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Comfort with and willingness to participate in COVID-19 contact tracing: The role of risk perceptions, trust, and political ideology

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ABSTRACT

Objective: Contact tracing (CT) can limit the spread of infectious diseases, however its effectiveness hinges on public participation. We evaluated perceptions of the financial and health risk posed by COVID-19 and trust in information about COVID-19 provided by the state health department that manages CT as predictors of comfort and willingness to comply with CT. We further examined the moderating effect of political ideology on these relationships.

Methods: We used structural equation modeling to test hypotheses in data from a cross-sectional survey completed by a representative sample of Michigan residents ($N = 805$) in 2020.

Results: Perceptions of the risk of COVID-19 to one's health (but not finances) was negatively related to comfort and willingness to participate in CT. Trust in information about COVID-19 and liberalism were positively related to comfort and willingness. There was also a moderating effect of political ideology, such that conservatives were less comfortable and willing at greater perceptions of health risk.

Conclusions: Conservatives and those who perceive a greater health risk may require targeted messaging and more deliberate engagement strategies to increase CT participation.

1. Introduction

The onset of the COVID-19 Pandemic in 2020 prompted governments to implement policies to mitigate infections, including guidelines to wear masks, limit the size of gatherings, and participate in contact tracing (Hale et al., 2021). Contact tracing (CT) refers to a process by which cases of COVID-19 are monitored and people who may have been exposed are alerted (Anglemyer et al., 2020). Evidence suggests that CT can be effective in curbing the spread of diseases (Ferretti et al., 2020). Importantly, the effectiveness of CT is dependent upon public participation. Yet some view CT efforts with suspicion, especially given privacy concerns (Zimmermann et al., 2021). As a result, lack of effective CT has been cited as a key factor in the failure to control COVID-19 infection rates (Islam et al., 2020).

The COVID-19 pandemic unveiled weaknesses in many nations' pandemic preparedness, spurring calls for research into the predictors of compliance with health guidelines (Kalyanaraman and Fraser, 2021; Walrave et al., 2020). Scholars often suggest providing more and better communication as a strategy for increasing cooperation (Islam et al.,

2020; Walrave et al., 2020) yet also acknowledge that information provision is insufficient without trust. Researchers have long theorized that trust is key for determining the willingness to take risks within a relationship (Mayer et al., 1995), and evidence suggests that trust could facilitate engagement in CT (Guillon and Kergall, 2020; Horvath et al., 2020).

Research also highlights risk perception as a second set of drivers for compliance. The pandemic has posed significant risk to personal and public health, as well as to financial markets (Zhang et al., 2020). Research indicates that perceptions of a variety of risks are often positively related to preventive health behaviors, ranging from wearing a mask and social distancing (Harper et al., 2020; Plohl and Musil, 2021), to vaccination intentions (Caserotti et al., 2021).

However, there is reason to suspect that risk perceptions related to COVID-19, a more unusual "protective behavior", may have a different relationship with attitudes towards CT. Participation in CT poses a somewhat unique risk of privacy violation (Zimmermann et al., 2021). Unlike mask wearing or vaccinations, which are relatively private actions, engagement with CT opens individuals and their social circle to

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government scrutiny, a risk that they may be motivated to take even more seriously in the face of an already heightened risk of harm from COVID-19. Along these lines, Västfjäll et al. (2014) found that when people were reminded of a natural disaster, they tended to perceive greater risk in everyday decisions. This increased awareness of vulnerability may be more likely in the current pandemic, given that COVID-19 was perceived by many as a major (even “catastrophic”) health threat (Lohiniva et al., 2020). Increased feelings of vulnerability due to COVID-19 could motivate people to be more cautious and less willing to expose themselves to other risks, like participation in CT. Protection motivation theory suggests that when people are motivated to engage in behaviors to manage perceived risk, they typically reject behaviors with high response costs (Norman et al., 2005). We suggest that the risk of privacy infringement in CT may be a response cost that becomes especially salient to those who already feel threatened by COVID-19.

