Gender differences in perceived risk of COVID-19

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Abstract
Objective: We examine gender-based differences in perceived risks related to COVID-19.

Methods: We analyze published findings from COVID-related research on beliefs and attitudes about the health risks posed by the pandemic. We also design and administer a pair of online survey experiments (n = 502) to test if and how responsive men’s attitudes are to information about male-specific risks.

Results: Across 16 studies, men consistently express lower perceived risk of contracting COVID-19 and less concern about the potential health consequences if they were to catch it. Our experimental results are mixed: Results for one information treatment indicate that men report greater relative risk of adverse outcomes. Men in one of the risk information treatments express less concern for their health if they were to contract the disease. Risk perceptions are positively correlated with self-reported propensity toward protective behaviors.

Conclusion: Our review of recent studies finds a small-but-consistent gap in men and women’s beliefs about their health risks related to the present pandemic. These risk beliefs are crucial determinants of whether individuals take protective measures. Our experimental results suggest that informing men of male-specific risks associated with COVID-19 can reduce their risk perceptions and perceptions of risk and widen the gap between men and women’s perceptions.

Governments have responded to the COVID-19 by implementing measures that reduce infection transmission (e.g., through lockdowns, social distancing, mask requirements) and by vaccinating the population against the virus. Public compliance with these measures, such as social distancing and COVID-19 vaccines, is critical for their success. Accordingly, policymakers are interested in understanding why individuals are more, or less, likely to comply with these measures. Gender is a very plausible factor accounting for some of the variation in compliance with COVID-19 health measures. An extensive literature has demonstrated that women tend to be more risk averse in terms of both attitudes and behavior (e.g., Charness and Gneezy 2012). Our contribution is to demonstrate that gender is an important factor explaining variations in perceptions and behavior related to the COVID-19 virus.

One contribution is to highlight the importance of gender by synthesizing a large corpus of research findings regarding the public’s perceptions and preferences relating to the pandemic. We conduct an extensive meta-analysis of recent research on COVID-19 risk perceptions. Men generally have lower estimates...
than women, of their COVID-related risks and men tend to be more willing to accept these risks than is the case for women. We implement a survey experiment that is designed to help understand the precise mechanism that might be causing this gender gap. Our experiment is designed to isolate the causal effect of COVID-19 risk information on men’s beliefs about the health risks associated with the COVID-19 virus. Survey experiments are particularly effective at estimating the effects of information treatments on belief updating (Haaland et al. 2020). In our case, randomly assigning subjects to a neutral control information treatment versus an information risk message allows us to calibrate the effect of information on belief updating. Our initial conjecture was that providing men with information messaging about the health risks of COVID-19 would cause them to increase their subjective probabilities of getting infected with the COVID-19 virus and increase their concern about the consequences of being infected. But based on two survey experiments conducted in the U.S., our second contribution demonstrates that providing information to men about the risks of the COVID-19 virus is either ineffective or, counterintuitively, reduces their concern about the consequences from catching the disease.

**RISK PERCEPTIONS AND HEALTH BEHAVIORS**

The propensity to take protective actions is correlated with the perceived risk of particular health outcome. For example, individuals who hold high perceptions of the risk of Lyme disease are considerably more likely than their counterparts with lower risk perceptions to be vaccinated against the disease (Brewer et al. 2004). A 2007 meta-analysis of 34 studies on vaccination behavior found that individuals’ perception of risk likelihood, susceptibility, and severity were all significant predictors of whether or not an individual became vaccinated. The study concluded that “risk perceptions are rightly placed as core concepts in theories of health behavior” (Brewer et al. 2007). Many argue that perceived vulnerability (i.e., high perceived risk) is “a necessary but not sufficient condition for protective action” (van der Pligt 1998).

Given the established relationship between risk and protective action, a key focus of behavioral research during the pandemic has been on how individuals judge the risks posed by COVID-19. Early results suggest that perceived risks related to COVID-19 are correlated with individuals’ propensity toward protective action. For example, a nationally representative survey of Americans conducted in March, 2020 found that a greater perceived risk of contracting the disease and a higher perceived fatality rate associated with infection, were both significantly correlated with propensity toward protective behaviors such as distancing, wearing a mask, and hand-washing (Bruine de Bruin and Bennett 2020). Another U.S. survey concluded that protective actions were “most strongly predicted by the perceived likelihood of being personally infected” (Wise et al. 2020). Similarly, a nationally representative survey of Belgians found that individuals with higher perceived chances of infection infectability were significantly more supportive of public health measures aimed at curbing the spread (De Coninck, Haenens, and Matthijs 2020). In the UK, researchers found fear of COVID-19 to be the “only predictor of positive behavior change” (Harper et al. 2020). These early findings related to the COVID-19 pandemic confirm this link between risk perceptions and behavior.

