Misperceptions of COVID-19 illness risk and preferences for business and school closures in the United States

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ABSTRACT

Misperceptions about COVID-19 health risks may be associated with preferences for school and business closures and fear of becoming seriously ill. We analyzed data from the Franklin Templeton-Gallup Economic of Recovery Study (July-December 2020, N = 35,068). Primary outcomes were whether a respondent favored closure of businesses or in-person schooling for elementary/secondary students. We also assessed respondents’ fear of COVID-19 illness. We assessed risk misperceptions using respondents’ estimates of the proportion of deaths from COVID-19 that occurred in persons under 55 years-old, the proportion of hospitalizations for COVID-19 that occurred in persons under 55 years-old, the mortality rate among patients hospitalized with COVID-19, and the rate of hospitalization for patients infected with COVID-19. The proportion of respondents who favored business closures ranged from 37% to 53%, and the proportion of respondents who favored school closures ranged from 38% to 44%. Most participants reported beliefs about COVID-19 health risks that were inaccurate, and overestimation of health risk was most common. For example, while deaths in persons younger than 55 years-old accounted for 7% of total U.S. deaths, respondents estimated that this population represented 43% of deaths. Overestimating COVID-19 health harms was associated with increased likelihood of fear of serious illness if infected, preferences for business closures, and preferences for school closures. U.S. survey respondents overestimated several COVID-19 risks, and overestimation was associated with increased fear of serious illness and stronger preferences for business/school lockdowns.

1. Introduction

The COVID-19 pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has thrust extraordinary policy challenges onto national, state and local governments around the world. Governments have responded primarily by implementing broad policy interventions, such as bans on public gatherings, stay-at-home orders, and closures of nonessential businesses and schools (Hartley and Perencevich, 2020). However, these policies have been the source of vigorous public debate over their effectiveness, appropriateness, and costs (Christakis et al., 2020; Gostin and Wiley, 2020; Great Barrington Declaration and Petition). The trade-offs associated with restrictions on business and educational activities designed to manage the pandemic have been a particularly sensitive area of controversy in the United States.

A central factor that may influence debates over lockdown policies for businesses and schools is a difference in the perception of risk associated with COVID-19 infection. In particular, both risk overestimation and risk underestimation could influence preferences for lockdown policies and individual concerns about becoming seriously ill if infected with COVID-19. These perceptions and their implications for policymaking may also be influenced by heuristics and decisional biases. For example, prospect theory proposes that individuals tend to overweight low probabilities and underweight high probabilities (Kahneman and Tversky, 1979; Tversky and Kahneman, 1981). The rapidly evolving scientific environment informing beliefs about COVID-19 may also play a role, as prior beliefs are debunked or clarified (2020; van Doremalen et al., 2020; Wiersinga et al., 2020). In addition, researchers recently...
reported that 91% of stories about COVID-19 by major U.S. media outlets were negative in tone, compared to 54% of stories from major non-U.S. sources (Sacerdote et al., 2020). This tendency may bias the U. S. population toward risk overestimation.

To better understand how risk perception and misperceptions may influence fears about contracting SARS-CoV-2 and preferences for business and school lockdowns, we analyzed data from the Franklin Templeton-Gallup Economics of Recovery Study from July to December 2020.

2. Methods

2.1. Data

We analyzed data from the Franklin Templeton-Gallup Economics of Recovery Study, a self-administered web survey from an opt-in sample provided by Dynata of 35,068 U.S. adults, aged 18 and older, of whom 24,649 participated in a single survey wave and 10,419 participated during more than one survey wave. There were no duplicate responses in the same wave. Survey participants were part of the Dynata Panel, and incentives were provided to encourage participation in the Panel, but not for time spent completing surveys. The survey was conducted in six waves: July 2–14, August 3–11, September 4–13, October 1–9, November 2–6, and December 1–7, 2020. Gallup weighted the obtained sample to correct for nonresponse and construct a nationally representative population. Nonresponse adjustments were made by adjusting the sample to match the national demographics of gender, age, race/ethnicity, region, education level, marital status and employment status. Demographic weighting targets were based on the Census Bureau’s 2018 data release of the American Community Survey and the Current Population Survey (February 2020). Each wave uses a slightly different questionnaire, allowing Gallup and Franklin Templeton to study various aspects of the pandemic, while maintaining trend data on consumer attitudes and behaviors. The institutional review board exempted this survey study because the data had no personal identifiers for respondents in data made available to researchers.