Importantly, it is likely that these perceptions of risk have different relationships with willingness to engage in CT for some people. In general, conservatives prefer a less intrusive government and are often concerned about their vulnerability to harm from government overreach (Carmines et al., 2012). As a result, conservatives who perceive greater risk from COVID-19 may be especially hesitant to share their personal information with the government. Conversely, liberals tend to focus less on personal vulnerability to government action and instead view protecting those vulnerable to harm as an important moral concern (Graham et al., 2009). As a result, liberals may be more comfortable with CT when they perceive greater COVID-related risk.

Based on these rationales, we posed *a priori* hypotheses to be tested in data collected in the State of Michigan during May of 2020.

- Hypotheses 1a-c: (1a) Trust in information about COVID-19 provided by the agency that manages CT will predict greater comfort with and willingness to participate in CT, and increased perceptions of the risk of COVID-19 to (1b) finances and (1c) health will predict lower comfort and willingness.
- Hypotheses 2a-b: Conservatism will strengthen the negative relationships between the (2a) financial and (2b) health risk of COVID-19 with comfort and willingness to participate in CT.

2. Methods

2.1. Study context

Michigan reported its first case of COVID-19 on March 10th, 2020. The governor instituted a stay-at-home order on March 23, 2020, during which individuals were permitted to leave their home only for essential purposes (e.g., obtaining groceries). The order was extended several times and ended June 1, 2021. The third extension corresponded to the data collection period (May 7-May 28) and loosened restrictions by allowing some workplaces to resume operation.

2.2. Participants

Our analytic sample consists of 805 Michigan residents surveyed in the 2020 State of the State Survey (SOSS) conducted by the Michigan State University Institute for Public Policy and Social Research. Additional detail on the survey sampling methodology and survey items is included as supplementary material. To be eligible, respondents had to be 18 years old or older, reside in Michigan, and speak English. Survey responses were collected between May 8th to May 25th, 2020. Participant demographics for the analytic sample are reported in Table 1.

Regarding missing data, 80–80.5% of responses to each question were provided and 796 participants (79.60% of the sample) provided complete responses. An analysis of the missingness suggested that the data were missing at random and were therefore appropriate for our analysis (Jamshidian et al., 2014). We addressed the patterns in missingness with maximum likelihood estimation (MLE). Participant

Table 1
Sample Demographics.

Variable	N	%
Sex		
Male	343	42.6
Female	455	56.5
Other	5	0.6
No response	2	0.2
Race/Ethnicity		
White	636	79.0
Black/African American	99	12.3
Hispanic	28	3.5
Mixed Race	17	2.1
Asian	15	1.9
Native American	3	0.4
Middle Eastern	1	0.1
Other	6	0.7
Annual Family Income		
< \$10,000	34	4.2
\$10,000-\$19,000	67	8.3
\$20,000-\$29,999	93	11.6
\$30,000-\$39,999	113	14.0
\$40,000-\$49,999	93	11.6
\$50,000-\$59,999	82	10.2
\$60,000-\$69,999	67	8.3
\$70,000-\$79,999	63	7.8
\$80,000-\$99,999	59	7.3
\$100,000-\$119,999	49	6.1
\$120,000-\$149,999	41	5.1
\$150,000-\$199,999	22	2.7
\$200,000-\$249,999	11	1.4
\$250,000-\$349,999	5	0.6
\$350,000-\$499,999	4	0.5
\$500,000 or more	2	0.2

demographics are reported in Table 1.

2.3. Measures

The following items from the Spring 2020 State of the State Survey (SOSS 79b, Michigan State University Institute for Public Policy and Social Research, 2020) were used in the current study.

Trust in Information. Respondents rated trust in information about COVID-19 from the Michigan Department of Health and Human Services (MDHHS), the agency responsible for implementing CT in Michigan. Responses were scored from 1 (Not at all) to 5 (A great deal).

Financial and Health Risk. Respondents rated the threat of the pandemic to their personal financial situation and health on a scale from 1 (Not a threat) to 3 (A major threat).

Political Ideology. Participants rated their political ideology from 1 (Very conservative) to 7 (Very liberal) with 4 (In the middle) at the midpoint.

Comfort and Willingness to Comply with Contact Tracing. Participants rated their comfort with: (a) reporting people that they have been in contact with to the local or state health department if they had symptoms of COVID-19 and (b) using a computer or phone app that shares their symptom information with their local or state health department, as well as their willingness to (c) give their local or state health department personal information to help limit the spread of COVID-19. Responses ranged from 1 (Not true at all) to 7 (Very true), $\alpha = 0.87$.

