finding

Gender differences in preventing the spread of coronavirus

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abstract

Social distancing, handwashing, and mask wearing are key to preventing the spread of COVID-19. However, people vary in the degree to which they follow these practices. Previous findings have indicated that women adhere more to preventive health practices than men do. We examined whether this pattern held true for the COVID-19 pandemic by comparing women and men in three studies. In Study 1, women reported a greater degree of social distancing and handwashing. In Study 2, conducted in three different states in the northeastern United States, a greater percentage of women wore masks in public. In Study 3, anonymous county-level GPS data collected from approximately 15 million smartphones per day between March 9 and May 29, 2020, indicated that counties with a greater percentage of women exhibited greater social distancing. These data suggest that during pandemics, policymakers may benefit from disseminating preventive health messages that are purposely tuned to motivate adherence by men.

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The guidelines for preventing COVID-19's spread are straightforward.[1] Medical experts have unanimously emphasized the importance of social distancing (avoiding physical contact with others), personal hygiene (such as handwashing), and mask wearing. Yet individuals and communities vary in their adherence to these guidelines.[2–4] Although some people have carefully followed shelter-in-place orders, others have flocked to packed beaches or gone on pub crawls.[5,6] The individual and group differences that underlie such divergences in compliance should inform policymakers' understanding of how to motivate people to engage in preventive measures during viral pandemics and whom to target.

In this article, we examine whether gender helps explain variance in individual and group responses to COVID-19-related public health guidelines. Specifically, do women adhere to the recommendations more than men do? We hypothesized that women would follow the guidelines more assiduously. For one, they typically engage in preventive health practices more in their daily lives: for example, they visit and comply with the recommendations of doctors and make use of preventive health services more than men do.[7] Women also pay more attention to their own and others' health-related needs and react more empathetically to others' pain.[8–14] Moreover, women are more likely to avoid risky behaviors and decisions, including risks related to their health.[15,16]

We conducted three studies to test whether women are more likely than men to endorse and engage in COVID-19 preventive behaviors. In Study 1, we examined whether women report greater social distancing and handwashing. We also looked into possible factors that could motivate reported compliance with these preventive measures, such as listening to medical experts and exhibiting alarm and anxiety over health threats posed by COVID-19. In Study 2, we looked at whether these results extend to actual behavior—do a greater percentage of women wear masks in public? Finally, in Study 3, we used GPS data of approximately 15 million people in the United States to assess whether people living in counties with a greater percentage of women than men exhibited greater social distancing by reducing general movement and visits to nonessential retailers (that is, nonessential stores and services) between March 9 and May 29, 2020.

Study 1

Method

Participants. We initially recruited 800 participants from the United States via the recruitment service Prolific. On April 8, 2020, participants completed a five-minute survey that was programmed on Qualtrics. We excluded 30 participants for inattention or because their gender was nonbinary. Of the remaining 770 participants, 442 were women. The average age was 30.7 years. The distribution of participant ethnicity was 61.9% White, 7.4% Black or African American, 13.7% Asian, 9.4% Hispanic, 5.4% mixed, 0.7% American Indian, 0.1% Native Hawaiian, and 1.7% other. See the Supplemental Material for details on the power analysis, participant recruitment, and participant characteristics.

Measures. Five questions assessed preventive COVID-19 practices. Participants reported the number of days they had had in-person contact with others in the past week (0–7 days), the number of days they had had in-person contact with friends and family in the past week (0–7 days), their frequency of handwashing, their tendency to stay home (other than shopping for groceries), and their tendency to maintain six feet of distance from others. Participants responded to the last three items on a scale ranging from 1 = *Strongly disagree* to 7 = *Strongly agree*. It is important to note that self-report items similar to these items are correlated with actual social distancing behaviors (as assessed by smartphone step counters and GPS tracking).[17] See the Supplemental Material for a complete list of the questions included in Study 1.

We assessed individuals' reported reliance on a number of external sources when deciding the extent to which they would socially distance: medical experts, the president, religious leaders, their governor, national media, social media,

other countries' experiences, their family, their friends, and their neighbors. We also assessed participants' reported reliance on internal sources: their own health history, anxiety, feelings of responsibility for themselves, and feelings of responsibility for others. Specifically, participants were asked, "How are the following factors influencing to what extent you are socially distancing yourself from others?" Participants answered on a scale ranging from 1 = *Not at all* to 7 = *Very much*.

