Collectivism predicts mask use during COVID-19

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Since its outbreak, COVID-19 has impacted world regions differentially. Whereas some regions still record tens of thousands of new infections daily, other regions have contained the virus. What explains these striking regional differences? We advance a cultural psychological perspective on mask usage, a precautionary measure vital for curbing the pandemic. Four large-scale studies provide evidence that collectivism (versus individualism) positively predicts mask usage—both within the United States and across the world. Analyzing a dataset of all 3,141 counties of the 50 US states (based on 248,941 individuals), Study 1a revealed that mask usage was higher in more collectivistic US states. Study 1b replicated this finding in another dataset of 16,737 individuals in the 50 US states. Analyzing a dataset of 367,109 individuals in 29 countries, Study 2 revealed that mask usage was higher in more collectivistic countries. Study 3 replicated this finding in a dataset of 277,219 Facebook users in 67 countries. The link between collectivism and mask usage was robust to a host of control variables, including cultural tightness–looseness, political affiliation, demographics, population density, socioeconomic indicators, universal health coverage, government response stringency, and time. Our research suggests that culture fundamentally shapes how people respond to crises like the COVID-19 pandemic. Understanding cultural differences not only provides insight into the current pandemic, but also helps the world prepare for future crises.

culture | collectivism | individualism | COVID-19 | mask

"It appears as though many Americans have maximized their psychological welfare by not covering their mouths. This behavior, however, has come at a grave cost for the collective. Each individual is protected as long as many others in the community wear masks. If a majority choose not to wear a mask, then you may not be protected even if you wear a mask. Unfortunately, again and again, many Americans prioritized their personal convenience or preference while ignoring the collective consequences of doing so."

—Shinobu Kitayama, President of the Association for Psychological Science (1)

Since its outbreak, the novel coronavirus (COVID-19) has impacted world regions differentially. As of January 2021, the pandemic is still raging in countries like the United States, the United Kingdom, and South Africa, with tens of thousands of new infections recorded daily (2). By contrast, countries like Thailand and South Korea have contained the virus and recorded few new infections and deaths over the past several months. What explains these striking regional differences?

We posit that culture fundamentally shapes people's response to the pandemic and helps explain regional differences in the severity of COVID-19 infections. Specifically, we propose that, net of other factors, people in more collectivistic (versus individualistic) regions are more likely to wear masks, a precautionary measure vital for curbing the pandemic (3). Collectivism–individualism is one of the most established cultural dimensions in psychology (4). Collectivism (versus individualism) is characterized by the view of an interdependent (versus independent) self (5, 6). Collectivism captures "the tendency to be more concerned with the group's needs, goals, and interests than with individualistic-oriented interests,"

whereas individualism captures "the tendency to be more concerned with one's own needs, goals, and interests than with group-oriented concerns" (7). People in collectivistic cultures are more likely to agree with statements like "I usually sacrifice my self-interest for the benefit of my group" and "My happiness depends very much on the happiness of those around me," whereas people in individualistic cultures are more likely to agree with statements like "I often do my own thing" and "What happens to me is my own doing" (6, 8–11). As evidenced by widely used collectivism–individualism indices (12–15), collectivism–individualism varies both across countries and within countries (e.g., among the 50 US states).

Based on the differences between collectivistic and individualistic cultures, we theorize that collectivism (versus individualism) positively predicts people's mask usage during the COVID-19 pandemic. Although masks effectively protect against COVID-19 (3), they can create physical discomfort and inconvenience. Because people in collectivistic cultures are more concerned with the collective welfare, they may be more willing to tolerate such personal inconvenience and to wear masks (5, 16). By contrast, much as Kitayama lamented (1), people in individualistic cultures may be more apt to prioritize their personal convenience or preference over the collective welfare and therefore less willing to wear masks. A COVID-19 survey found that 64% of Americans who did not wear masks indicated "It's my right as an American to not wear a mask" or "It is uncomfortable" (17). Related research has found that individualists are less likely than collectivists to engage in environmentally friendly behaviors that entail sacrificing personal convenience for the collective welfare (18, 19).

Relatedly, a sizable number of people in individualistic cultures refuse to wear masks because they view masks as a symbolic infringement on their personal choice and freedom (1, 20). There have been many anti-mask protests in predominantly individualistic cultures like Germany and the United States, featuring signs

Significance

What explains the striking regional differences in COVID-19 severity around the world? We reveal the role of culture in mask usage, a precautionary measure vital for mitigating the pandemic. Leveraging a dataset of all 3,141 counties of the 50 US states, a dataset of 16,737 individuals in the 50 US states, a dataset of 367,109 individuals in 29 countries, and a dataset of 277,219 Facebook users in 67 countries, we provide evidence that people in more collectivistic (versus individualistic) regions are more likely to wear masks. Our research suggests that culture fundamentally shapes how people respond to crises like the COVID-19 pandemic.

such as "Masks are muzzles" (20, 21). Some protesters even asserted, "If I'm going to get COVID and die from it, then so be it" (20). This assertion epitomizes the values of personal choice and autonomy in individualism, but disregards the possibility that one may infect other people and harm the larger community. Indeed, culturally individualistic regions have witnessed a large number of "super-spreader" incidents, where people chose to gather or party without masks and consequently caused a massive number of infections (22). By contrast, because of collectivistic cultures' emphasis on interdependence and shared goals, many people in such cultures consider wearing masks not only a civic responsibility but also a symbol of solidarity signaling that they are fighting the pandemic together (23).

