Economics Bulletin

Volume 42, Issue 1

Knowledge, overconfidence, and behavior in COVID-19: results from an online survey

Guanlin Gao
Chaminade University of Honolulu

Danyang Li
Hofstra University

Abstract

This study answers three questions: (1) how much correct information does the U.S. public possess about COVID-19; (2) whether they hold any misconceptions or suffer from any cognitive biases regarding COVID-19; and (3) how people's knowledge level and overconfidence affect their preventative behaviors. We examined individuals' objective and subjective knowledge levels and the relationship between their knowledge, overconfidence, and behaviors using 595 observations collected from an online survey. Our results show that people with less understanding of COVID-19 are more overconfident and are less likely to take preventative actions.

Citation: Guanlin Gao and Danyang Li, (2022) "Knowledge, overconfidence, and behavior in COVID-19: results from an online survey", *Economics Bulletin*, Volume 42 Issue 1 pages 215-223.
Contact: Guanlin Gao - guanlin.gao@chaminade.edu, Danyang Li - danyang.li@hofstra.edu.
Submitted: June 03, 2021. **Published:** February 20, 2022.

Economics Bulletin

Submission Number: EB-21-00522

Knowledge, overconfidence, and behavior in COVID-19: results from an online survey

Guanlin Gao
Chaminade University of Honolulu

Danyang Li
Hofstra University

Abstract

This study answers three questions: (1) how much correct information does the U.S. public possess about COVID-19; (2) whether they hold any misconceptions or suffer from any cognitive biases regarding COVID-19; and (3) how people's knowledge level and overconfidence affect their preventative behaviors. We examined individuals' objective and subjective knowledge levels and the relationship between their knowledge, overconfidence, and behaviors using 595 observations collected from an online survey. Our results show that people with less understanding of COVID-19 are more overconfident and are less likely to take preventative actions.

Submitted: June 03, 2021.

1. Introduction

There is an urgent need to understand the general public's knowledge, perceptions, and behaviors toward COVID-19 in the United States. This study answers three research questions: (1) how much correct information does the U.S. public actually possess about COVID-19, (2) whether they hold any misconceptions or suffer from any cognitive biases regarding COVID-19, and (3) how people's knowledge level and potential cognitive biases affect their behaviors towards COVID-19. We conduct an online survey with 595 Amazon Mechanical Turk (MTurk) workers in the United States. We examine their objective and subjective knowledge levels of COVID-19 and the relationship between their knowledge, overconfidence, and behaviors. Our results show that people with less knowledge of COVID-19 are more overconfident and think they know more. Also, the more overconfident people are, the less likely they will practice preventive behaviors against COVID-19.

Research shows that there is a discrepancy between how much people think they know and what they actually know. Also, people's ability of knowing about knowing is bounded by their ability of knowing itself (Kruger and Dunning 1999). Poor-performers tend to overestimate themselves in their self-evaluations (Ferraro 2010, Mynttinen et al. 2009, Park and Santos-Pinto 2010). The cognitive bias about oneself can also originate from comparing one's perceived self with the perceived average person and falsely believing oneself is better than the average (Alicke et al. 1995, Kruger 1999). In the case of COVID-19, this cognitive bias may cause people to be unaware of their inadequate understanding of COVID-19 and thus, not willing to learn more. Overconfidence also leads to fewer preventive actions taken, including delayed testing and vaccination.

Recent studies from other countries show that people's knowledge of COVID-19 is positively correlated to their engagement in preventative actions (Saefi et al. 2020, Tadesse et al. 2020, Zhong et al. 2020). Our work extends the existing literature on COVID-19 by connecting the link between one's knowledge, overconfidence, and behaviors during the pandemic. Based on the studies cited above, we test the following behavioral hypotheses:

Hypothesis 1. Low performers of the knowledge test are more overconfident in assessing their performance.

Hypothesis 2. The more overconfident a subject is, the less likely he will practice preventive behaviors against COVID-19.

2. Survey Design

We design a survey to collect information on the U.S. residents' knowledge, belief, and behaviors toward COVID-19. Our survey contains three sections: (1) a knowledge test with subjective beliefs, (2) behavioral questions, and 3) demographic questions.