Participants reported their anxiety ("Thinking about Covid-19 makes me feel extremely anxious") on a scale of 1 = *Strongly disagree* to 7 = *Strongly agree*, preoccupation ("How much preoccupied are you by the current Coronavirus pandemic?") on a scale of 1 = *Not at all* to 7 = *Extremely*, and uncertainty regarding COVID-19 ("How much uncertainty do you experience in your daily life as a result of the current Coronavirus pandemic?") on a scale of 1 = *Not at all* to 7 = *Extremely*.

To explore whether additional factors might have influenced responses to these questions, we had participants answer several other questions. They reported their daily frequency of checking COVID-19 news in an open-ended question. They also reported how knowledgeable they felt about the disease on a scale of 1 = *Not at all knowledgeable* to 7 = *Extremely knowledgeable*. They reported whether they belonged to a vulnerable population for contracting COVID-19 (such as due to health, age, profession, or other reasons), whether they knew anyone who contracted the disease, the likelihood of their contracting COVID-19 in the future (1 = *Not at all likely*, 7 = *Very likely*), how important not contracting the disease was to them (1 = *Not at all important*, 7 = *Very important*), and how much their daily routines changed during the pandemic (1 = *Not at all*, 7 = *Extremely*). All these questions were presented in random order. We also assessed whether participants' answers were skewed by a desire to respond in a socially acceptable or desirable way.[18] Finally, we asked participants to report their number of on-site workdays in the past week, as well as demographic characteristics, including political orientation (1 = *Very Conservative*, 7 = *Very Liberal*).

Results

Results are shown in Table 1 and, more fully, in Table S1 in the Supplemental Material.

Preventive Practices. Women reported engaging in four of the five measured preventive practices to a greater degree than men—maintaining six feet of distance, handwashing, staying at home, and having less frequent in-person contact with family and friends. The only item without a gender difference was the frequency of in-person contact with people other than family or friends, although the means were in the predicted direction.

Sources of Information for Social Distancing. Women reported relying on information from data-driven sources (medical experts, their governor, other countries' experiences, media) more than men did when deciding to what extent they should social distance. Additionally, compared with men, women reported being more influenced by all four internal sources (health history, anxiety, feeling responsible for others, feeling responsible for oneself). The tendency to listen to data-driven sources and the tendency to consult internal sources both positively correlated with preventive health practices, suggesting that women were more likely to listen to sources that motivate compliance with preventive COVID-19 health practices. Women and men, however, were about equally likely to turn to less data-oriented external sources, such as the president, religious leaders, and familiar others. The reported influence of these sources showed either weak correlations (in both directions) or no significant correlations with preventive health practices. See Table S2 in the Supplemental Material for specific correlations.

Psychological Experience. Women reported experiencing negative emotions (anxiety, preoccupation, uncertainty) in response to COVID-19 to a greater degree than men did.

Other Factors. Most of the other factors we examined did not influence the observed