**GENDER AND RISK PERCEPTIONS?**

A consistent finding in the literature is the existence of a gender gap in perceptions of, and attitudes toward, risk. Faced with the same circumstance, men will, on average, both perceive their risk to be lower, and be more risk-seeking, than women. A meta-analysis of 150 papers comparing risk-taking tendencies between men and women found that men were significantly more likely to take risk in 14 out of 16 tested domains (Byrnes, Miller and Schafer, 1999). Similar results have been found in the areas of financial risk (Charness and Gneezy 2012), gambling and recreation (Harris, Jenkins, and Glaser 2006), driving (Waldron, McCloskey, and Earle 2005), and, most notably, health risk (Finucane et al. 2000), amongst others.

Perceptions of health risks, specifically, the chances of being infected and the perceived vulnerability if infected, are correlated with protective behavior. Yet men consistently estimate their own chances of
infection to be lower than their female counterparts (Duncan, Schaller, and Park 2009; Díaz, Soriano, and Beleña 2016), a perception that has implications for the actual likelihood of infection in the context of a highly transmissible disease. This relates to a broader risk attitude known as “danger invulnerability,” whereby men consistently exhibit greater perceived invulnerability to various health risks, despite no evident gender differences in generalized optimism bias (Lapsley and Hill 1910). This perceived imperviousness to, and taste for, risk is particularly prevalent amongst young men with some characterizing this as “the young male syndrome” (Wilson and Daly 1985).

Medical research indicates that men are at greater risk for negative health outcomes if they contract COVID-19. For example, the Sex, Gender and COVID-19 Project estimates that for every 10 women who have died from COVID-19, 13 men have died; and that for those with confirmed cases, the gap is 15 men for every 10 women.\footnote{https://globalhealth5050.org/the-sex-gender-and-covid-19-project/the-data-tracker/} Similarly, a meta-analysis of over 3 million reported global cases found that, despite men and women contracting COVID-19 at statistically similar rates, “male patients have almost three times the odds of requiring intensive treatment unit,” and roughly 39 percent increased likelihood of mortality (Peckham et al. 2020). Other studies have estimated the increased mortality risk to men as anywhere between 62 percent (Hanes et al. 2020) to as high as two times greater (Klein et al. 2020; c.f. Bischof, Wolfe, and Klein 2020). Some research has suggested that these sex-based differences exist independent of age (Jin et al. 2020). Men should be more concerned than women about the risk of adverse outcomes if they contract COVID-19, and certainly not less.\footnote{See the evidence from Austria https://covid19-dashboard.ages.at/dashboard_Tod.html.}

GENDER AND COVID-19 RISK PERCEPTION: AN ANALYSIS OF RESEARCH FINDINGS

In order to understand the relationship between gender and risk perceptions of COVID-19, we conduct a review of behavioral research published since the start of the pandemic that deals specifically with individuals’ beliefs about their risk of contracting, or getting sick or dying from, COVID-19. The majority of these early studies found a significant gender gap in perceptions of risk. For example, a cross-national survey with participants from 10 countries found “being male was uniformly associated with lower risk perception” in the majority of countries sampled (Dryhurst et al. 2020). Women generally evaluate their COVID-specific risk more highly than men, exhibit higher levels of anxiety about the pandemic (Petzold et al. 2020), and report higher psychological distress (Qiu et al. 2020) than their male counterparts.

Using Google Scholar, we report the results of studies matching the keywords “COVID-19” and “risk perception.” We include only studies that meet one of two criteria: (1) disaggregated gender results are reported in the published research, or (2) disaggregated gender data are publicly available in the paper’s supplemental materials to enable author calculations.\footnote{We include one additional study, Niepel et al. (2020), that does not meet either criteria, but for which the authors provided these analyses upon written request. We thank the authors for their contribution.} We additionally analyzed data from the Understanding America Study (UAS) conducted by the Center for Economic and Social Research (CESR) at the University of Southern California.\footnote{See acknowledgments for funding sources and other information related to the UAS data. Data are publicly available pending researcher authorization at https://uasdata.usc.edu/index.php.} The UAS data have been collected in 22 (to date) biweekly waves beginning in March 2020, with roughly 7000 Americans taking part in each wave (Kapteyn et al. 2020).

The results of this literature survey are presented in Figure 1. The directional column in Figure 1 indicates whether perceived risk is higher for women. Results are listed as significant if they have $p$-values of less than 0.05. Of the 16 projects included, 12 find statistically significant gender differences in perceived risk. Two further papers find a directional but statistically insignificant effect—while two papers find no gender differences at all.