Controls. We included participants’ age (in years), sex (−1 = male, 1 = female), race, and annual family income as control variables. Income was coded in 16 increments, ranging from 1 (less than \$10,000) to 16 (\$500,000 or more).

3. Results

3.1. Descriptive results

Means, standard deviations, and correlations between study variables are presented in Table 2. Trust ($r = 0.60$) and political ideology ($r = 0.50$) were positively correlated with comfort and willingness to comply with CT such that more trust and liberalism corresponded with a greater comfort and willingness. Lower perceptions of financial ($r = -0.13$) and health risk ($r = -0.41$) were associated with increases in comfort and willingness.

3.2. Main findings

We tested hypotheses using structural equation modeling and MLE to address missing data, using Mplus version 8.0 (Muthén and Muthén, 2017). We also estimated the same models using only the full data (e.g., listwise deletion) and multiple imputation (Azur et al., 2011) in Mplus 8.0 with 10 datasets. Results of these analyses were not substantively different from those reported in text. Full details of these analyses are available upon request. To evaluate the dimensionality of the comfort and willingness to comply measure, we conducted a confirmatory factor analysis. All three items were modeled as indicators of a single willingness latent factor. The model was saturated, CFI = 1.0, RMSEA = 0.00, SRMR = 0.00, $\chi^2(0) = 0.00$. This precluded a direct test, but all standardized factor loadings were greater than 0.70 and significant, providing evidence for unidimensionality.

Because all predictor variables were collected using single items we treated them as observed variables. We centered all continuous predictor and moderator variables and calculated multiplicative interaction terms. We regressed the latent factor of comfort and willingness onto control variables, risk variables, trust, political ideology, and terms interacting financial and health risk with political ideology. For completeness, we also included the exploratory interaction term of trust and political ideology (see Table 3 and Fig. 1). This model explained significant variance in comfort and willingness, $R^2 = 0.46$, $se = 0.03$, $p < .001$.

Hypotheses 1a-c concerned whether trust in information and perceptions of the health and financial risk of COVID-19 would predict comfort and willingness for CT. As expected, trust was a significant predictor such that people were more comfortable and willing when they had greater trust in the information about COVID-19 from MDHHS, $\beta = 0.40$, $p < .001$. Contrary to our expectations, financial risk was not a significant predictor, $\beta = 0.03$, $p = .35$, but health risk was, $\beta = -0.20$, $p < .001$. As expected, greater perceptions of the risk posed by COVID to health were associated with less comfort and willingness to comply with CT. Political ideology was also a significant predictor, $\beta = 0.25$, $p < .001$, such that liberalism was positively associated with of comfort and willingness.

Hypotheses 2a-b predicted that political ideology would moderate these relationships. The interaction between political ideology and

Table 2
Means, standard deviations, and correlations between variables.

	1.	2.	3.	4.	5.	6.
1. Financial Risk	–					
2. Health Risk	.41*	–				
3. Trust in Information	-.10*	-.29*	–			
4. Political Ideology	.14*	-.29*	.51*	–		
5. CT Willingness	-.13*	-.41*	.60*	.50*	($\alpha = .87$)	
6. Age (in years)	-.15*	.05	-.14*	.23*	.01	–
7. Income	.01	.01	-.01	-.02	.03	.06
Mean	1.92	1.82	3.52	4.25	4.82	53.23
SD	.75	.71	1.27	2.06	1.78	17.22

Note. $N = 800-805$. * $p < .05$. Cronbach's α is reported along the diagonal in parentheses for CT Willingness.

Table 3

Model Results Predicting Comfort and Willingness to Participate in Contract Tracing.