Table 1. Study 1 results: Gender differences in self-reported measures

Variable	Women (n = 442)	Men (n = 328)		95% CI		
	M (SD)	M (SD)	p	Lower bound	Upper bound	Cohen's d
Preventive practices						
In-person contact with family or friends (days per week)	4.18 (2.97)	4.72 (2.86)	.011	0.12	0.96	0.19
In-person contact with others (days per week)	1.61 (2.07)	1.81 (2.08)	.191	−0.10	0.49	0.09
Handwashing	6.37 (1.07)	6.17 (1.25)	.020	−0.36	−0.03	−0.17
Staying at home (other than shopping)	5.83 (1.65)	5.51 (1.83)	.013	−0.57	−0.07	−0.19
Attention to maintaining six-foot distance	6.29 (1.14)	6.03 (1.20)	.003	−0.42	−0.09	−0.22
Source of information for social distancing						
External						
The president	2.87 (2.09)	2.91 (1.93)	.775	−0.24	0.33	0.02
Religious leaders	2.03 (1.73)	1.98 (1.65)	.714	−0.29	0.20	−0.03
Your governor	5.03 (1.95)	4.48 (1.87)	<.001	−0.82	−0.27	−0.28
Medical experts	6.23 (1.24)	5.98 (1.36)	.009	−0.43	−0.06	−0.19
National media	4.75 (1.78)	4.29 (1.72)	<.001	−0.71	−0.21	−0.26
Social media	3.93 (2.06)	3.51 (1.85)	.003	−0.70	−0.14	−0.22
Other countries	5.51 (1.75)	5.15 (1.69)	.004	−0.61	−0.12	−0.21
Your family	4.62 (2.01)	4.68 (1.82)	.662	−0.21	0.33	0.03
Your friends	3.74 (1.97)	3.76 (1.88)	.891	−0.26	0.29	0.10
Your neighbors	2.51 (1.84)	2.34 (1.71)	.582	−0.32	0.18	−0.04
Internal						
Your health history	4.08 (2.25)	3.52 (1.99)	<.001	−0.87	−0.26	−0.27
Your anxiety	4.92 (1.92)	4.04 (1.90)	<.001	−1.16	−0.61	−0.46
Your feeling of responsibility for others	6.10 (1.34)	5.78 (1.32)	.001	−0.51	−0.13	−0.24
Your feeling of responsibility for yourself	6.06 (1.34)	5.70 (1.42)	<.001	−0.56	−0.17	−0.28
Psychological experience						
Feeling extremely anxious	4.94 (1.65)	4.09 (1.67)	<.001	−1.09	−0.61	−0.51
Feeling preoccupied	4.71 (1.50)	4.41 (1.55)	.007	−0.52	−0.08	−0.20
Feeling uncertain	4.88 (1.56)	4.61 (1.57)	.016	−0.50	−0.05	−0.17
Other factors						
Subjective knowledge	5.22 (1.09)	5.09 (1.07)	.089	−0.29	0.02	−0.12
Frequency of checking news	3.88 (4.43)	3.82 (4.04)	.828	−0.68	0.55	−0.02
Social desirability	0.43 (0.23)	0.41 (0.23)	.348	−0.05	0.02	−0.07
Number of on-site workdays (per week)	0.75 (1.70)	0.98 (1.89)	.088	−0.03	0.49	0.13
Change in routines	5.33 (1.67)	5.27 (1.63)	.634	−0.29	0.18	−0.03
Expectancy of getting the virus	3.72 (1.48)	3.58 (1.45)	.188	−0.35	0.07	−0.09
Importance of not getting the virus	5.88 (1.41)	5.68 (1.51)	.060	−0.41	0.01	−0.14

Note. Where the variances across women and men were not equal, we report the p value generated by a statistical test that takes into account of this unequal variance. In technical terms, we generated the p values from a t test that was conducted based on an adjusted degrees of freedom accounting for dissimilar variances across the two groups (details are available in the Supplemental Materials). M = mean; SD = standard deviation; CI = confidence interval.

gender differences in preventive actions, sources of information, or emotional response (see the Supplemental Material for details). Men in our sample were, however, more conservative than women, $t(767) = 4.44$, $p < .001$ (see note A for a discussion of the statistical notations used in this article). When we controlled for political conservatism, the effect size of many of the observed findings decreased by between 43% and 6%, although the results remained significant in most cases. These results suggest that some latent factor underlying male gender and conservatism may have influenced our results. In the future, researchers should test whether psychological constructs related to both maleness and conservatism—for instance, a greater sense of power, more assertiveness, or greater feelings of autonomy and independence[10,17,19,20]—help explain the observed gender differences.

Study 2

Although Study 1 revealed gender differences, it remains possible that the reported behaviors do not reflect actual behavior. To address this concern, in Study 2, we used observational methodologies to test whether women are more likely than men to wear face coverings in public during the COVID-19 pandemic. Observational methods are thought to be more valid for reflecting real-world behavior than are methods that merely rely on self-reports.[21–24] Differences found in the field are also more convincing because they show up in spite of other contextual influences (that is, in spite of noise or error variance in the data).[25] Based on the results of Study 1 and on previous work on gender differences in preventive health behavior, we predicted that women would be more likely than men to wear masks in public.

Method

Observation Locations & Participants. We conducted our observations in three U.S. locations, identified by zip code: 10012 in New York City; 06511 in New Haven, Connecticut; and 08901 in New Brunswick, New Jersey. Although these locations are all in the northeastern United States, they differ on a variety of demographic variables, such as income, the race and ethnicity of inhabitants, the median age of the inhabitants, and the average number of people per household. (See the Supplemental Material for details.) The percentages of male and female inhabitants were similar across the three locations, however. All three observation locations had main streets with paved sidewalks that are convenient for walking.

