD)[21] to identify people with disabilities: "Are you limited in any way in any activities because of a physical, mental or emotional problem?" and "Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?" Respondents who endorsed either of these items were recruited into the survey. We also utilized an additional question to oversample rural respondents (county with an urban core of 49,999 or less).[22]

Measures

Vaccination hesitancy. We asked about current vaccination status (yes/no). For those who were not vaccinated, we asked if they "want to get the free COVID-19 vaccine, when it becomes available?" using a 5-point Likert-type scale (1 = definitely yes to 5 = definitely no.) We constructed a dichotomous vaccination hesitancy variable from these responses, where individuals who responded "unsure," "probably no," or "definitely no" were coded as hesitant.

Concerns about COVID-19 vaccines. Respondents rated agreement with statements about COVID-19 vaccine concerns on a 7-point Likert-type scale (1 = strongly disagree to 7 = strongly agree). Statements included: "I'm worried about adverse side effects from a COVID-19 vaccine," "I think the COVID-19 vaccines were developed too quickly," "I think the COVID-19 vaccines are too new," "I think politics influenced the development of the COVID-19 vaccines," "I think the COVID-19 vaccines will be effective." We reverse coded the item about effectiveness, summed respondent scores across all questions, and divided by five to create a composite variable representing average concern about the COVID-19 vaccines.

Concerns about COVID-19 disease. Respondents rated level of concern on two items using a 7-point Likert-type scale (1 = strongly disagree to 7 = strongly agree) including: "I'm worried about getting sick from the COVID-19 virus" and "I'm worried about people around me getting sick from the COVID-19 virus." We summed respondent scores and divided by two to create an average concern about COVID-19 disease variable.

Tested for COVID-19. Respondents indicated if they had been tested for COVID-19 in the last 7 days (yes/no).

Trust in experts. Respondents rated their trust of various information sources about COVID-19 on a 5-point Likert-type scale from 1 = total distrust to 5 = total trust. Information source categories were based on literature[26,27] about trust in public health recommendations from (1) personal contacts (e.g. family, friends, neighbors), (2) service providers (e.g. physicians, case managers), (3) local news, (4) national news, (5) local/county/state agencies (e.g. county health departments), (6) federal agencies (e.g. CDC), and (7) Dr. Anthony Fauci, head of the National Institute of Allergy and Infectious Diseases. We used factor analysis to examine variability across information sources, and created a composite "trust in experts" variable by summing trust ratings among "service providers," "local/county/state agencies," "federal agencies," and "Dr. Anthony Fauci."

Health literacy. We used the single item literacy screener (SILS) to assess health literacy.[25] The measure assesses reading ability as a component of health literacy, and asks: "How often do you need to have someone help you when you read instructions, pamphlets, or other written material from your doctor or pharmacy?" (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always). A higher score on the SILS indicates lower levels of health literacy.

Demographics. Demographic questions included gender, age, race/ethnicity, education, employment, and income. We constructed variables for employment status coded as "not employed" or "employed" and education coded as "bachelor's degree or higher" and "no bachelor's degree". We split income categories by the median, and created two groups: "$40,000 or less" and "$40,0001 or higher".

Political party. All respondents were asked: "Do you consider yourself: Democrat, Republican, independent, or other?"

Rural and urban classifications. Respondents provided county and state residence. We matched responses to Federal Informational Processing Standard county codes, and used the Office of Management and Budget (OMB) guidelines to classify residence as urban (containing an urban core of 50,000 or more) or rural (containing an urban core of 49,999 or less).

Health conditions. We asked about underlying health conditions the CDC recommended for prioritization in vaccination plans: cancer, chronic kidney disease, chronic lung disease, down syndrome, sickle cell disease, heart condition, asthma, diabetes, cerebrovascular disease, severe obesity, immunodeficiency, autoimmune disease, HIV/AIDS, cystic fibrosis, liver disease, pulmonary fibrosis, thalassemia, neurological conditions, hypertension/high blood pressure, and chronic obstructive pulmonary disease (COPD).[24] Anyone indicating at least one of these conditions

was coded has having a health condition.