2.2. Primary measures

We assessed fear of COVID-19 illness by asking participants if they were very worried about becoming seriously ill or dying from the coronavirus. Preferences for policies supporting business and school lockdowns were assessed in July and August 2020 by asking participants whether they would prefer to (1) reopen non-essential businesses and workplaces for in-person operations, (2) reopen elementary and secondary schools for in-person schooling, or delay reopening each site. We coded participants who preferred to delay reopening until COVID-19 was “under greater control” or there was “effective treatment or vaccine” as favoring business or school closures. In later months, participants were asked whether they supported policies that would require non-essential businesses to temporarily close in-person operations, or whether they supported providing in-person schooling for elementary and secondary students. We coded participants who supported cessation of in-person business operations or did not support in-person schooling as favoring business or school closures. Specific questions, response scales, and respondent options are provided in the Appendix.

2.3. Perceptions of COVID-19 health risks

We evaluated perceptions of the health risk associated with COVID-19 using a variety of questions. In July and August, respondents were asked about the percentage of all COVID-19 deaths in the U.S. that fell into different age strata (age 24 and below, age 25–34, age 35–44, age 45–54, age 55–64, and age 65 and older). We used the reported proportion of deaths attributable to persons under the age of 55 as our metric for assessing misperceptions, as most deaths from COVID-19 have occurred in persons older than 55. Perceptions about age-related COVID-19 health risks were assessed in October 2020 with an analogous question about the age distribution of COVID-19 hospitalizations.

In the November 2020 survey, respondents were asked what percentage of patients hospitalized with COVID-19 died. In the December 2020 survey, respondents were asked what percentage of patients infected with COVID-19 required hospitalization. The September 2020 survey was not used (n = 5,017 respondents) because it did not include questions about policy preferences.

2.4. Estimation of actual COVID-19 health risks

We used CDC data to estimate the proportion of deaths from COVID-19 by age and data from the COVID-19-Associated Hospitalization Surveillance Network (COVID-NET) to estimate hospitalizations by age (2020). Because COVID-NET data on hospitalizations were reported using different age strata than those provided to survey respondents, we adjusted these data using simple proportional methods. Specifically, we multiplied hospitalizations reported in COVID-NET by the proportion of years in a corresponding age stratum in order to recategorize hospitalizations into different age strata. For example, to estimate the number of hospitalizations among people aged 24 years-old and younger (an age stratum used in our survey), we summed COVID-NET hospitalizations for the 0–4 year-old category and 5–17 year-old category and multiplied the 18–29 year-old category by 7/12 (the number of years between 18 and 24 as a proportion of the width of the COVID-NET age stratum). The likelihood of hospitalization after infection was estimated to be approximately 5% as reported by Reese and colleagues from the CDC estimate that there were 52.9 million infections from February to September 2020 and 2.4 million hospitalizations, implying a hospitalization rate of 4.5% (Reese et al., 2020). Their method accounted for underreporting. We estimated the likelihood of death among patients hospitalized for COVID-19 to be 12% based on an analysis of 38,517 hospitalized patients from January 1, 2020 to June 30, 2020 (Asch et al., 2021).

2.5. Other measures

In each wave, survey respondents were asked whether they or a household member had a comorbidity that increased the risk of severe COVID-19 illness. Respondents also reported sociodemographic characteristics, household income, and preferences for political parties. Per capita deaths from COVID-19 in each U.S. county from March 1 until December 1 were assessed using CDC data.

2.6. Analyses of survey data

Descriptive analyses of respondents’ characteristics were performed using data from July/August and December. The July and August surveys were combined for analyses because questions about risk perception and lockdown preferences were identical between those two time points. We used multivariable logistic regression analyses to examine the relationship between misperceptions about COVID-19 health risks and (1) fear of becoming infected with COVID-19 or (2) preferences for business and school lockdown policies. Results from these models were presented as predictive margins, in which the regression models were used to estimate the marginal effect of risk overestimation (expressed as a proportion), while holding the distribution of all other covariates constant (Graubard and Korn, 1999). Full model results are presented in the Appendix. Perceptions about risk were characterized as being overestimates, underestimates, or accurate estimates. To provide respondents with a reasonable degree of latitude and account for any uncertainty in our reference estimates, we considered responses that were within 5 percentage points above or below (10 percentage points above or below for hospitalizations of persons younger than 55 years-old, due to the larger proportion) the correct estimate as being accurate.
We performed mean imputation from the overall sample for education (missing < 1%), income (missing < 1%), and whether the respondent or their family had a serious medical condition (missing < 1%). We used this method instead of a more robust multiple imputation model because of the low rate of missingness. All analyses used analytic weights that accounted for the effects of nonresponse. Analyses were performed using Stata (version 14; Stata Corp, College Station, Texas).