In light of the above reasoning, we hypothesize that people in culturally more collectivistic (versus individualistic) regions are more likely to wear masks during the COVID-19 pandemic. To test this hypothesis, we conducted four large-scale studies. In Study 1a, we constructed a dataset of mask usage in all 3,141 counties of the 50 US states (based on 248,941 individuals) to test whether mask usage was higher in more collectivistic states. In Study 1b, we sought to replicate this finding in a dataset of 16,737 individuals in the 50 US states. In Study 2, we constructed a dataset of mask usage of 367,109 individuals in 29 countries to test whether mask usage was higher in more collectivistic countries. In Study 3, we further tested the link between collectivism and mask usage in a dataset of 277,219 Facebook users in 67 countries. Across these four studies, we accounted for a broad set of control variables, including cultural tightness–looseness, political affiliation, demographics, population density, socioeconomic indicators, universal health coverage, government response stringency, and time.

This research uncovers the role of culture in mask usage during the COVID-19 pandemic. Recent studies have examined factors that influence the macrolevel spread of COVID-19, such as demographics (24), socioeconomic variables (25), relational mobility (26), and personality (27). We extend this line of research by examining the microlevel behavior of mask usage, which is critical to curbing COVID-19 (28). By providing a cultural perspective on the pandemic, we shed light on the stark regional differences in the severity of COVID-19 infections around the world. More broadly, by examining how different cultures respond to the pandemic, our research highlights the importance of cultural psychology in understanding and fighting global crises.

Study 1a: Collectivism Predicts Mask Usage within the United States

To test the link between collectivism and mask usage, we first constructed a large dataset of all 3,141 counties of the United States. Importantly, examining this link within one large country precludes any between-country confounding effects.

Method. We obtained permission to analyze a dataset collected by *The New York Times* and Dynata, which conducted a one-question survey about mask usage from July 2 to July 14, 2020. It is noteworthy that by the time of the survey, COVID-19 had spread all over the United States, and the general public had been informed of the effectiveness of masks in mitigating the pandemic. 248,941 individuals from all 3,141 US counties participated in this survey.

Personal mask usage. Participants were asked, "How often do you wear a mask in public when you expect to be within six feet of another person?" (0 = never, 1 = rarely, 2 = sometimes, 3 = frequently, and 4 = always). *The New York Times* aggregated raw survey responses into county-level estimates based on participants' ZIP codes (for methodological details, see https://github.com/nytimes/covid-19-data). For each US county, we computed a mask usage score = never*0 + rarely*1 + sometimes*2 + frequently*3 + always*4.

We collected a broad set of region-level cultural, demographic, socioeconomic, and political variables and combined them with the mask usage question in *The New York Times* survey. For detailed sources of all variables in this paper, refer to *SI Appendix*, Table S1.

Collectivism. The United States is a large country, and its 50 states vary considerably in collectivism–individualism (13, 29). We used the collectivism–individualism index from Vandello and Cohen, with higher scores indicating more collectivistic states (13). This index covers all 50 US states and is the most widely used measure of collectivism–individualism at the US state level (30).

Tightness. A related but distinct cultural variable is tightness (versus looseness), or the degree to which social entities "have many strongly enforced rules and little tolerance for deviance" (30, 31). Harrington and Gelfand (30) found that at the US state level, collectivism and tightness correlate only moderately at $r = 0.37$. For example, Hawaii ranks high on collectivism but low on tightness (13, 30).

We controlled for tightness to examine whether the relationship between collectivism and mask usage was in fact driven by tightness (32–34). We used the US state-level index of tightness–looseness from Harrington and Gelfand, with higher scores indicating tighter states (30). This index covers all 50 US states.

COVID-19 severity. Because people in more infected regions may be more likely to wear masks, we controlled for the new confirmed cases of COVID-19 per million population between July 2 and July 14, 2020 (daily average).* This variable is commonly used in the COVID-19 literature (35).

Government stringency. We controlled for the Government Response Stringency Index because US states vary in the stringency of their COVID-19 policies (e.g., mask usage, private gathering limits, school closures). We sourced this stringency index from the Oxford COVID-19 Government Response Tracker (36) and computed the mean score for each state between July 2 and July 14, 2020 (daily average).

Political affiliation. It is commonly known that political affiliation has a large impact on mask usage in the United States, where people in more Republican states tend to use masks less than people in more Democratic states (37). Thus, it is important to control for political affiliation. We sourced state-level data on political affiliation from the Pew Research Center (38), which documents the percentages of adults who identify as Democrat/leaning Democrat, no political leaning, or Republican/leaning Republican.

Education level. Because people with higher education may be more likely to use masks, we sourced education data from the US Economic Research Service to control for the percentage of adults with a bachelor's degree or higher.

Population density. We controlled for population density because people in more populated regions may be more collectivistic and also have more social contact (13). From the US Census Bureau, we sourced total population data and land area (square miles). To compute population density, we divided population by land area. Because population density was skewed, log transformation was applied.

Income per capita. We controlled for annual personal income per capita (US dollar) because it could be a confounding variable simultaneously related to both collectivism and mask usage. On the one hand, research suggests that income is related to individualism–collectivism (39–41). On the other hand, it is possible that some people cannot purchase masks for income-related reasons. Thus, we sourced data on personal income per capita

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*Individuals may be more likely to use masks when COVID-19 is currently severe in their region. On the other hand, increased mask usage can reduce the spread of COVID-19 in the future (e.g., subsequent weeks) (59).