Disability. In addition to screening questions, we included the Washington Group Short Set (WGSS) to gain a more comprehensive view of disability status.[23] Respondents used a 4-point Likert-type scale (1 = no difficulty to 4 = cannot do at all) to indicate their difficulty "because of a health problem": (1) seeing, even if wearing glasses, (2) hearing, even if using a hearing aid, (3) walking or climbing steps, (4) remembering or concentrating, (5) self-care, and (6) communicating. We analyzed these dichotomously (any difficulty vs. no difficulty).

Analyses

We compared continuous variables with t-tests, ANOVAs, and Pearson's correlations, and categorical variables using Chi-square tests with Bonferroni corrections for post-hoc tests. We also used a logistic regression to estimate the odds of COVID-19 vaccination hesitancy among respondents. Correlations between variables included in the regression did not indicate multi-collinearity.[28]

Sample

Respondents were aged 18–34 (48%), 35–64 (47%), and 65+ (5%). They were female (49%), male (50%) and other gender (1%). Respondents were White (74%), Asian (7.5%), Black (5%), American Indian/Alaska Native (2%), Native Hawaiian/Pacific Islander (0.5%), other race (1%), and approximately 10% reported Hispanic ethnicity of any race. Respondents were employed (72%), had a bachelor's degree or higher (53%) and were from urban locations (78%). Respondents were Democrat (44%), Republican (26%), independent (25%), or other political party (5%).

Results

Disability and health conditions

Respondents reported various types of disabilities and health conditions that increased risk of severe outcomes from COVID-19. Over 85% of respondents reported at least one WGSS disability: seeing (43%), hearing (23%), walking or climbing steps (50%), remembering or concentrating (57%), self-care (31%), and communicating (21%). The average number of WGSS disabilities was 2.2 (ranging 0–6), with 34% reporting three or more. Approximately 68% reported at least one health condition with an average of 1.5 (ranging 0–20). The most common health conditions were high blood pressure (21%), asthma (20%), and diabetes (18%).

Concerns about COVID-19 disease and vaccines

Table 1 compares concerns about the COVID-19 disease and vaccines for key socio-demographic groups. On average, females were more worried about side effects from a vaccine and were less likely to agree that the vaccines would be effective compared to males. Political party was also significant predictor in concerns about COVID-19 disease and COVID-19 vaccines. Specifically, Democrats reported the highest concerns about contracting or spreading COVID-19, whereas Republicans reported the highest concerns about vaccine safety. Additionally, rural residents reported more concerns about vaccines side effects, how quickly they were developed, and newness.

Hesitancy about COVID-19 vaccination

Approximately 25% of respondents indicated some hesitancy to vaccination ("unsure" = 9.8%, "probably no" = 4.8%, and "definitely no" = 10.5%). Table 2 reports the percentages of hesitancy among socio-demographic groups.

Table 3 reports the results of a logistic regression on vaccination hesitancy. Concern about vaccines was the most significant predictor of vaccination hesitancy (OR = 2.805, $p < .001$). Lower odds of hesitancy were associated with concern about getting sick from COVID-19 (OR = 0.713, $p = .005$), recently getting tested for COVID-19 (OR = 0.350, $p = .044$), increased trust in expert sources of information (OR = 0.780, $p < .001$), having a Bachelor's degree (OR = 0.469, $p = .033$), and being a Democrat (OR = 0.431, $p = .018$). Model fit, as measured by Nagelkerke pseudo R^2 was 0.526, indicating strong model fit.[29]

Discussion

Approximately 25% of our sample indicated some level of hesitancy toward COVID-19 vaccination. A KFF survey of the general U.S population from the same time period found that 15% definitely did not want a vaccine, 7% would get it if it was required, and 22% wanted to wait.[10] These differences might indicate that people with disabilities were less hesitant compared to the general population during this time period.