The knowledge test contains ten fact-check questions related to COVID-19. Immediately after the test, subjects answer how many questions they believe they have answered correctly and an average person can answer correctly. We incentivize these tasks by paying subjects a bonus for each correct answer. We ask subjects about their preventative actions towards COVID-19, such as

if they have been practicing social distancing, wearing a mask in public[1], and frequently washing their hands in the past two weeks. We also collect subjects' demographics and their socioeconomic status. Appendix A presents the survey questionnaire.

3. Results

We conducted our survey on MTurk in August 2020 and collected 662 responses. We ended with 595 observations after excluding 41 observations with a duplicate IP address, 25 observations failing the attention check question, and one observation with no answer in the knowledge test. We paid subjects \$0.1 for completing the survey, plus an additional 10 cents for each correctly answered belief questions.[2] All survey responders are 18 years old and above currently living in the United States. Table 1 presents the summary statistics. Overall, our sample represents the typical MTurk crowdsource workers (Hara 2018).

Table 1: Summary statistics (n=595)

	Mean	Std. Dev.	Min	Max
Age >= 35	0.51	0.50	0	1
Female	0.44	0.50	0	1
Married	0.28	0.45	0	1
White	0.67	0.47	0	1
No college	0.19	0.39	0	1
Low income (annual income <\$25,000)	0.13	0.33	0	1
# of correct answers in knowledge test	6.54	2.48	0	10

3.1 Knowledge and Beliefs

Figure 1 and Figure 2 present subjects' knowledge and beliefs. On average, subjects answered 6.5 out of 10 questions correctly but believed they answered 7.8 questions correctly (two-sided, paired t-test: $p<0.001$). 79% of them believed that their performance was at least as good as an average person. In sum, subjects were overconfident.

3.2 Overconfidence and Knowledge

We define two measurements for overconfidence based on subject's performance in the knowledge test:

Absolute Confidence = Perceived Performance - Actual Performance;

Relative Confidence = (Perceived Performance - Perceived Performance of an Average Person) – (Actual Performance - Actual Performance of an Average Person).

[1] The Centers for Disease Control and Prevention (CDC) asserted that wearing a mask is an effective protection against COVID-19 for oneself and others when we conducted our survey in August 2020. Almost all the states had mask mandates at that time, which required individuals to wear a mask in public and maintain a 6-feet distance.

[2] On average, subjects spent 6 minutes and 36 seconds on the survey and earned \$0.3. This translates to an effective wage of \$2.73 per hour, which is the approximate average hourly pay on MTurk (Hara 2018).

A zero value in these measurements indicates an accurate evaluation. A positive value implies overconfidence, and a negative value implies an underestimation in one's absolute or relative confidence.