(US dollar) from the US Bureau of Economic Analysis. Because income per capita was skewed, log transformation was applied.
Median age. Because COVID-19 is known to be particularly lethal to the elderly (24), counties with older populations might use masks more. Thus, we sourced data on population median age from the US Census Bureau.
Gender percentage. Finally, we sourced data on gender percentage from the US Census Bureau.

Results. Descriptive statistics and bivariate correlations are displayed in *SI Appendix,* Tables S2–S4. To demonstrate the robustness of the link between collectivism and mask usage, we present both US state-level analyses ($n = 50$) and US county-level analyses ($n = 3,141$).
State-level analyses. As illustrated by Fig. 1, collectivism by itself positively predicted mask usage at the state level ($r = 0.44$, $P = 0.002$). Collectivism remained significant when we controlled for state-level demographic variables (*SI Appendix,* Table S5 Model 2: $B = 0.016$, $SE = 0.004$, $t = 4.08$, $P < 0.001$, adjusted $R^2 = 0.52$), COVID-19 severity, government stringency, population density, income per capita, and political affiliation (*SI Appendix,* Table S5 Model 3: $B = 0.007$, $SE = 0.003$, $t = 2.21$, $P = 0.03$, adjusted $R^2 = 0.77$). Importantly, the effect of collectivism was robust to different combinations of the control variables.

Collectivism remained significant when we further controlled for tightness ($B_{collectivism} = 0.007$, $SE = 0.003$, $t = 2.33$, $P = 0.025$). Consistent with prior research (30), tighter US states tend to be more Republican ($r = 0.59$, $P < 0.001$). Although tightness was negatively correlated with mask usage ($r = -0.46$, $P < 0.001$), it became nonsignificant once we controlled for political affiliation ($B_{tightness} = 0.002$, $SE = 0.003$, $t = 0.67$, $P = 0.50$). Tightness remained nonsignificant in the full model that included the other control variables ($B = -0.004$, $SE = 0.004$, $t = 0.98$, $P = 0.33$).
County-level analyses. *SI Appendix,* Fig. S1 maps the mask usage of all 3,141 US counties. Because US counties are nested within US states, we conducted multilevel analyses to account for within-state statistical dependence (42).

County-level results were consistent with the aforementioned state-level results. Collectivism by itself positively predicted mask usage (*SI Appendix,* Table S6 Model 1: $B = 0.015$, $SE = 0.004$, $z = 3.42$, $P < 0.001$). Collectivism remained significant when we controlled for county-level demographic variables (*SI Appendix,* Table S6 Model 2: $B = 0.015$, $SE = 0.004$, $z = 4.07$, $P < 0.001$) and the other control variables (*SI Appendix,* Table S6 Model 3: $B = 0.007$, $SE = 0.002$, $z = 3.17$, $P = 0.002$).

Collectivism remained significant when we further controlled for tightness ($B_{collectivism} = 0.009$, $SE = 0.003$, $z = 3.33$, $P < 0.001$). Although tightness by itself appeared to negatively predict mask usage ($B = -0.014$, $SE = 0.004$, $z = -3.63$, $P < 0.001$), it became nonsignificant once we controlled for political affiliation ($B_{tightness} = 0.002$, $SE = 0.003$, $z = 0.69$, $P = 0.49$). Tightness remained nonsignificant in the full model that included the other control variables ($B = -0.003$, $SE = 0.003$, $z = -1.10$, $P = 0.27$).

Discussion. By constructing a large dataset covering all 3,141 US counties, Study 1a provided evidence that collectivism positively predicted mask usage—above and beyond a broad set of control variables (e.g., tightness, political affiliation, government stringency). The converging results from the state-level and county-level analyses highlight the robustness of the link between collectivism and mask usage within the United States (a single, large country).

Study 1b: Collectivism Predicts Mask Usage within the United States

Study 1b had two aims. First, we aimed to replicate the link between collectivism and mask usage within the United States in another large dataset. Second, whereas the mask usage data in Study 1a were aggregated at the county level, Study 1b provided greater empirical precision by examining mask usage at the person level.

Method. From April 1 to September 20, 2020, YouGov (an international market research and data analytics firm) partnered with
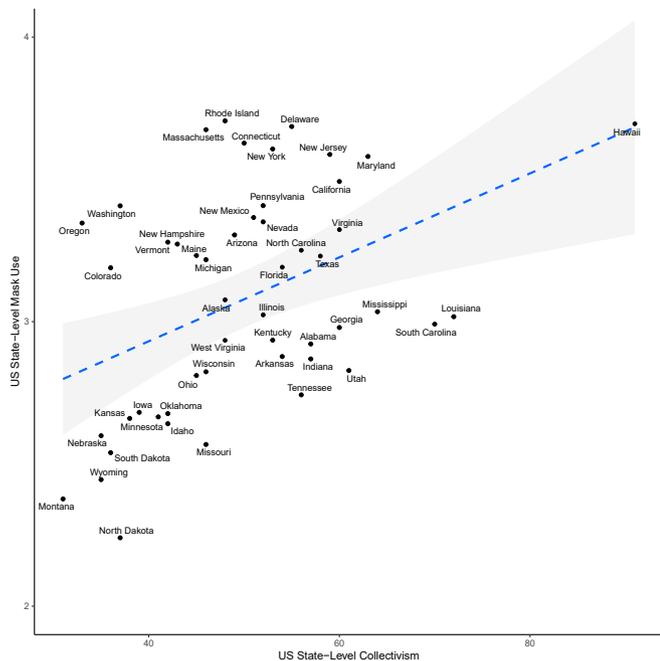
Fig. 1. Study 1a. Mask usage is higher in more collectivistic US states. Note: Collectivism and mask usage correlated at $r(48) = 0.44$, $P = 0.002$. The correlation was robust when we excluded Hawaii (a potential outlier), $r(47) = 0.38$, $P = 0.007$. The shaded region represents SEs.