Like other research,[8,9,11,12] our data indicated that females were more hesitant about getting a COVID-19 vaccine, but these results were not statistically significant when included in the regression. Rural residents were more concerned about vaccines (side effects, speed, and newness) compared to urban residents, but this did not necessarily lead to increased odds of hesitancy when included in the logistic regression. While we did observe differences of hesitancy across racial and ethnic groups, these were also not significant in the regression model. In contrast to Fisher et al.[11] and Khubhchandani et al.,[8] who suggested low levels of health literacy may account for vaccination hesitancy, health literacy, measured as reading ability, was not a factor in our study. However, other dimensions of health literacy (e.g., numeracy or cultural/conceptual knowledge[30]), may impact these findings. Concerns about the vaccines, concerns about COVID-19, getting tested for COVID-19, and trust in experts about COVID-19 were significant factors in in predicting the odds of vaccination hesitancy among individuals with disabilities in our study. Some characteristics were still relevant even after including these COVID-specific factors such as having a bachelor's degree and being a Democrat.

While prior research has reported higher rates of vaccination hesitancy among some groups such as women, rural residents, and younger adults, our results may indicate that these groups could simply be more concerned about COVID-19 vaccine safety compared to concerns about getting sick from COVID-19. Both vaccines that were available during our data collection were based on mRNA technology. This technology uses genetic material from the SARS-CoV-2 virus to trigger an immune response to produce antibodies which prevent COVID-19.[31] mRNA vaccine technology is unfamiliar to many individuals, which may explain some hesitancy and concerns about COVID-19 vaccines. Unfortunately, we did not include any questions to assess this potential factor of concern.

Hesitancy is likely compounded by inconsistent information provided by political leaders and experts. COVID-19 vaccines were developed within an impassioned and divided political climate frequently at odds with scientific guidance (e.g., Dr. Anthony Fauci). Suppression of expert voices in the public discussion of COVID-19 and vaccination,[32] may be reflected in our findings. For example, trust in experts was associated with lower odds of vaccination hesitancy. Providing the public with direct access to expert sources of information that are culturally appropriate and understandable may be one strategy to overcoming concerns about COVID-19 vaccines and fostering vaccination uptake. This is especially

Table 1
Average concerns about COVID-19 disease and vaccines.