Figure 1. Knowledge test

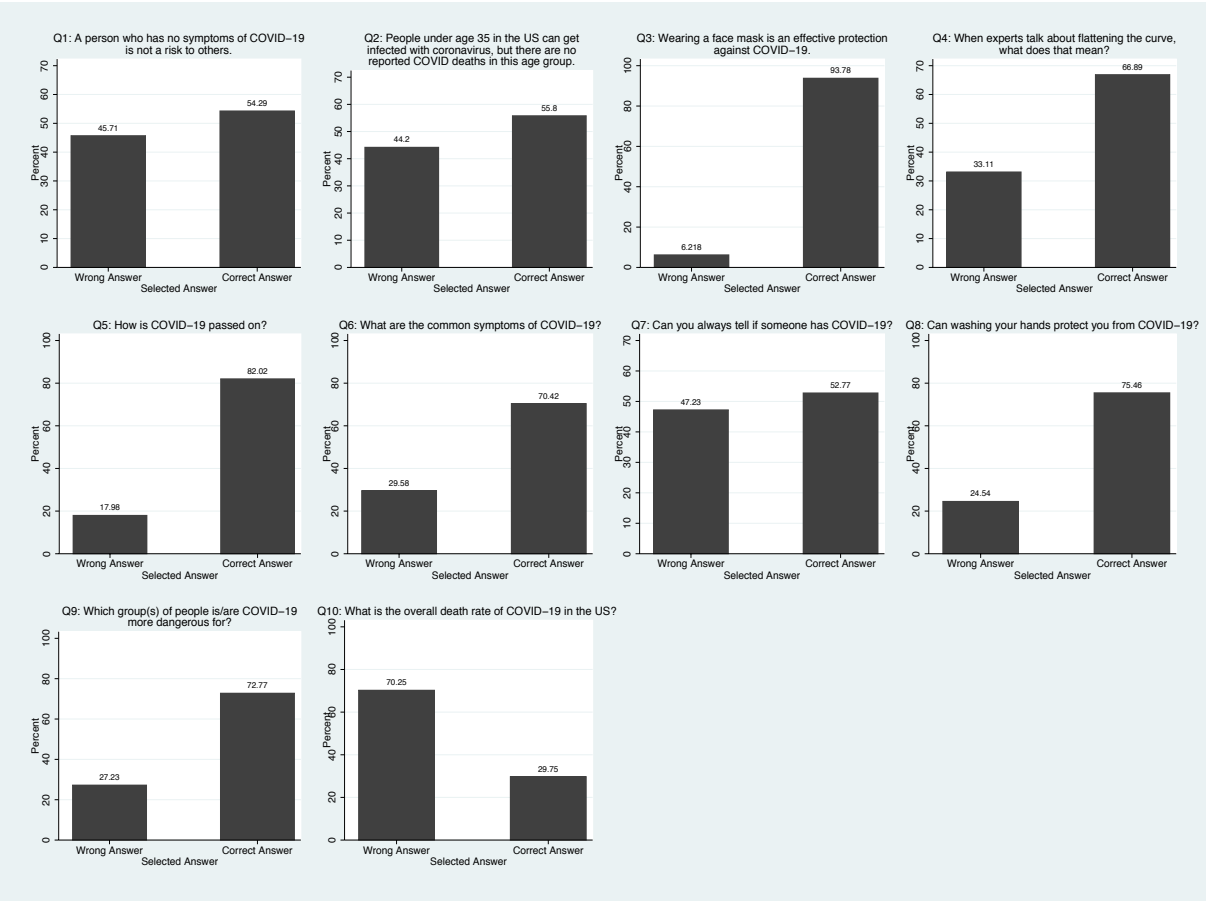
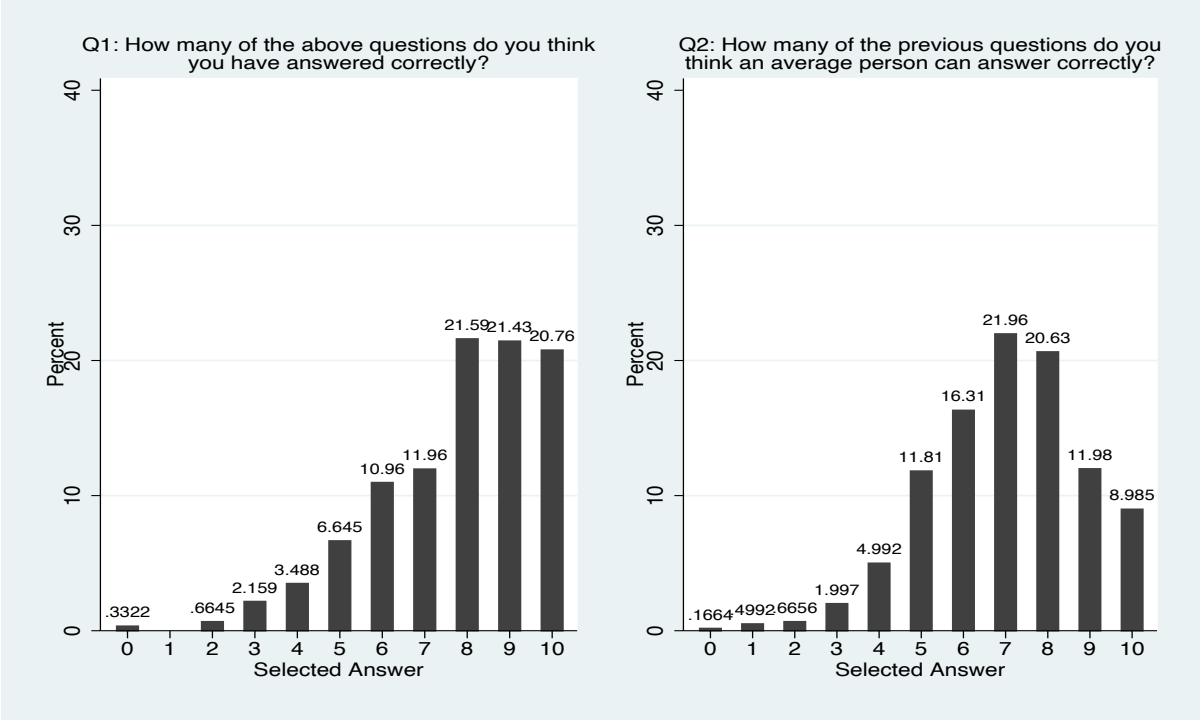