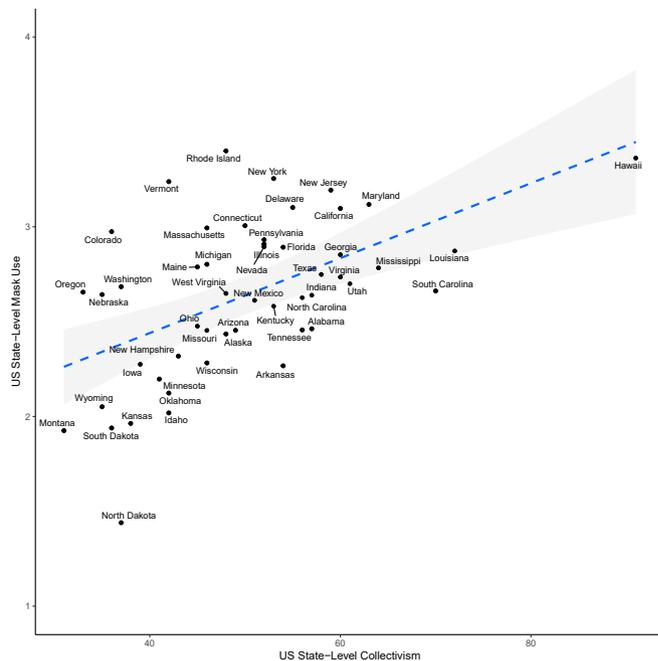**Fig. 2.** Study 1b. Mask usage is higher in more collectivistic US states. Note: Collectivism and mask usage correlated at $r(48) = 0.54$, $P < 0.001$. The correlation was robust when we excluded Hawaii (a potential outlier), $r(47) = 0.49$, $P < 0.001$. The shaded region represents SEs.

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the Institute of Global Health Innovation to survey people's behaviors in response to COVID-19 in 29 countries (https://github.com/YouGov-Data/covid-19-tracker). Study 1b focused on the United States. A nationally representative sample of 16,737 Americans participated in the survey (54.2% female; mean age = 47.9, $SD = 17.6$).

Mask usage. Participants were asked, "How often have you worn a face mask outside your home (e.g., when on public transport, going to a supermarket, going to a main road)?" (0 = not at all, 1 = rarely, 2 = sometimes, 3 = frequently, and 4 = always).

To test the link between collectivism and mask usage within the United States, we constructed a large dataset by collecting a broad set of state-level cultural, demographic, socioeconomic, and political variables and combining them with the mask usage question in the YouGov survey.

Collectivism. As in Study 1a, we used the US state-level index of collectivism–individualism from Vandello and Cohen (13).

Control variables. We collected control variables similar to those in Study 1a: cultural tightness–looseness (30), daily COVID-19 severity (36), government stringency (36), political affiliation (38), logged population density, logged income per capita, age, gender, and education.

In line with the literature (43), we also controlled for week fixed effects to account for any unobserved time-varying effects from April to September 2020. The results were robust without week fixed effects.

Results. Descriptive statistics and bivariate correlations are displayed in *SI Appendix*, Tables S7 and S8. To demonstrate the robustness of the link between collectivism and mask usage, we present both state-level analyses ($n = 50$) and person-level analyses ($n = 16,737$).

State-level analyses. As illustrated by Fig. 2, collectivism and mask usage were positively correlated at the state level ($r = 0.54$, $P < 0.001$). Notably, Study 1a (*New York Times*) and Study 1b (YouGov) were highly correlated in state-level mask usage scores ($r = 0.85$, $P < 0.001$), which highlights the reliability of our findings. In both studies, low-collectivism states like Montana and North Dakota were low in mask usage, whereas high-collectivism states like Hawaii were high in mask usage (Figs. 1 and 2).

Collectivism remained significant when we controlled for state-level demographic variables (*SI Appendix*, Table S9 Model 2: $B = 0.02$, $SE = 0.004$, $t = 4.62$, $P < 0.001$, adjusted $R^2 = 0.55$), COVID-19 severity, government stringency, population density, income per capita, and political affiliation (*SI Appendix*, Table S9 Model 3: $B = 0.01$, $SE = 0.004$, $t = 2.65$, $P = 0.01$, adjusted $R^2 = 0.71$). The effect of collectivism was robust to different combinations of the control variables.

Collectivism remained significant when we further controlled for tightness ($B_{collectivism} = 0.010$, $SE = 0.004$, $t = 2.80$, $P = 0.008$). As in Study 1a, although tightness was negatively correlated with mask usage ($r = -0.33$, $P = 0.02$), it became nonsignificant once we controlled for political affiliation ($B_{tightness} = 0.006$, $SE = 0.004$, $t = 1.59$, $P = 0.12$). Tightness remained nonsignificant in the full model that included the other control variables ($B = -0.006$, $SE = 0.005$, $t = -1.19$, $P = 0.24$).

