Public Health 183 (2020) 122–125

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Short Communication

Assessing changes in US public trust in science amid the COVID-19 pandemic

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ARTICLE INFO

Article history:
Received 26 March 2020
Received in revised form
29 April 2020
Accepted 1 May 2020
Available online 13 May 2020

Keywords:
Trust
Coronavirus
Epidemiology
2019-nCoV
COVID-19

ABSTRACT

Objectives: The emergence of the coronavirus disease 2019 (COVID-19) and subsequent pandemic has led to the most substantive large-scale, open, and public social discussion of epidemiology and science in recent history. In the United States (US), extensive debate has ensued as to the risk posed by the disease, whether the health system is prepared to manage a high volume of critical cases, whether any number of public health responses are necessary and appropriate, and the appropriate ways to prevent, manage, and treat the pandemic. I hypothesized that the interplay between scientists, policymakers, and the public in an open forum was associated with increased overall public trust in science and scientists, but that this was moderated by political orientation and/or religious commitment. In the context of a public health emergency, it is important to understand the degree to which science and scientists are trusted to produce information that can provide reassurance and also can explain the details of a highly complex event such as a viral pandemic while providing actionable recommendations.

Study design: The study design was analytic cross-sectional.

Methods: Data were obtained on March 17–18, 2020, from a sample of 242 US-based Amazon Mechanical Turk users. Respondents completed a 49-question survey consisting of key sociodemographic variables, political affiliation, religious commitment, and two iterations of the *Trust in Science and Scientist Inventory* (one for March 2020, and one for December 2019 using retrospective recall). Changes in mean level of trust and interaction with political affiliation and/or religious commitment were assessed using mixed ANOVA via the general linear model.

Results: On a scale from 1 (low trust) to 5 (high trust), the mean level of trust in science and scientists was static; 3.82 in December 2019 and 3.81 in March 2020. Conservative political orientation and high religious commitment were associated with significantly less overall trust in science; the interaction effect suggested that liberal trust in science decreased slightly from December 2019 to March 2020, whereas conservative trust increased slightly.

Conclusions: Counter to my expectations, the overall level of trust in science remained static after the first several months of COVID-19 in the US, although there is some evidence that political orientation was associated with magnitude and directionality of change in trust. Continued examination of these trends is important for understanding public response to epidemiologic recommendations.

Introduction

Since the emergence of coronavirus disease 2019 (COVID-19), we have observed a rapid, public back-and-forth exchange between scientific research, policy, and social media that is largely unprecedented. On January 20, 2020, the first confirmed case of the novel COVID-19, was reported in the United States (US).[1] Much early communal discussion analyzed the epidemiologic risks posed by the disease within the US, although the preponderance of data remained sourced from international cases. A preprint scoping review/meta-analysis of 61 studies from January 1, 2019 to February 24, 2020 reported that 13.9% of COVID-19 cases were severe and 4.7% were critical, with an overall case fatality rate (CFR) of 1.1%.[2] The US CFR on the *COVID-19 Dashboard* at Johns Hopkins University as of April 24th indicated a 5.7% CFR, although only 4,692,797 total tests had been conducted.[3] Without access to true data (e.g. complete information or data via random sample), debate

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https://doi.org/10.1016/j.puhe.2020.05.004
0033-3506/

continued as to the actual severity and CFR.[4] Reasonable and serious concerns were raised that the US healthcare system is under-resourced and understaffed to manage a high volume of COVID-19 cases, which has led to efforts at and calls for self-monitoring, quarantine, capacity-building, and other methods to 'flatten the curve.'[5] Non-pharmaceutical, behavioral, and policy responses to COVID-19 were expected to be a primary mechanism by which the basic reproduction number, R_0, could be reduced below 1.0.[6] In the time between initial submission and revision of this study, additional public debate has also illustrated tension between differing perspectives and advice on perceptions, treatment, and management of the pandemic, such as continued comparisons between COVID-19 and influenza,[7] the proposed use of hydroxychloroquine to treat COVID-19,[8] and implementation of and compliance with social distancing measures.[9]

The COVID-19 pandemic has produced a large-scale, open, and public epidemiologic investigation and discussion, with contributions from scientists, journalists, clinicians, politicians, and laypeople often shared contemporaneously.[10,11] Because of the way in which the scientific process, such as making conclusions based on complex epidemiological modeling, has been conducted rapidly and discussed in open forums, public perception of the scientific enterprise may have been altered in some way in the past several months.