Figure 2. Belief questions



We assign subjects into three categories based on their performance in the knowledge test: *Low, Medium,* and *High*, each with less than 6, 6 to 8, and more than 8 correct answers. We use these numbers as the thresholds to create groups of approximately the same size. Table 2 presents the correlation between subjects' overconfidence and performance for each group. Both the absolute and relative confidence are inversely related to subjects' knowledge levels. All these statistics are significantly different from 0 (two-sided *t*-test: $p<0.001$). Wilcoxon rank-sum tests show that the differences of the group pairwise comparisons are all significant at the 1% level. These results are reported in Appendix B.

Table 2: Overconfidence and knowledge

Mean	Low (<6)	Medium (6-8)	High (>8)
Absolute confidence	3.38 (2.45)	0.72 (1.82)	-0.75 (1.41)
Relative confidence	3.28 (1.86)	0.67 (1.59)	-0.55 (1.58)
N	210	214	171

Note: Standard errors in parentheses.

We build the following Tobit regression to examine the relationship between one's confidence and knowledge:

$$Y_i = \beta_0 + \beta_1 \cdot correctanswers_i + \beta_2 \cdot age35_i + \beta_3 \cdot nocollege_i + \beta_4 \cdot married_i + \beta_5 \cdot white_i + \beta_6 \cdot female_i + \beta_7 \cdot lowincome_i + \varepsilon_i \quad (1)$$

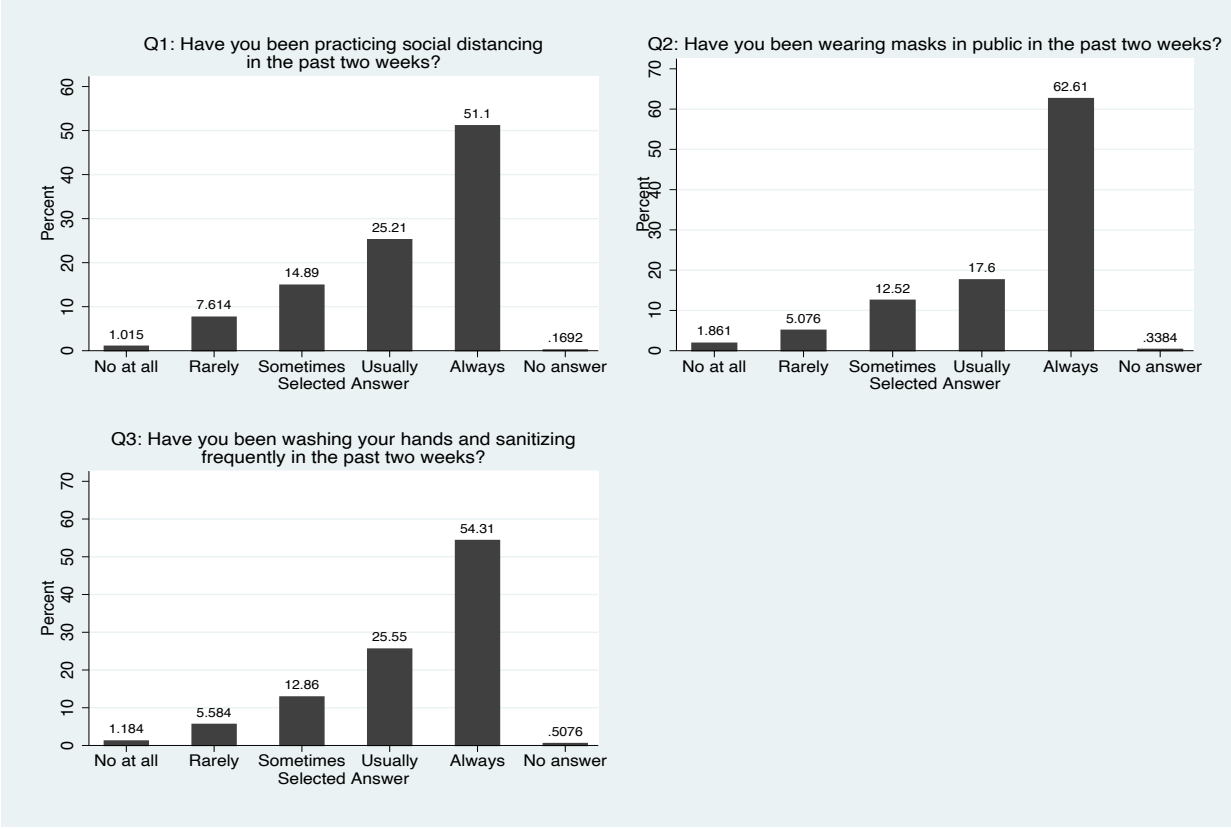
Table 3 presents the regression results with four dependent variables. We include other personal characteristics such as gender, marital status, and race in all regression models and only report significant coefficients henceforth. Our results show that subjects' absolute and relative confidence are negatively associated with their actual performance in the knowledge test. Model (3) and (4) show the robustness check results using the absolute values of subjects' absolute confidence and relative confidence as the dependent variables, both describing the degree of inaccuracy in subjects' self-evaluations. We find an inverse relationship between the number of correct answers and these dependent variables. These results imply that subjects with a better understanding of COVID-19 are more accurate in evaluating their own performance and relative performance.