2.7. Data availability

The data used in this study are available from the corresponding authors upon request and with the permission of Franklin Templeton and Gallup.

3. Results

Descriptive characteristics of the sample are presented in Table 1. The overall mean age of respondents was 47 years (interquartile range, 32–62), 52% were female, and median household income was $48,000 to $89,999. Half of respondents (50%) reported that either they or a household member had a serious medical condition that increased their risk of serious illness from COVID-19.

After July/August, the proportion of respondents who favored business closures increased from 37% to between 52% and 53%, in subsequent months. The proportion of respondents who favored school closures peaked in July/August at 44% and trended downward to between 38% and 42% in subsequent months.

3.1. Misperceptions about COVID-19 health risks

Most participants reported beliefs about COVID-19 health risks that were inaccurate (Fig. 1). Overestimation of health risk was the most common type of inaccuracy at each survey time point. Fig. 2 shows the distribution of actual versus perceived proportion of deaths attributable to COVID-19 by age of decedents. While deaths in persons younger than 55 years-old accounted for 7% of total U.S. deaths at the time of the July/August surveys, respondents estimated that this population accounted for a mean of 43% of total deaths. In estimating the proportion of COVID-19 hospitalizations that occurred in persons younger than 55 years-old (October survey), respondents reported that this population accounted for 46%, compared to an actual proportion of 38% (Fig. 3). The mortality rate of patients hospitalized with COVID-19 (November survey) was estimated by respondents to be 25% compared to an actual rate of 12%. The proportion of patients hospitalized after being infected with COVID-19 (December survey) was estimated by respondents to be 34% compared to an actual proportion of 5%.

3.2. Fear/worries about COVID-19

The proportion of respondents who reported being “very worried” that they would become seriously ill or die if they contracted COVID-19 did not vary substantially over time, ranging between 30% and 32% (Fig. 4). Overestimating proportion of death or hospitalizations from COVID-19 was associated with a significantly increased likelihood of fear of experiencing severe illness from the coronavirus (Table 2).

3.3. Association of misperceptions with policy preferences for business and school shutdowns

Overestimation of COVID-19 health risks was consistently associated with an increased likelihood of favoring business closures (Table 2). Overestimation was also associated with an increased likelihood of favoring school closure policies in July/August and in December, but not at other time points.

4. Discussion

This survey analysis examined the existence and extent of misperceptions about COVID-19 health risks in the U.S. from July to December 2020. Using four different questions corresponding with the morbidity or mortality associated with COVID-19, we consistently found that survey respondents were more likely to overestimate health risks.
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Overestimation of risk was particularly marked in July and August when 87% of respondents overestimated the proportion of young persons (<55 years old) who had died from COVID-19, and in December, when 66% of respondents overestimated the likelihood of hospitalization among people infected with COVID-19. Overestimation of risk was consistently associated with how worried respondents were about becoming seriously ill from COVID-19, and with support for public health measures that closed businesses. Overestimation of risk was also associated with support for closing schools in July/August and December surveys.

From July to December, a substantial proportion of respondents favored policies that shutdown in-person activities at nonessential businesses and in-person school for elementary and secondary students. Our analyses suggest that some of these preferences for business and school shutdowns can be explained by misperceptions (overestimation) of the risk of harm from COVID-19. Notably, the findings persisted in a sensitivity analysis that excluded the small proportion of respondents who underestimated risk.