Person-level analyses. In addition to state-level analyses ($n = 50$), we also conducted person-level analyses ($n = 16,737$), which allowed us to account for person-level demographics (e.g., gender). Because participants are nested within US states, we conducted multilevel analyses to account for within-state statistical dependence.

Collectivism by itself positively predicted mask usage ($B = 0.018$, $SE = 0.004$, $z = 4.40$, $P < 0.001$). Collectivism remained significant when we controlled for time fixed effects (*SI Appendix*, Table S10 Model 1: $B = 0.017$, $SE = 0.004$, $z = 4.22$, $P < 0.001$), demographics (*SI Appendix*, Table S10 Model 2: $B = 0.019$, $SE = $

0.003, $z = 5.94$, $P < 0.001$), COVID-19 severity, government stringency, population density, income per capita, and political affiliation (*SI Appendix*, Table S10 Model 3: $B = 0.011$, $SE = 0.003$, $z = 3.82$, $P < 0.001$). The effect of collectivism was robust to different combinations of the control variables.

Collectivism remained significant when we further controlled for tightness ($B_{collectivism} = 0.012$, $SE = 0.003$, $z = 4.07$, $P < 0.001$). Consistent with the state-level analyses, although tightness by itself appeared to negatively predict mask usage ($B = -0.01$, $SE = 0.004$, $z = -2.74$, $P = 0.006$), it became nonsignificant once we controlled for political affiliation ($B_{tightness} = 0.005$, $SE = 0.003$, $z = 1.53$, $P = 0.13$). Tightness remained nonsignificant in the full model that included the other control variables ($B = -0.005$, $SE = 0.003$, $z = -1.39$, $P = 0.17$).

As a robustness check, we recoded the mask usage variable as a binary variable (1 = used mask, and 0 = not at all). The link between collectivism and mask usage was robust—whether without controls ($B = 0.02$, $SE = 0.005$, $z = 3.93$, $P < 0.001$) or with controls ($B = 0.02$, $SE = 0.005$, $z = 3.65$, $P < 0.001$).

Discussion. Leveraging another large dataset of individuals from all 50 US states, Study 1b replicated the link between collectivism and mask usage within the United States. This effect was again robust to a host of control variables (e.g., tightness, political affiliation, government stringency, income per capita). The converging results from state-level analyses and person-level analyses underscore the robustness of the link between collectivism and mask usage within the United States (a single, large country).

Study 2: Collectivism Predicts Mask Usage in 29 Countries and Territories

Study 2 aimed to replicate and extend the first two studies. Whereas Studies 1a and 1b focused on the United States, Study 2 examined 29 countries to ascertain the link between collectivism and mask usage on a global scale.

Method.

Personal mask usage. Data on individuals' mask usage were from the same YouGov survey as in Study 1b (https://github.com/YouGov-Data/covid-19-tracker). Participants were asked, "How often have you worn a face mask outside your home (e.g., when on public transport, going to a supermarket, going to a main road)?" (0 = not at all, 1 = rarely, 2 = sometimes, 3 = frequently, and 4 = always). Nationally representative samples of 367,109 individuals from 29 countries participated in the survey (49.9% female; mean age = 42.6, $SD = 16.2$). Mask usage data were missing for only 59 participants.

To test the link between collectivism and mask usage, we constructed a large dataset by collecting a broad set of country-level cultural, demographic, and socioeconomic variables and combining them with the mask usage question in the YouGov survey.

Collectivism. The two most widely used country-level indices of collectivism–individualism are Hofstede's index (12) and the Global Leadership and Organizational Behavior Effectiveness (GLOBE) in-group collectivism index (15, 44). Since their inception, both indices have been expanded and refined over time. These two indices are strongly correlated for the countries in our dataset ($r = 0.84$, $P < 0.001$), so we computed a composite index of collectivism by standardizing and then averaging these two indices. This composite index was available for all 29 countries in our dataset.

Tightness. We used the country-level combination index of looseness–tightness from Uz (45). In line with the literature (46), we reverse coded this index to denote tightness (= –looseness) for ease of interpretation, such that higher scores indicate tighter countries. Uz's index was available for 20 of the 29 countries in the dataset.

COVID-19 severity. For each country, we controlled for daily COVID-19 severity. We sourced daily "new confirmed cases of COVID-19 (7-day smoothed) per 1,000,000 people" from *Our World in Data* (https://github.com/owid/covid-19-data). Commonly used in the COVID-19 literature (35), this variable denotes the mean number of new COVID-19 cases per million population in the preceding 7 d, a statistic that can influence people's behaviors (e.g., whether to wear masks).

Government stringency. As in Studies 1a and 1b, we controlled for the Government Response Stringency Index because countries vary in the stringency of their COVID-19 policies (e.g., mask usage, private gathering limits, school closures). For each country, we sourced this daily stringency index from *Our World in Data*.

Population density and gross domestic product per capita. We sourced population density (population per square kilometers) from the United Nations and gross domestic product (GDP) per capita (US dollar) from *Our World in Data*. Because both variables were skewed, log transformation was applied.

Universal health coverage. The Universal Health Coverage Index measures the coverage of essential health services in a given country. We sourced this variable from the World Health Organization.