Table 3: Tobit regression results: Overconfidence and knowledge

	Absolute confidence	Relative confidence	|Absolute confidence|	|Relative confidence|
# of correct answers	-0.758*** (-0.0316)	-0.699*** (-0.0273)	-0.552*** (-0.033)	-0.456*** (-0.0286)
Age >= 35	0.323** (-0.164)	0.117 (-0.141)	0.196 (-0.17)	0.026 (-0.148)
No college	0.139 (-0.197)	0.199 (-0.169)	0.413** (-0.204)	0.386** (-0.178)
Low income	-0.434* (-0.227)	-0.212 (-0.195)	0.184 (-0.233)	-0.277 (-0.207)
Constant	6.029*** (-0.25)	5.701*** (-0.216)	5.413*** (-0.257)	4.863*** (0.225)
Other	Y	Y	Y	Y
N	595	594	595	594

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Figure 3. Behavioral questions



3.3 Overconfidence and Behaviors

Figure 3 and Table 4 report subjects' preventative behaviors. Table 4 shows that high performers of the knowledge test are better at protecting themselves against COVID-19 in all activities. Wilcoxon rank-sum tests show that the results of group pairwise comparisons are all significant at the 1% or 5% level. These statistics are reported in Appendix B.

Table 4: Behavior and knowledge

Mean	Low (<6)	Medium (6-8)	High (>8)
Social distancing	3.77 (1.15)	4.26 (.96)	4.58 (.67)
Mask-wearing	3.96 (1.11)	4.42 (.98)	4.71 (.69)
Handwashing	3.92 (1.10)	4.37 (.87)	4.56 (.78)
N	205	212	171

Note: Standard errors in parentheses.

Furthermore, overconfidence is the driving force behind subjects' behavioral differences between groups. We construct the following ordered-logit regression to examine the relationship between one's confidence and behavior:

$$Y_i = \beta_0 + \beta_1 \cdot confidence_i + \beta_2 \cdot age35_i + \beta_3 \cdot nocollege_i + \beta_4 \cdot married_i + \beta_5 \cdot white_i + \beta_6 \cdot female_i + \beta_7 \cdot lowincome_i + \varepsilon_i \quad (2)$$

Table 5 reports the ordered-logistic regression results with three dependent variables. Overconfident subjects are less likely to engage in preventative actions, so do subjects without a college degree.