In observing this display of science in action, I hypothesized that the interplay between scientists, policymakers, and the public in an open forum increased overall public trust in science and scientists, but that this was moderated by political orientation and/or religious commitment. In referring to 'science and scientists' I did not mean the institutional or governmental implementation of policy based on scientific research, but rather trust in scientists *qua* scientists, and in the scientific methodology.[12] This was somewhat different from much (though not all) of the prior literature on trust as it relates to science, such as the fairly extensive body of work on vaccine hesitancy,[13] as the focus of this hypothesis was not on a specific set of evidence but rather on the people and processes involved in generating evidence. In this case, for example, I was not concerned with measuring whether individuals believed that COVID-19 was similar to influenza, but rather whether there was any preliminary evidence that the pandemic shifted how people thought about science itself. In doing so, I was guided by the work of Nadelson et al. (2014),[12] who conceptualized trust as a complex and multifaceted belief, weighted by epistemology (e.g. 'how our degrees of confidence are rationally constrained by our evidence').[14] Their instrument measured trust using Likert-type scales capturing a wide variety of components of trust, such as 'When scientists change their mind about a scientific idea it diminishes my trust in their work' and 'Scientists will protect each other even when they are wrong.'[12]

The way that individuals respond to recommendations or advice regarding public health appears to rely on a variety of factors, among which trust in multiple entities, including government, community, and scientists, appears to play a role.[9,12] Any such shift in trust is therefore important to understand. Jones (2020) describes prior work explaining epidemics as social dramas involving citizens that include 'desire for self-reassurance' followed by 'reluctant acknowledgement' and then a demand for explanations.[15] In this context, too, it is important to understand the degree to which science and scientists are trusted to produce information that can provide reassurance and also can explain the details of a highly complex event similar to a viral pandemic. We therefore conducted a pilot survey to investigate changes in trust of science and scientists among US adults aged 18+ two months after the first COVID-19 case was identified in the US.

Methods

Data were obtained on March 17–18, 2020, from a sample of 242 US-based Amazon Mechanical Turk (mTurk) users. Respondents completed a 49-question survey consisting of key sociodemographic variables (age, race, ethnicity, education level), political affiliation (1:Liberal to 10:Conservative), religious commitment (1:low to 10:high), and two iterations of the *Trust in Science and Scientist Inventory*,[12] a 21-question validated scale. One set of questions was worded for the present, and the other asked for recall of attitudes (retrospective pretest[16]) from December 2019. To avoid biasing responses, no content in the survey or invitation to participate specifically mentioned COVID-19.

'Trust' was used as the dependent variable and was computed for each time point (December 2019 and March 2020) by managing reverse coded items and then calculating the sum of all responses divided by 21 to form an average value between 1 (low trust) and 5 (high trust). Analyses were repeated measures 2 × 2 analyses of variance (ANOVAs) using GLM; because this was a hypothesis-generated study, it was powered to examine the interaction, separately, between religious commitment/political affiliation (each dummy coded) and mean trust in science/scientists, assuming a small within-between interaction effect ($f = .1$; $\alpha = .025$; $1\text{-}\beta = .8$), yielding the suggested sample of 242. The study alpha was set at .05 but was adjusted downward for the power analysis to control for noise because of the potential for some mTurk respondents to provide careless or random data.[17] Sociodemographic data were provided in descriptive format for a transparent view of the sample but were not hypothesized to influence levels of trust and therefore analyses were not conducted. However, a full, unaltered data set is available alongside this study should other researchers wish to explore the data. Data collection was Exempt (Indiana University IRB #2003822722).

Results

Characteristics of the sample are provided in Table 1. Mean trust was computed from low (1) to high (5); overall trust in science/scientists was 3.81 in mid-March 2020 and 3.82 for December 2019.

Religious commitment was dichotomized (low: 1–5, high: 6–10). A score >5 was associated with lower overall trust in science/scientists ($F = 51.47$, $P < .001$, $\eta^2_{part} = .177$), and the interaction effect religion*time was very small and non-significant ($F = 1.94$, $P = .165$, $\eta^2_{part} = .008$). Conservative political orientation was dichotomized (liberal: 1–5, conservative: 6–10). A score >5 was associated with lower trust in science/scientists ($F = 62.86$, $P < .001$, $\eta^2_{part} = .208$). The interaction effect politics*time was small ($F = 4.29$, $P = .039$, $\eta^2_{part} = .018$) (Table 2).

There was no overall change in trust from December 2019 to March 2020, but the interaction effects and marginal means suggest that conservative trust in science increased slightly, and liberal trust in science decreased slightly (Table 2).