Demographics and time fixed effects. Finally, we controlled for age, gender, and week fixed effects.

Results. Descriptive statistics and bivariate correlations are displayed in *SI Appendix*, Tables S11 and S12. To demonstrate the robustness of the link between collectivism and mask usage, we present both country-level analyses ($n = 29$) and person-level analyses ($n = 367,050$).

Country-level analyses. As illustrated by Fig. 3, which maps mask usage in the 29 countries, collectivism and mask usage were strongly correlated at the country level ($r = 0.80$, $P < 0.001$). Collectivism remained significant when we controlled for country-level demographic variables (*SI Appendix*, Table S13 Model 2: $B = 0.94$, $SE = 0.15$, $t = 6.22$, $P < 0.001$, adjusted $R^2 = 0.62$), COVID-19 severity, government stringency, population density, GDP per capita, and universal health coverage (*SI Appendix*, Table S13 Model 3: $B = 0.94$, $SE = 0.19$, $t = 4.91$, $P < 0.001$, adjusted $R^2 = 0.69$). Moreover, collectivism remained significant when we further controlled for tightness ($B_{collectivism} = 0.93$, $SE = 0.26$, $t = 3.65$, $P = 0.004$), while tightness was nonsignificant ($B = 0.01$, $SE = 0.01$, $t = 1.19$, $P = 0.26$).

Person-level analyses. In addition to country-level analyses ($n = 29$), we also conducted person-level analyses ($n = 367,050$),

which allowed us to account for person-level demographics (e.g., gender). Because participants were nested within countries, we conducted multilevel analyses to account for within-country statistical dependence.

Collectivism by itself positively predicted mask usage ($B = 0.85$, $SE = 0.12$, $z = 7.23$, $P < 0.001$). Collectivism positively predicted mask usage when controlling for time fixed effects (*SI Appendix*, Table S14 Model 1: $B = 0.83$, $SE = 0.12$, $z = 6.74$, $P < 0.001$), demographics (*SI Appendix*, Table S14 Model 2: $B = 0.84$, $SE = 0.12$, $z = 6.77$, $P < 0.001$), COVID-19 severity, government stringency, population density, GDP per capita, and universal health coverage (*SI Appendix*, Table S14 Model 3: $B = 0.79$, $SE = 0.17$, $z = 4.54$, $P < 0.001$). Again, collectivism remained significant when we further controlled for tightness ($B_{collectivism} = 0.85$, $SE = 0.27$, $z = 3.16$, $P = 0.002$), while tightness was nonsignificant ($B = -0.003$, $SE = 0.011$, $z = -0.26$, $P = 0.80$).

As a robustness check, we recoded the mask usage variable as a binary variable (1 = used mask, and 0 = not at all). The link between collectivism and mask usage was robust—whether without controls ($B = 1.65$, $SE = 0.17$, $z = 9.93$, $P < 0.001$) or with controls ($B = 1.49$, $SE = 0.26$, $z = 5.74$, $P < 0.001$).

Discussion. By analyzing a large dataset of 367,109 individuals in 29 countries, Study 2 provided evidence that mask usage tended to be higher in more collectivistic countries. Again, this effect was robust to a host of control variables at different levels of analyses.

Study 3: Collectivism Predicts Mask Usage in 67 Countries and Territories

Study 3 replicated and extended the previous studies in three ways. First, Study 3 examined the link between collectivism and mask usage in another large global sample ($n = 277,219$). Second, whereas Study 2 involved 29 countries, Study 3 expanded the list to 67 countries. Third, to address the possibility that individuals might overstate their personal mask usage due to social desirability concerns, Study 3 also surveyed individuals about mask usage in their communities.

Method. In collaboration with Facebook, Massachusetts Institute of Technology conducted a global survey about COVID-19 in 67 countries from July 6 to September 23, 2020 (https://dataforgood.fb.com/tools/preventive-health-survey/). This study was approved by the Institutional Review Board of Massachusetts Institute of Technology (protocol E-2294), and all participants provided
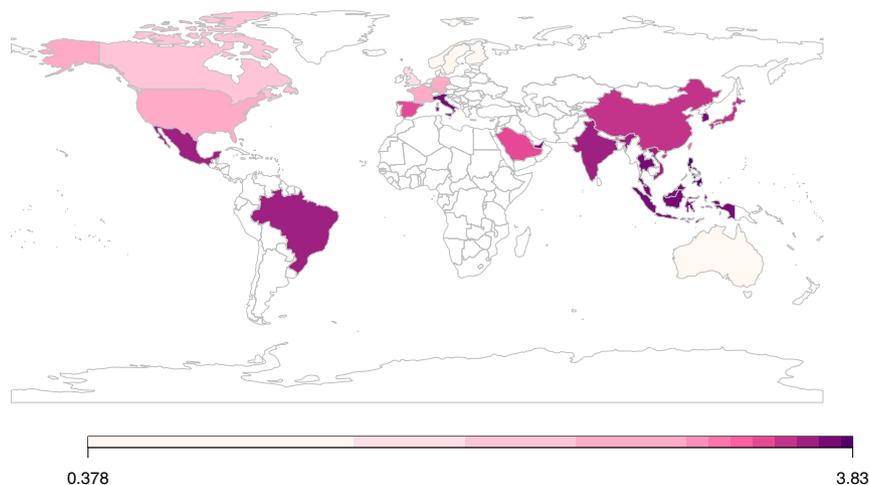
Fig. 3. Study 2. Mask usage is higher in more collectivistic countries and territories ($r(27) = .80$, $P < 0.001$). Note: Mask usage: 0 (not at all) to 4 (always).