\footnote{https://globalhealth5050.org/the-sex-gender-and-covid-19-project/the-data-tracker/.}
\footnote{See the evidence from Austria https://covid19-dashboard.ages.at/dashboard_Tod.html.}

\footnote{We include one additional study, Niepel et al. (2020), that does not meet either criteria, but for which the authors provided these analyses upon written request. We thank the authors for their contribution.}

\footnote{See acknowledgments for funding sources and other information related to the UAS data. Data are publicly available pending researcher authorization at https://uasdata.usc.edu/index.php.}
We analyzed data from 22 waves of the UAS sample that consisted of 56,722 men and 80,207 women. The results of these analyses are presented in Figure 2. On average, men estimated that in the next three months their likelihood of contracting COVID-19 as roughly 3.51 percentage points (14 percent) lower than their female counterparts. If they were to contract COVID-19, men estimate their perceived risk of dying as being roughly 2.50 percentage points lower than women (13.51 percent). Moreover, these differences have widened slightly over the course of the pandemic. For the first 10 waves of the survey, the
results of a one-way ANOVA show a mean difference in perceived likelihood of contraction of 2.66 \( (F(1, 62341) = 231.6, p < 0.001) \), whereas we observe a mean difference for the same question in the subsequent 10 waves of 3.80 \( (F(1, 60850) = 460.7, p < 0.001) \).

**METHODS: SURVEY EXPERIMENTS WITH COVID-19 RISK INFORMATION TREATMENTS**

An implication of these observational studies is that men do not update their beliefs based on information about the actual risks associated with the COVID-19 virus; or at least they update less than women.\(^5\) We design a pair of survey experiments to test how responsive men's beliefs are to information about their actual relative risk of becoming sick and dying if they were to contract the disease. As noted above, men's risk of encountering severe symptoms or dying if they contract COVID-19 is considerably greater than the risk to women. Thus, the experimental treatment effect of interest is how men respond to information about their relative risk. We present this information in an article (Experiment 1) and in graphical form (Experiment 2), allowing us to test whether different ways of communicating the same information affects treatment effects. The null hypothesis is that information has no effect on men’s risk beliefs. Alternatively, our updating hypothesis is that men will respond to information about the increased risk to males of severe illness and death from COVID-19 by updating their risk perceptions. Our meta-analysis of recent studies clearly suggests that men have lower risk perceptions about the health hazards associated with the COVID-19 virus. We conjecture that some of this gender gap in risk perceptions can be narrowed by exposing men to information regarding the health dangers of COVID-19—the survey experiment is designed to test this proposition.

**Data**

The participants are recruited from the LUCID Marketplace subject pool, comprised of American residents aged 18 and over. Participants enter the survey via Qualtrics and are randomized into either control or treatment. In control, participants read an unrelated article about COVID-19 data visualization. In treatment, participants read a summary of medical research detailing men's increased health risks related to the disease. For Experiment 1, the treatment is presented in article-form, whereas for Experiment 2 key information from the article (e.g., relative mortality risk by gender) is summarized with graphics. The main outcome variables of interest are individuals' perceived likelihood of becoming infected with COVID-19 and their concern for their own health if they were to become infected. These outcome variables are measured with a 1–100 sliding scale – participants are asked to select the percent likelihood that best matches their beliefs. We also measure, post-treatment, a number of covariates. Gender is the covariate of primary interest. Other covariates include political ideology and demographics. Results are analyzed by two-way ANOVA with gender and treatment assignment as factors.

**Experimental results**

Experiment 1 delivers the risk information in a written vignette while in Experiment 2 the information is delivered in graphical format. In both experiments, the treatment effects are, for the most part, counter to our expectation: Rather than becoming more concerned about their risk after reading the information, men adjust their risk perceptions downwards. Informing men about their increased risk of severe infection and death should they contract COVID-19 makes them report less concern for their own health if they were to contract the disease.

\(^5\) It may also be the case that men simply are exposed to less risk information than woman.
In Experiment 1, the treatment effect is negative—subjects have a lower perceived likelihood of contracting COVID-19 and are less concerned for their own health if they were to contract it. Neither of the treatment effects are statistically significant at the $p < 0.05$ level.

In Experiment 2, men’s perceived risk of contracting COVID-19 increases slightly, though insignificantly, by 1.8 percentage points. Men in the treatment condition report a significantly lower level of concern for their own health if they were to contract the disease. The result is a 12.54 percentage point (16.9 percent) difference in means between control ($M = 73.97$) and treatment groups ($M = 61.43$) ($F(1, 117) = 5.352, p = 0.022$). In Experiment 1, there is a 4.91 percentage point (6.63 percent) mean difference between health concern in treatment and control, though again the result is insignificant at the $p < 0.05$ level. The Experiment 1 (Text version) mean reported concerns for health (on a 100-point scale) with 95 percent confidence intervals for the control and treated groups are presented in Figure 3. Similar mean reported concerns for health (again with 95 percent confidence intervals) from Experiment 2 (Graphics version) are also presented in Figure 3.