![Fig. 1. Comparison of respondents’ perceived risk versus actual risk associated with COVID-19 illness, the percentage of respondents that over-, under-, or accurately estimated the risk of each outcome.](image)

![Fig. 2. Comparison of respondents’ perceived versus actual proportion of deaths from COVID-19 by age group. Respondents estimated proportion of deaths by age group are compared to actual deaths.](image)
Risk perception has long been recognized as a factor in decision-making (Brewer et al., 2007; Rogers, 1975; Sheeran et al., 2014). Prior research in health behaviors has shown that individuals who perceive higher levels of risk are more likely to engage in protective health behaviors (Brewer et al., 2007; Rogers, 1975; Sheeran et al., 2014). However, while preventive health behaviors may yield beneficial health effects, they may not be optimal if their costs exceed their benefits (Zeckhauser and Shepard, 1976). Analogously, policy recommendations for or against business and school closures that are influenced by overestimation or underestimation of risk may lead to suboptimal policy-making. In the context of COVID-19, survey responses indicate that overestimation of risk is substantially more common than accurately estimating or underestimating risk.

In prospect theory, Tversky and Kahneman propose that individuals...
tend to overweigh low probabilities and underestimate high probabilities (Kahneman and Tversky, 1979; Tversky and Kahneman, 1981). Because the most clinically significant and harmful consequences of COVID-19 tend to be low probability events—death or severe morbidity—the anticipated effect of this bias would be to increase the subjective weight of these low probability events, including among people who (modestly) overestimate risk. The availability heuristic, a heuristic in which people predict the likelihood of an event in a way that is influenced by how easily an example of that event can be imagined, may also be contributing to overestimation. Media coverage of the COVID-19 pandemic has been substantially more negative in the U.S. than in other countries (Sacerdote et al., 2020). Exposure to media coverage of hospitalizations and deaths, particularly deaths of young persons, may increase subjective beliefs of the likelihood of these events.

Our findings indicate that both overestimation and underestimation of risk occurred, with risk overestimation affecting perceptions of risk among older people. However, because most deaths from COVID-19 have occurred in persons older than 55 years and COVID-19 mortality risk increases markedly around this age, we felt that our metric was appropriate.

Both risk overestimation and risk underestimation can influence preferences for lockdown policies and concerns about becoming seriously ill from COVID-19 (Erev et al., 2020). The survey was not targeted to political leaders, but it is possible that differences in policymaking between states in the U.S. may analogously reflect differences in perception of risk among state governors, for example. In addition, differences by race/ethnicity, sex, and age may influence perceptions and experiences during the pandemic. Our adjusted analyses, reported in the Appendix, found differences in misperceptions and preferences for business and school closures by these characteristics. In particular, women, older individuals, and Hispanic individuals were more likely to favor business closures, while Black individuals were less likely to favor school closures.

Prior research has highlighted the “description-experience gap,” a concept which is relevant to our findings (Hertwig and Erev, 2009). This concept describes a phenomenon in which, when decisions are based on past experience, individuals often behave as if rare events are less impactful than what objective probabilities imply, whereas when decisions are based on description (such as in survey research), individuals often behave as if rare events are more impactful than what objective probabilities imply (consistent with prospect theory). This may explain why individuals who report heightened concern related to COVID-19 may still not adhere to public health recommendations.

There is a possibility that overestimation of risk for individuals below 55 years-old is related to the design of our survey question, with more categories falling below 55 years-old than above 55 years-old. That is, our results could change with changes in the age cut-point used, for example. However, we think any contribution from survey question design is likely to be minor because the degree of risk over-estimation for young people was pronounced. And while overestimation of risk among the young implies underestimation of risk among the old when the total risk “points” to be allocated is fixed (our survey design), the consistent trend toward overestimation of risk across multiple risk perception questions (Fig. 1) suggests that we are capturing actual, underlying perceptions rather than an artifact of survey design.

Our study has limitations. We examined changes over time using a serial cross-sectional design. We therefore were unable to assess within-person changes in fear of COVID-19 illness or preferences for business and school closures. Second, the questions we used to assess risk perceptions changed over time, which precluded direct comparisons of risk perception between time periods. However, survey questions related to COVID-19 risk perception consistently probed beliefs about hospitalization and mortality risk, and our finding of an association between risk overestimation and fear or support of lockdown policies was generally consistent, despite the changing questions. Third, our survey questions inform public opinion but do not necessarily reflect the opinions of political leaders and health officials who have drafted and implemented COVID-19 policies.