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informed consent. The survey was translated into 51 languages (*SI Appendix*, Table S21).

With over 2.3 billion users, Facebook is the most popular social media platform in the world. A large sample of Facebook users were invited to participate voluntarily (see *SI Appendix*, Fig. S2 for the Facebook survey interface). To ensure the sample's representativeness in each country, Facebook used weight values to correct for nonresponse bias and coverage bias. To correct for nonresponse bias, Facebook used user characteristics correlated with nonresponse to calculate the inverse probability that sampled users would complete the survey. These inverse probabilities were then used to create weights for responses so that the survey sample reflected the active adult user population on Facebook. To correct for coverage bias, Facebook further adjusted the weights so that the distribution of age, gender, and administrative region of residence in the survey sample reflected that of the general population. All participants were 18 y or older. The dataset does not contain any identifying information.

Personal mask usage. 277,219 participants (45.0% female) from 67 countries responded to a question about whether they wore a face mask or covering to prevent COVID-19 infection in the past week (1 = yes, and 0 = no). *SI Appendix*, Fig. S3 maps mask usage in these 67 countries. A total of 22 of these countries also appeared in Study 2's dataset; notably, Study 2 and Study 3 were highly correlated in country-level personal mask usage scores ($r = 0.84$, $P < 0.001$). In both studies, collectivistic countries like South Korea (East Asia), Thailand (Southeast Asia), the United Arab Emirates (Middle East), and Mexico (Latin America) were high in mask usage, whereas individualistic countries like the United States and the United Kingdom were low in mask usage. These results highlight the reliability of our findings.

Perceived community mask usage. Participants were also asked about mask usage in their communities: "Out of 100 people in your community, how many do you think wear a face mask or covering when they go out in public?" Participants answered this question with a 0 to 100 slider ($M = 68.26$, $SD = 29.78$).

Collectivism. As in Study 2, we created a composite country-level index of collectivism based on Hofstede's index and the GLOBE index. This composite index was available for 59 of the 67 countries in the dataset.

Control variables. We collected control variables similar to those in Study 2: cultural tightness–looseness (45), daily COVID-19 severity, government stringency, logged population density, logged GDP per capita, universal health coverage, age, gender, education, and week fixed effects.

Results. Descriptive statistics and bivariate correlations are displayed in *SI Appendix*, Tables S15 and S16.

Country-level analyses. At the country level, collectivism was correlated with both personal mask usage ($r = 0.39$, $P = 0.002$) and community mask usage ($r = 0.37$, $P = 0.004$). By contrast, tightness was not significantly correlated with either personal mask usage ($r = -0.08$, $P = 0.68$) or community mask usage ($r = -0.09$, $P = 0.64$). As detailed in *SI Appendix*, Tables S17 and S18, the effects of collectivism on a) personal mask usage and b) community mask usage were robust when controlling for country-level demographic variables, COVID-19 severity, government stringency, population density, GDP per capita, and universal health coverage.

Person-level analyses. We also conducted person-level analyses, which allowed us to account for person-level demographics (age, gender, education). Because participants were nested within countries, we conducted multilevel regressions to account for within-country statistical dependence. As detailed in *SI Appendix*, Tables S19 and S20, the effects of collectivism on a) personal mask usage and b) community mask usage were robust across different models.

Discussion. Using another large dataset of 277,219 Facebook users in 67 countries, Study 3 demonstrated that collectivism positively predicted both individuals' mask usage and perceived mask usage in their communities. Once again, these effects were robust to a host of control variables at different levels of analyses.

General Discussion

Across four large-scale studies, collectivism positively predicted mask usage during the COVID-19 pandemic. Analyzing a dataset of all 3,141 counties of the 50 US states, Study 1a revealed that mask usage was higher in more collectivistic US states. Study 1b replicated this finding in a dataset of 16,737 individuals in the 50 US states. Analyzing a dataset of 367,109 individuals in 29 countries, Study 2 revealed that mask usage was higher in more collectivistic countries. Study 3 replicated this finding in a dataset of 277,219 Facebook users in 67 countries.†

Methodological Strengths. This research has a number of methodological strengths. First, our studies featured large and representative samples collected by different institutions. These large-scale studies also enabled us to create a US map of mask usage for all 3,141 counties of the 50 states (*SI Appendix*, Fig. S1) and world maps of mask usage (Fig. 3 and *SI Appendix*, Fig. S3). Second and relatedly, we demonstrate the robustness of the link between collectivism and mask usage both among different countries (Studies 2 and 3) and within the United States (Studies 1a and 1b). The finding that more collectivistic US states were higher in mask usage suggests that the link between collectivism and mask usage is not merely a story of between-country differences. Third, the link between collectivism and mask usage was robust to a broad set of control variables, including cultural tightness–looseness, political affiliation, demographics, population density, socioeconomic indicators, universal health coverage, and government response stringency. Fourth, this link was consistent across different levels of analyses (country level, US state level, US county level, and person level). Together, these methodological strengths underscore the reliability of our findings.