And men’s graphic based Information Experiment 2: Control = 73.97, Treatment = 61.43. Error bars represent 95 percent CIs.

**Partisanship**

We include questions on self-identified party preference and vote choice in the 2020 U.S. Presidential election. Figure 4 compares the treated and control means (with 95 percent confidence intervals) for those voting in the previous election for Biden versus Trump. There are differences in means between male
respondents who voted for Vice President Biden versus those who voted for President Trump although the treatment effects are imprecisely estimated because of the small sample sizes and none of the differences are statistically significant. Figure 4 presents the results for the perceived risk of contracting COVID-19 outcome variable: for the treated Biden voters there is an increased perceived risk of contracting COVID-19 while the treated Trump voters become less likely to believe they will get the disease. On the other hand, treated Trump and Biden voters become less concerned for their health if they contracted the disease, although Biden voters start from a higher level of concern in the control ($M = 79.24$) than do Trump voters ($M = 68.0$) and update downward slightly less intensely in the treatment (Biden $M = 69.03$; Trump $M = 58.81$). Again, though, the sample sizes in these subgroups are rather small and the results are merely suggestive.

Across the full samples of both experiments, we find similar results. In Experiment 1 there is 17.08 percentage point mean difference between individuals who voted for President Trump ($M = 62.71$) and those who voted for President Biden ($M = 79.79$) ($F(3, 246) = 7.036, p < 0.001$).

In Experiment 2, the same result shows a 12.33 percentage point mean difference between Trump voters ($M = 66.02$) and Biden voters ($M = 78.35$) ($F(3, 230) = 8.88, p < 0.001$). These results are consistent with an emerging body of evidence showing partisan differences in both risk perceptions of COVID-19 (see, for example, Barrios and Hochberg 2020) and propensity toward protective action (Gollwitzer et al. 2020).

**Risk perceptions and behavior**

We believe that understanding risk perceptions regarding the COVID-19 virus is important because risk perceptions shape behavior. As Figure 5 demonstrates, there clearly is a correlation between risk perceptions regarding the COVID-19 virus, as measured in our survey, and respondents’ likelihood of voluntarily taking protective action: wearing a mask and self-isolating if one comes into contact with an individual who has COVID-19. This suggests that efforts to communicate the risk associated with the COVID-19 virus can increase protective behavior by the general public.
FIGURE 5  Scatterplot of concern for own health with likelihood of voluntarily wearing a mask (r = 0.53) and likelihood of voluntarily self-isolating (r = 0.56).
DISCUSSION AND CONCLUSION

A central concern of public health officials world-wide has been to communicate to the general public the risks associated with the COVID-19 virus. It is widely accepted, and our evidence confirms, that risk beliefs are correlated with behavior.

In order to effectively convince the general public about the risks associated with the COVID-19, public health authorities require a sound understanding of current beliefs about the virus and of the effective communication strategies they should adopt. This research note provides two important insights in this regard. First, we address the notion that there is a gender gap in COVID-19 risk perceptions. We conduct an extensive meta-analysis of recent research on COVID—19 risk perceptions. This analysis indicates that men generally have lower estimates, than women, of their COVID-related risks; and men tend to be more tolerant than women of those risks.

We conjecture that some of this gender gap difference can be narrowed by exposing men to information regarding the health dangers of COVID-19. The survey experiment is designed to test this proposition. A second contribution implements survey experiments designed to identify the effect of information treatments on men’s beliefs about the risks of the COVID-19 virus. First, presentation matters; we observer stronger treatment effects for Experiment 2 that presents the risk information in a graphic format. In fact, none of the treatment effects are significant in Experiment 1 when we have subjects read a short discussion of the risks of COVID-19. Second, how messages are framed and communicated matters—in fact, information frames can have perverse outcomes. Our Experiment 2 treatment simply highlights men’s increased risks of adverse outcomes from COVID-19—but the framing has the perverse effect of reducing self-reported concern about the disease.

There is no evidence in our two experiments to suggest that providing information about the risks associated with the COVID-19 will cause men to increase their risk assessments associated with the disease—in fact they might have the opposite effect. This highlights the importance of carefully crafting information campaigns designed to change risk perceptions. Future work could focus, for example, on framing this risk information in ways that are amenable to “identity-protective cognition,” such that men are less likely to view the treatment as a threat to their own self-perception. As Kahan (2007) writes, “it is not enough that the information be true; it must be framed in a manner that bears an acceptable social meaning.”

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