Coefficient	b	95% CI	SE	β
Age (in years)	.01*	.01, .02	.003	.15
Annual Family Income	.02	-.01, .04	.01	.03
Sex	-.05	-.14, .03	.04	-.04
Black/African American vs. Mean	.05	-.22, .31	.14	.02
Hispanic vs. Mean	-.31	-.71, .08	.20	-.11
Asian vs. Mean	.34	-.17, .85	.26	.11
Mixed Race vs. Mean	-.14	-.62, .34	.25	-.05
Risk to Financial Situation	.06	-.07, .18	.06	.03
Risk to Health	-.43*	-.57, -.29	.07	-.20
Trust in Information	.47*	.38, .55	.04	.40
Political Ideology	.18*	.13, .23	.03	.25
Financial Risk \times Ideology	-.02	-.08, .04	.03	-.03
Health Risk \times Ideology	.10*	.04, .17	.03	.10
Trust in Information \times Ideology	-.03	-.07, .00	.02	-.05

Note. $N = 805$. * $p < .05$. Sex (male = -1) and race (White = -1) are effect coded. CFI = 0.99, RMSEA = 0.03, SRMR = 0.01, $\chi^2(28) = 43.20$, $p = .03$.

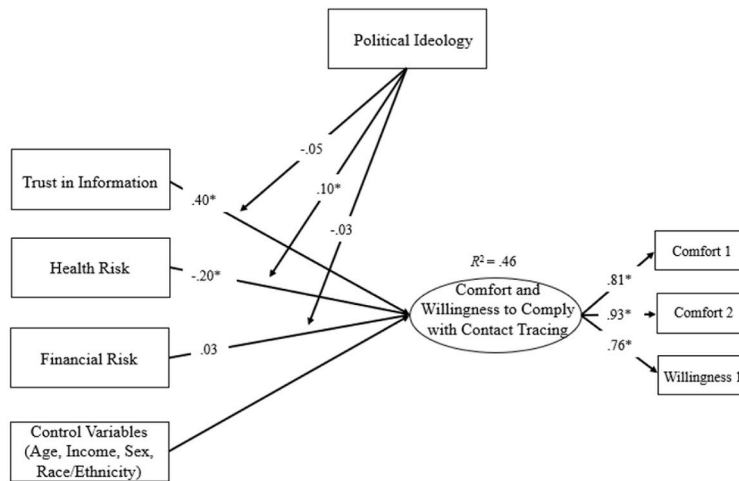
financial risk was not significant, $\beta = -0.03$, $p = .43$. However, the interaction term between political ideology and health risk was, $\beta = 0.10$, $p = .003$. We plotted the simple slopes for this effect (Fig. 2) at 1 standard deviation below and above the mean of political ideology (Aiken and West, 1991). A simple slope test indicated that the gradient of the slope 1 standard deviation above the mean (i.e., greater liberalism) was not significant, $b = -0.21$, $t = -1.81$, $p = .07$. For 1 SD below the mean (i.e., greater conservatism), the gradient was significant, $b = -0.78$, $t = -7.12$, $p < .001$. The negative relationship between risk perceptions and comfort and willingness to comply with CT is significant and stronger with increasing conservatism.

As an exploratory analysis, we also tested the interaction between trust and political ideology, but this interaction term was not significant, $\beta = -.05$, $p = .08$.

4. Discussion

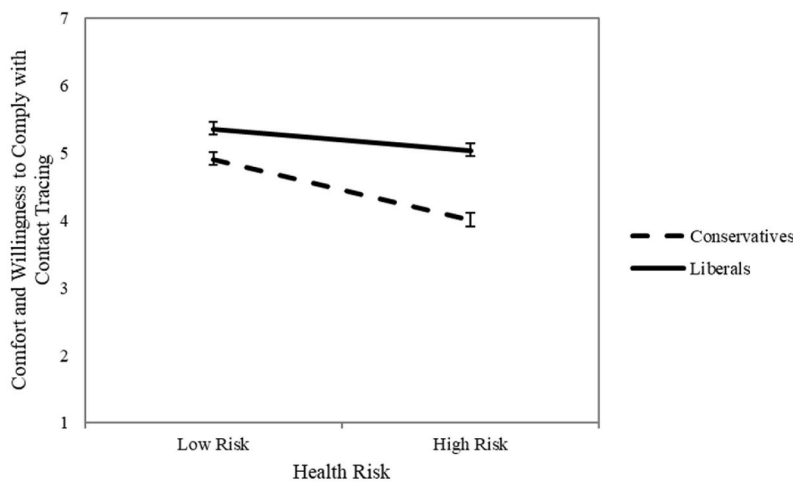
CT can be an effective tool to prevent the spread of infectious diseases with adequate public participation (Ferretti et al., 2020). Thus, understanding what factors contribute to comfort and willingness to comply with CT is essential for managing future outbreaks. This study examined trust and perceptions of risk from COVID-19 as predictors of CT acceptance, as well as the moderating role of political ideology. First, our results suggest that trust in information is important for comfort with and willingness to participate in CT. Public health organizations looking to bolster support for CT should therefore be concerned with assessing and maintaining public trust (Holroyd et al., 2021). Governments may even look to communicate information through additional channels (e.g., social media) to build trust (Mansoor, 2021). Conversely, perceived financial risk did not predict comfort and willingness. Scholars have argued that people may calculate risks and benefits differently within different domains (Blais and Weber, 2006; Weber et al., 2002). The reason that health risk was a stronger predictor could potentially be because the health threat of COVID-19 leads people to consider the possibility of death (Lohiniva et al., 2020), resulting in a more pronounced effect on attitudes compared to financial risk.