In conclusion, survey respondents overestimated several health risks associated with COVID-19, and this overestimation was associated with increased fear of becoming seriously ill and stronger preferences for business and school closures. Public health strategies that improve the accuracy of risk perception during the COVID-19 pandemic and during future health emergencies may help optimize policymaking, particularly in regard to costly interventions such as business and school closures.
Data availability

All data analyzed during the study are available from the corresponding author on reasonable request.

Author contributions

All authors were involved with data collection, data analysis, discussed results, and drafted the manuscript.

CRediT authorship contribution statement

Joseph A. Ladapo: Conceptualization, Methodology, Validation, Supervision, Formal analysis, Writing – original draft. Jonathan T. Rothwell: Conceptualization, Methodology, Supervision, Formal analysis, Data curation, Writing – review & editing. Christina M. Ramirez: Conceptualization, Methodology, 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.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2022.101780.

References

Asch, D.A., Sheiks, N.E., Islam, M.N., Chen, Y., Werner, R.M., Buresh, J., Doshi, J.A., 2021. Variation in US hospital mortality rates for patients admitted with COVID-19 during the first 6 months of the pandemic. JAMA Int. Med. 181 (4), 471.

Brewer, N.T., Chapman, G.B., Gibbons, F.X., Gerrard, M., McCaul, K.D., Weinstein, N.D., 2007. Meta-analysis of the relationship between risk perception and health behavior: the example of vaccination. Health Psychol. 26, 136–145.

CDC. 2020. ‘Coronavirus Disease 2019 (COVID-19)’. Centers for Disease Control and Prevention.

Christakis, D.A., Van Cleve, W., Zimmerman, F.J., 2020. Estimation of US Children’s educational attainment and years of life lost associated With primary school closures during the coronavirus disease 2019 pandemic. JAMA Netw. Open 3 (11), e2028786.

Erev, I., Ploosky, O., Roth, Y., 2020. Complacency, panic, and the value of gentle rule enforcement in addressing pandemics. Nat. Hum. Behav. 4, 1095–1097.

Gostin, L.O., Wiley, L.F., 2020. ‘Governmental public health powers during the COVID-19 pandemic: stay-at-home orders, business closures, and travel restrictions’. JAMA 323, 2137–2138.

Graubard, B.I., Korn, E.L., 1999. Predictive margins with survey data. Biometrics 55, 652–659.

Great Barrington Declaration and Petition. Great Barrington Declaration.

Hartley, D.M., Perencevich, E.N., 2020. Public health interventions for COVID-19: emerging evidence and implications for an evolving public health crisis. JAMA 323, 1908–1909.

Hertwig, R., Erev, I., 2009. The description-experience gap in risky choice. Trends Cogn. Sci. 13, 517–523.

Kahneman, D., Tversky, A., 1979. Prospect theory: an analysis of decision under risk. Econometrica 47, 263–291.

Reese, H., Iuliano, A.D., Patel, N.N., Garg, S., Kim, L., Silk, B.J., Hall, A.J., Fry, A., Reed, C., 2020. Estimated incidence of COVID-19 illness and hospitalization - United States, February-September, 2020. Clin. Infect. Dis.

Sacerdote, Bruce, Ranjan Sehgal, and Molly Cook. 2020. “Why Is All COVID-19 News Bad News?” In: National Bureau of Economic Research.

Sheeran, P., Harris, P.R., Epton, T., 2014. ‘Does heightening risk appraisals change people’s intentions and behavior? A meta-analysis of experimental studies’. Psychol. Bull. 140, 517–543.

Tversky, A., Kahneman, D., 1981. The framing of decisions and the psychology of choice. Science 211, 453–458.

van Doremalen, N., Bushmaker, T., Morris, D.H., Holbrook, M.G., Gamble, A., Williamson, R.N., Tamin, A., Harcourt, J.J., Thorsberg, N.J., Gerber, E.L., Lloyd-Smith, J.O., de Wit, E., Munster, V.J., 2020. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. N. Engl. J. Med. 382, 1564–1567.

Wiersinga, W.J., Rhodes, A., Cheng, A.C., Peacock, S.J., Prescott, H.C., 2020. Pathophysiology, transmission, diagnosis, and treatment of coronavirus disease 2019 (COVID-19): a review. JAMA 324, 782–793.

Zeckhauser, R., Shephard, D., 1976. Where now for saving lives? Law Contem. Probl. 40, 5.