Table 5: Ordered-logit regression results: Overconfidence and behavior

	Social distancing	Mask-wearing	Hand-washing	Social distancing	Mask-wearing	Hand-washing
Absolute confidence	-0.132*** (-0.032)	-0.143*** (-0.0332)	-0.115*** (-0.0324)	-	-	-
Relative confidence	-	-	-	-0.200*** (-0.0358)	-0.205*** (-0.0385)	-0.162*** (-0.0362)
Age >=35	0.306* (-0.172)	0.224 (-0.184)	0.094 (-0.175)	0.274 (-0.172)	0.170 (-0.185)	0.066 (-0.175)
No college	-0.457** (-0.198)	-0.395* (-0.213)	-0.493** (-0.202)	-0.492** (-0.200)	-0.403* (-0.214)	-0.510** (-0.202)
Low income	-0.233 (-0.24)	-0.419* (-0.244)	-0.255 (-0.238)	-0.22 (-0.240)	-0.406* (-0.245)	-0.245 (-0.238)
Other	Y	Y	Y	Y	Y	Y
N	590	589	588	589	588	587

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Based on the findings above, we draw the following conclusions:

Result 1. On average, low performers of the knowledge test are less accurate in assessing their knowledge about COVID-19 and tend to be overconfident.

Result 2. The more overconfident a subject is, the less likely he will engage in preventive behaviors to protect himself and others against COVID-19.

4. Concluding remarks

This study shows that individuals with less accurate knowledge of COVID-19 appear to be overconfident and less likely to practice preventative behaviors. Their source of information about COVID-19, skepticism of the mainstream media, distrust of the government and health officials, and simply arrogance and ignorance, can contribute to not acquiring and believing scientific-based facts of COVID-19. What causes inadequate knowledge of COVID-19 will be an important question worth studying in the future.

Our results may depict an overoptimistic situation than actual as the overall population contains fewer college-educated and technology-savvy individuals compared to our sample. This research study provides empirical evidence and practical insights for policymakers. Policy interventions

should focus on specific demographics with limited knowledge of COVID-19. This is necessary not only to mitigate the spread of the virus but also to prepare for mass testing and vaccination uptake.

References

Alicke, Mark D., Mary L. Klotz, David L. Breitenbecher, Tricia J. Yurak, and Debbie S. Vredenburg. "Personal contact, individuation, and the better-than-average effect." *Journal of Personality and Social Psychology* 68, no. 5 (1995): 804.

Ferraro, Paul J. "Know thyself: Competence and self-awareness." *Atlantic Economic Journal* 38, no. 2 (2010): 183-196.

Hara, Kotaro, Abigail Adams, Kristy Milland, Saiph Savage, Chris Callison-Burch, and Jeffrey P. Bigham. "A data-driven analysis of workers' earnings on Amazon Mechanical Turk." In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, pp. 1-14. 2018.

Kruger, Justin. "Lake Wobegon be gone! The "below-average effect" and the egocentric nature of comparative ability judgments." *Journal of Personality and Social Psychology* 77, no. 2 (1999): 221.

Kruger, Justin, and David Dunning. "Unskilled and unaware of it: how difficulties in recognizing one's own incompetence lead to inflated self-assessments." *Journal of Personality and Social Psychology* 77, no. 6 (1999): 1121.

Mynttinen, Sami, Anna Sundström, Jan Vissers, Marita Koivukoski, Kari Hakuli, and Esko Keskinen. "Self-assessed driver competence among novice drivers–a comparison of driving test candidate assessments and examiner assessments in a Dutch and Finnish sample." *Journal of Safety Research* 40, no. 4 (2009): 301-309.

Park, Young Joon, and Luís Santos-Pinto. "Overconfidence in tournaments: Evidence from the field." *Theory and Decision* 69, no. 1 (2010): 143-166.

Saefi, Muhammad, Ahmad Fauzi, Evi Kristiana, Widi Cahya Adi, M. Muchson, M. Eval Setiawan, Novita Nurul Islami, Dian Eka Aprilia Fitria Ningrum, M. Alifudin Ikhsan, and Mavindra Ramadhani. "Survey data of COVID-19-related knowledge, attitude, and practices among indonesian undergraduate students." *Data in Brief* 31 (2020): 105855.

Tadesse, Abay W., Negesse Melese, Sisay Eshetie, Mulugeta Chane, and Amhed Ali. "Knowledge, attitude, and practice and associated factors towards COVID-19 among college students in Amhara region, Ethiopia: a cross-sectional study." (2020).

Zhong, Bao-Liang, Wei Luo, Hai-Mei Li, Qian-Qian Zhang, Xiao-Ge Liu, Wen-Tian Li, and Yi Li. "Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey." *International Journal of Biological Sciences* 16, no. 10 (2020): 1745.