Theoretical Contributions and Practical Implications. The present research offers important theoretical contributions and timely implications. First, it reveals the influence of culture on mask usage during the COVID-19 pandemic. We extend the existing COVID-19 research by moving beyond macrolevel outcomes (disease spread) to the microlevel behavior of mask usage, which is critical to mitigating the pandemic (3). Whereas most research has focused on how the spread of COVID-19 is influenced by demographic variables (e.g., age, gender) and socioeconomic variables (e.g., income, political affiliation), our research has uncovered

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†Tightness–looseness did not significantly predict mask usage in any of our large-scale studies. A closer examination of our data revealed that mask usage was high in some regions that are collectivistic but loose. For example, Hawaii—a collectivistic but loose US state (13, 30)—ranked near the top in mask usage in both Studies 1a and 1b. As a country-level example, Thailand—a collectivistic but loose culture (12, 60)—ranked high in mask usage in both Studies 2 and 3. Several reasons may underlie the null effects of tightness. First, our outcome variable is mask usage rather than mask enforcement (e.g., punishment for not wearing masks). Collectivism is conceptually more relevant to mask usage because it captures "the tendency to be more concerned with the group's needs, goals, and interests than with individualistic-oriented interests" (7). By contrast, tightness may be more relevant to mask enforcement because tightness refers to how strictly norms and rules are enforced in a social entity (30). That is, although tightness did not predict people's mask usage, it might predict how strictly law enforcement agencies enforce mask policies (e.g., hefty fines). Second, mask usage is a uniquely politicized issue in some countries, such as the United States. In our within–US studies, Republican affiliation was strongly and negatively correlated with mask usage ($r = -.85$, $p < .001$ in Study 1a and $r = -.76$, $p < .001$ in Study 1b). Meanwhile, tighter US states tend to be more Republican ($r = .59$, $p < .001$). Because mask usage is such a politicized issue in the United States, political affiliation might have precluded the predictive power of tightness. By contrast, collectivism was not significantly correlated with Republican affiliation ($r = -.24$, $p = .09$), and thus, political affiliation would not have precluded the predictive power of collectivism.

the role of cultural values above and beyond those demographic and socioeconomic variables.

Second, we contribute to cultural psychology by identifying a critical outcome of collectivism in the real world: mask usage during COVID-19. While individualism is an important driver of creativity, innovations, and long-run economic growth (47–50), collectivism may help people stand together during a crisis (51). By examining how different cultures respond to the pandemic, our research highlights the importance of cultural psychology in the face of global disasters. Understanding cultural differences not only provides insight into the current pandemic, but also helps the world prepare for future crises.

A key implication of our research is that, net of other factors, more collectivistic cultures are less vulnerable to global crises like the COVID-19 pandemic. To curb the pandemic, it is critical that people prioritize the collective welfare over personal convenience (52, 53). In *SI Appendix*, we report an experiment (Study S1) that provides suggestive evidence that priming people to focus on "we" rather than "I" has the potential to increase their willingness to wear masks (54). While this finding indicates a potential intervention to promote mask usage, the efficacy of such an intervention will likely depend on the specific context. In fact, some research suggests that appeals to collectivistic awareness and action can undermine motivation for individualistic Americans (55). To facilitate mask usage in individualistic cultures, practitioners could appeal to individualistic tastes through mask design (e.g., masks that are both effective and stylish).

Limitations and Future Directions. The current research has several limitations which provide opportunities for future research. First, given the risks of COVID-19, our studies relied on self-reported mask usage rather than in-person observations of mask usage. If possible, future research could utilize image or video data of mask usage in different regions. Nevertheless, it is noteworthy that the link between collectivism and mask usage was reliable across four large-scale studies conducted by different institutions. Moreover, Study 1a and Study 1b were highly correlated in US state-level mask usage scores ($r = 0.85$, $P < 0.001$), and Study 2 and Study 3 were highly correlated in country-level mask usage

scores ($r = 0.84$, $P < 0.001$). Furthermore, to mitigate potential biases in self-reporting personal mask usage, Study 3 also surveyed individuals about mask usage in their communities. Together, the converging results highlight the reliability of our findings.

Second, while our studies demonstrated the link between collectivism and mask usage in the context of COVID-19, future research could explore the role of collectivism in other kinds of crises (e.g., wildfires, hurricanes). Third, while our research focused on how culture shapes people's responses to the COVID-19 pandemic, it would be valuable to explore whether and how the pandemic will shape cultures over time (56–58). On the one hand, the shared challenges of the pandemic might foster a sense of collectivism (57). On the other hand, social distancing and isolation may heighten individuals' sense of self-reliance and independence.

Conclusion. Leveraging a dataset of all 3,141 counties of the 50 US states, a dataset of 16,737 individuals in the 50 US states, a dataset of 367,109 individuals in 29 countries, and a dataset of 277,219 Facebook users in 67 countries, we provided evidence that collectivism positively predicts mask usage during the COVID-19 pandemic—both within the United States and across the world. Overall, this research highlights the importance of collectivism in the face of global crises.

Data Availability. Data for Study 1a were collected by *The New York Times* and Dynata (https://github.com/nytimes/covid-19-data). Data for Studies 1b and 2 were collected by YouGov in collaboration with the Institute of Global Health Innovation (https://github.com/YouGov-Data/covid-19-tracker). Data for Study 3 were collected by Massachusetts Institute of Technology in collaboration with Facebook (https://dataforgood.fb.com/tools/preventive-health-survey/). All analyses are included in the main text and *SI Appendix*.

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