	n	Worried about getting COVID	Worried about contacts getting COVID	Worried about vaccine side effects	Vaccines developed too quickly	Vaccines too new	Politics influenced development	Vaccines will be effective
Overall	349	5.11	5.6	4.77	4.34	4.43	4.91	5.3
Gender		(p = .845)	(p = .980)	**(p = .033)***	(p = .133)	(p = .120)	(p = .108)	**(p = .002)****
Female	213 (49%)	5.08	5.59	5	4.49	4.59	5.06	5.07
Male	219 (50%)	5.12	5.6	4.58	4.2	4.29	4.77	5.54
Age		**(p = .038)***	(p = .083)	**(p = .003)****	**(p = .002)****	**(p = .007)****	(p = .071)	**(p = .005)****
18-34	212 (48%)	4.91 [a]	5.43	4.6 [a,b]	4.31 [a]	4.45 [a]	4.82	5.14 [a]
35-64	205 (47%)	5.34 [b]	5.73	5.05 [a]	4.52 [a]	4.55 [a]	5.07	5.36 [a]
65+	22 (5%)	4.86 [a,b]	5.95	3.68 [b]	2.95 [b]	3.1 [b]	4.18	6.27 [b]
Race/Ethnicity		(p = .194)	(p = .337)	(p = .566)	(p = .657)	(p = .065)	(p = .516)	(p = .161)
White (non-Hispanic)	326 (74%)	5	5.52	4.69	4.27	4.34	4.84	5.24
Black, AI/AN (non-Hispanic)	32 (7%)	5.56	5.84	5.09	4.53	4.56	4.91	5.12
Asian, NH/PI (non-Hispanic)	34 (8%)	5.18	5.94	4.88	4.44	4.38	5.24	5.76
Hispanic (any race)	43 (10%)	5.44	5.72	5.02	4.62	5.21	5.16	5.6
Education		(p = .108)	(p = .675)	(p = .946)	(p = .562)	(p = .374)	(p = .499)	**(p = .002)****
Bachelor's degree+	231 (53%)	5.24	5.63	4.76	4.39	4.52	4.85	5.52
No bachelor's degree	208 (47%)	4.96	5.57	4.77	4.28	4.34	4.97	5.06
Employment		(p = .148)	(p = .260)	**(p = .041)***	**(p = .006)****	**(p = .035)***	(p = .154)	(p = .456)
Employed	314 (72%)	5.03	5.54	4.89	4.5	4.56	4.99	5.27
Not employed	125 (28%)	5.3	5.73	4.45	3.93	4.11	4.7	5.39
Income		(p = .786)	(p = .986)	(p = .718)	(p = .745)	(p = .349)	(p = .807)	**(p = .042)***
Income less than 40K	216 (49%)	5.08	5.6	4.73	4.31	4.34	4.88	5.14
Income over 40K	223 (51%)	5.13	5.6	4.8	4.37	4.52	4.93	5.45
Political Party		**(p = .013)***	**(p = .009)****	**(p = .021)***	**(p < .001)*****	**(p < .001)*****	**(p = .026)***	**(p < .001)*****
Democrat	194 (44%)	5.35 [a]	5.84 [a]	4.53 [a]	3.92 [a]	4.07 [a]	4.66 [a]	5.66 [a]
Republican	115 (26%)	5.02 [a,b]	5.34 [b]	5.19 [b]	4.96 [b]	5.1 [b]	5.25 [b]	4.89 [b]
Independent	108 (25%)	4.71 [b]	5.39 [a,b]	4.7 [a,b]	4.34 [a,b]	4.35 [a]	4.99 [a,b]	5.21 [a,b]
Geography		(p = .464)	(p = .288)	**(p = .043)***	**(p = .010)****	**(p = .019)***	(p = .098)	(p = .090)
Urban	341 (78%)	5.07	5.56	4.66	4.21	4.31	4.83	5.37
Rural	98 (22%)	5.22	5.75	5.13	4.8	4.86	5.18	5.06
Health		**(p < .001)*****	**(p = .003)****	**(p = .017)***	(p = .087)	(p = .091)	(p = .710)	(p = .673)
Health condition	298 (68%)	5.32	5.76	4.93	4.45	4.55	4.93	5.32
No health condition	141 (32%)	4.67	5.27	4.43	4.1	4.19	4.86	5.26

Note. Values are scaled from: 1 = "strongly disagree," 4 = "neither," 7 = "strongly agree." We report the mean value for each group listed. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$. [a,b] Different letters indicate post-hoc values significantly differ within variables that have more than two categories at $p = .05$ with Bonferroni adjustment.

critical for people with disabilities because many are more likely to report conditions that put them at higher risk of experiencing a severe outcome from COVID-19.

While trust of information about COVID-19 is associated with preventive actions (i.e. wearing masks, social distancing),[33] people with disabilities can also experience barriers to accessing public health information.[34] Strategies to address these barriers should include translating scientific knowledge into plain language, especially for those with intellectual or developmental disabilities, providing communication through accessible formats (i.e. large print, sign language, closed captioning), and ensuring that information is available both in-person and virtual platforms.[34] Ultimately, however, vaccination uptake relies on trust; another strategy may involve health educators and practitioners collaborating with established organizations within the disability community[33] such as the National Council on Independent Living, the ADA National Network, TASH, or the American Association of People with Disabilities, among many others.