The negative relationship between health risk and comfort and willingness contrasts with findings that health risk predicts greater compliance with health behaviors, like social distancing (Harper et al., 2020; Plohl and Musil, 2021). This could be because government tracking is often seen as posing its own risk to privacy (Bernard et al., 2020). Our results suggest that when vulnerability is already salient because of a health threat, people may be more reluctant to accept additional risk by allowing the government access to personal information. Yet, this effect is qualified by an interaction with political ideology. Consistent with previous work (Plohl and Musil, 2021;



Note. Higher values of political ideology represent greater liberalism, lower values represent greater conservatism. Effect sizes are standardized.

Fig. 1. Model results.



Note. Liberals = 1 SD above the mean of political ideology, Conservatives = 1 SD below the mean of political ideology. Error bars indicate margins of error for the 95% confidence interval.

Fig. 2. Simple slopes for risk to health × political ideology interaction.

Rothgerber et al., 2020), liberals were generally more open to CT. There was also an interaction between political ideology and health risk such that the negative relationship between health risk and CT comfort and willingness was more pronounced for conservatives. By contrast, liberals both reported higher levels of comfort and willingness to participate and were not significantly impacted by increases in health risk. Liberal and conservative ideologies fundamentally disagree about the appropriate role and reach of the government, with conservatives advocating for less government power (see Carmines et al., 2012; Ellis and Stimson, 2012). Our results may be interpreted through the lens that if a health threat makes people more aware of their vulnerability and cautious regarding additional risks, conservatives may be especially attuned to the threat of government overreach.

4.1. Strengths and limitations

A study strength is that we evaluated a representative sample of Michiganders during the pandemic in Michigan. However, generalizability to other states could be more limited. Michigan was led by a Democratic governor during the pandemic, and the sentiment among many conservatives was that her public health responses were overly restrictive (Hinckley, 2021). The threat of government overreach perceived by conservatives may have been more minimal in a state led by a Republican. Similarly, a nationally representative survey may yield different results given the changes in elected officials since the data collection period. Another limitation is the use of a cross-sectional survey design, which cannot provide causal insights or help to understand trends over time. Lastly, our measure of CT participation focused on

rated comfort and willingness to participate in CT. Although people who perceive a greater health risk may be more leery of CT, it could still be that they will begrudgingly participate when given the opportunity. Future research should investigate actual CT participation.

5. Conclusions

This study helps clarify the nexus among risk, trust, and contact tracing. We found that trust in information about COVID-19 and liberalism were positively related to comfort and willingness to comply with contact tracing. Results further suggest that foregrounding the health risk of COVID to motivate CT compliance may backfire. Moreover, conservatives were increasingly less comfortable and willing as perceptions of the health risk of COVID-19 increased. Public health organizations may need to target efforts to increase trust in information and CT compliance to those who perceive a greater health risk and conservatives.

CrediT author statement

Jenna A. Van Fossen: Conceptualization, Analyses, Writing- Original draft preparation, Revisions. **John W. Ropp:** Conceptualization, Writing-Original draft preparation, Revisions. **Katie Darcy:** Conceptualization, Revisions. **Joseph A. Hamm:** Conceptualization, Revisions.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2022.115174>.

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