Discussion

Counter to my hypothesis, the overall level of trust in science remained static between March 2020 and December 2019, although conservatives reported slight increases in trust, and liberals reported slight decreases in trust. This interaction effect was small and should be re-examined by future studies to verify whether similar effects continue to be observed, which would potentially indicate a differential response to COVID-19 in terms of trust. Although not the focus of this study, data also indicated substantive differences between liberal and conservative respondents, as well as respondents with low and high levels of

Table 1
Sociodemographic characteristics of respondents ($n = 242$).

Characteristics	Mean (SD)	Median
Age (years)	37.04 (10.54)	34.00
Religious commitment (0 = low, 10 = high)	3.55 (3.80)	2.00
Political orientation (0 = liberal, 10 = conservative)	4.25 (3.30)	4.00
Current trust in science/scientists (1 = low, 5 = high)[a]	3.81 (.70)	3.90
Retrospective (Dec. 2019) trust in science/scientists (1 = low, 5 = high)[b]	3.82 (.73)	3.90
Results	**N**	**%**
Gender		
Male	141	58.3
Female	101	41.7
Race		
Black or African American	18	7.4
American Indian or Alaska Native	2	.8
Asian	13	5.4
White	201	83.1
Other	8	3.3
Hispanic or Latino/a	23	9.5
Highest level of education		
Less than high School	2	.8
High school or GED	64	26.4
Associate's degree	28	11.6
Bachelor's degree	117	48.3
Master's degree	22	9.1
Doctoral or professional degree	9	3.7

GED = general educational development test.
[a] Cronbach's alpha = .937.
[b] Cronbach's alpha = .945.

Table 2
Analytic results ($n = 242$).[a]

	MS	F	*P*	η^2_{part}
Religious commitment				
Time (within)	1.04E-5	.000	.984	.000
Time*religious commitment	.048	1.94	.165	.008
Error (time)	.025			
Religious commitment (between)	42.55	51.47	<.001	.177
Political orientation				
Time (within)	.001	.023	.880	.000
Time*political orientation	.105	4.29	.039	.018
Error (time)	.024			
Political orientation (between)	50.01	62.86	<.001	.208
	EM Mean (SE)	95% CI		N
Time 1 (December 2019)				
Low religious commitment	4.03 (.05)	3.93–4.13		162
High religious commitment	3.38 (.08)	3.23–3.52		80
Time 2 (March 2020)				
Low religious commitment	4.01 (.05)	3.91–4.11		162
High religious commitment	3.40 (.07)	3.26–3.54		80
Time 1 (December 2019)				
Liberal political orientation	4.06 (.05)	3.96–4.16		159
Conservative political orientation	3.35 (.05)	3.21–3.49		83
Time 2 (March 2020)				
Liberal political orientation	4.03 (.07)	3.93–4.13		159
Conservative political orientation	3.38 (.07)	3.25–3.52		83

MS = mean square; EM = estimated marginal; CI = confidence interval.
[a] Levene's Test of Equality of Variances was violated for these analyses, but inspection of the variance for key variables indicates that interpretation of test results is still reasonable. For transparency, data are included as a supplement to this letter.

religious commitment, in terms of overall trust in science and scientists. These latter findings were consistent with correlations observed in the validation study for the instrument used to measure trust.[12]

Research conducted by Gadarian et al.[18] identified self-placed political ideology as the 'most consistent factor that differentiates' Americans health behaviors' in the context of COVID-19. Thus, in addition to continued research on changes, if any, brought about by the COVID-19 pandemic, it seems that additional investigation into the directionality of influence of political orientation on trust in science/scientists, and vice versa, might be also valuable, especially in cases where health-related advice from scientists and non-scientific entities differs, and individuals are determining whose advice to follow, and in what way.

These findings are not statistically representative of the US and are subject to standard self-report mTurk survey limitations, including limited generalizability and potentially random (e.g. rushed) responses. At the same time, the design also allowed for a

complete absence of missingness and for a rapid response to an ongoing public health event. The measure of trust has been validated and was reliable for this sample, but the extent to which change in trust could be observed over several months is unclear, though this was, to some degree, an impetus for the present study. Importantly, as with all preliminary findings, the results should be replicated, and the research concepts expanded, before conclusions are drawn.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2020.05.004.

Author statements

Ethical approval

Approved by Indiana University IRB #2003822722.

Funding

This study was unfunded.

Competing interest

None reported.

Author contributions

The author thanks Dr. Mikyoung Jun for her statistical review and advice.

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