Limitations

A primary limitation of this study is reliance on the MTurk platform for data collection. While MTurk is a valuable recruitment strategy for hard-to-reach populations, including those with

Table 2
Hesitancy about COVID-19 vaccination.

	Hesitant about COVID-19 Vaccination
Overall	25.1%
Gender	**(p = .002)****
Female	31.9%
Male	18.7%
Age	(p = .074)
18-34	26.4%
35-64	25.9%
65+	4.5%
Race/Ethnicity	**(p = .012)***
White (non-Hispanic)	28.5%
Black, AI/AN (non-Hispanic)	25%
Asian, NH/PI (non-Hispanic)	8.8%
Hispanic (any race)	11.6%
Education	**(p < .001)*****
Bachelor's degree+	18.2%
No bachelor's degree	32.7%
Employment	(p = .166)
Employed	23.2%
Not employed	29.6%
Income	(p = .283)
Income less than 40K	27.3%
Income over 40K	22.9%
Political Party	**(p < .001)*****
Democrat	12.4%
Republican	33.9%
Independent	35.2%
Geography	(p = .362)
Urban	24%
Rural	28.6%
Health	(p = .529)
Health condition	24.2%
No health condition	27%

Note. Vaccination hesitancy was analyzed as a binary variable where responses including "unsure," "probably no," and "definitely no" were coded as hesitant. *p ≤ .05, **p ≤ .01, ***p ≤ .001.

Table 3
Logistic regression on COVID-19 vaccination hesitancy.

	Exp(B)	95% CI	Sig.
Average concerns, vaccines	2.805	1.924–4.090	**< .001*****
Average concerns, COVID-19	.713	.563–.902	**.005****
Tested for COVID-19 (Referent: Not tested)	.350	.126–.972	**.044***
Trust in experts	.780	.704–.863	**< .001*****
Low health literacy	.785	.578–1.067	.122
Female (Referent: Not female)	1.889	.957–3.729	.067
Age (Referent: 65+)			
18–34	4.335	.432–43.485	.213
35–64	3.318	.342–32.195	.301
White, non-Hispanic (Referent: Non-white)	1.870	.833–4.200	.129
Bachelor's degree+ (Referent: < Bachelor's)	.469	.235–.939	**.033***
Not employed (Referent: Employed)	1.517	.682–3.375	.307
Income over 40K (Referent: Income <40K)	.771	.392–1.519	.453
Democrat (referent: Not Democrat)	.431	.215–.863	**.018***
Rural (Referent: Urban)	.868	.403–1.869	.718
Health condition (Referent: No condition)	1.269	.610–2.639	.524
Constant	.133		.249

Note. Vaccination hesitancy was analyzed as a binary variable where responses including "unsure," "probably no," and "definitely no" were coded as hesitant. Indicates a continuous variable. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$. Nagelkerke $R^2 = 0.526$.

disabilities,[19,35] it does not necessarily result in representative samples. Past research indicates MTurk workers are younger, more educated, less racially diverse, more liberal, and from lower income brackets than the general population,[18,36–38]and MTurk workers with disabilities report higher rates of individuals with psychological disability, relative to physical disability.[39,40] Further, MTurk's reliance on online data collection and engagement may skew the sample to those with higher computer literacy. Finally, the cross-sectional nature of these data only informs associations between factors, not causality. Despite limitations, MTurk provides a platform for rapid data collection for a hard to reach population during an evolving crisis.

Conclusions

Overall, we found that concern about COVID-19 vaccines was associated with higher odds of hesitancy while trust in experts, getting tested for COVID-19, concern about getting COVID-19, and education were associated with lower odds of hesitancy. Addressing concerns about vaccines is critical for fostering vaccination uptake among people with disabilities, for whom severe outcomes from COVID-19 are more likely. Some strategies may include promoting better access to, and fostering trust in information from experts, and partnering with established disability organizations.

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Disclaimer

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