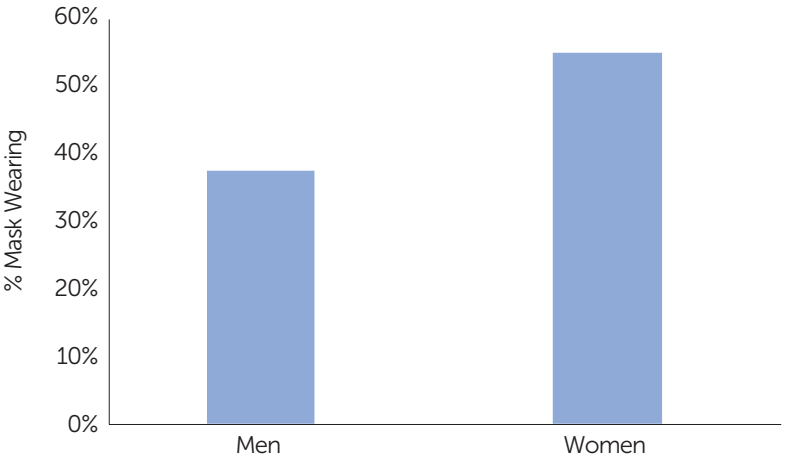
Participants. Before beginning the study, we made an observation plan and preregistered it, as described in the Supplemental Material. Specifically, we determined that each of us would observe 100 pedestrians in our assigned zip code region. Observations were made over two hours on May 4 in New York and Connecticut and over approximately eight hours across May 4 and May 5 in New Jersey (because of low pedestrian traffic). We observed 127 women and 173 men in total.

Procedure. Because we were self-quarantining in our respective homes in the three locations, we selected one street, or several blocks close by to observe pedestrians. We assessed and tallied the gender of each observed individual (including individuals on bikes but not those in cars) and noted whether the individual was wearing a mask. A person was deemed to be wearing a mask if his or her chin, mouth, and nose were covered (whether with cloth or with an actual mask). An individual who had a mask around his or her neck or in his or her hands was counted as not wearing a mask.

Results

The results are shown in Figure 1 (for details, see Table S3 in the Supplemental Material). A chi-square analysis revealed a significant association between gender and mask wearing, with women being more likely than men to wear masks, as compared with chance, $p = .003$. Follow-up analyses showed that a significantly higher percentage of women wore a mask (55.1%) than did not wear a mask (44.9%), $p < .05$. In contrast, the proportion of men who wore a mask (37.6%) was significantly lower than the proportion of those who did not (62.4%), $p < .05$. Although we did not make a prediction

Figure 1. Study 2 results: Percentage of mask wearing in men versus women



about a gender difference in the number of people in public, we observed more men (57.7%) than women (42.3%) on the street, $p = .008$, despite the fact that the overall gender distribution of the examined zip code locations was largely evenly split. This result aligns with the finding of Study 1 that women reported a higher tendency to stay at home during the pandemic.

Study 3

Consistent with the self-reported gender differences observed in Study 1, measures of an observed behavior—mask wearing—in Study 2 indicated that women are more likely than men to engage in COVID-19 preventive practices. However, the samples of Studies 1 and 2 were not completely representative of the U.S. population. For instance, the sample in Study 1 differed from the general population in being younger by about 10 years, being more educated, and having a higher proportion of Asians and lower proportions of Black and Hispanic individuals (see note B). Additionally, the sample in Study 2 was limited to people seen in three specific U.S. locations. Therefore, in Study 3, we tested whether our results extend to social distancing behavior at the U.S. county level.

Using the aggregated geotracking data of approximately 15 million people around the United States per day (tracked via individuals' smartphone GPS location coordinates), we examined whether the gender makeup of approximately 3,000 U.S. counties predicts the extent to which people in those counties practiced social distancing early in the COVID-19 pandemic, between March 9 and May 29, 2020. Social distancing was measured via (a) overall reduction in movement and (b) reduction in visits to nonessential retailers (encompassing stores and services) as compared with movement and visits before the pandemic started in the United States (that is, before March 9). See the Supplemental Material for a fuller definition of *nonessential retailer*.

Method

Participants. The aggregated movement data of approximately 15 million people across the United States per day between March 9 and May 29, 2020 were shared by Unacast (a software company that provides location and map services).[26] These data are anonymized in that they aggregate GPS coordinates by county. The data set included information from 3,054 counties. Twenty-nine counties with 2,000 or fewer inhabitants were removed from this number for the analyses. We excluded 952 additional counties from the analyses involving visits to nonessential retailers because of missing data.

Measures

Social Distancing. As noted earlier, social distancing was assessed in two ways: by decreases in overall movement and decreases in visits to nonessential retailers (as compared with pre-COVID-19 movement and visits, individually controlled for in each county). For more details, see Study 3 in the Supplemental Material.

County Gender Percentages. Counties' gender breakdowns were provided by https://github.com/JieYingWu/COVID-19_US_County-level_Summaries.

Additional Considerations. Descriptions of covariates (variables we controlled for in additional analyses) and of the coding of these variables can be found in Table S4 in the Supplemental Material. The variables are also listed in the Results section below.

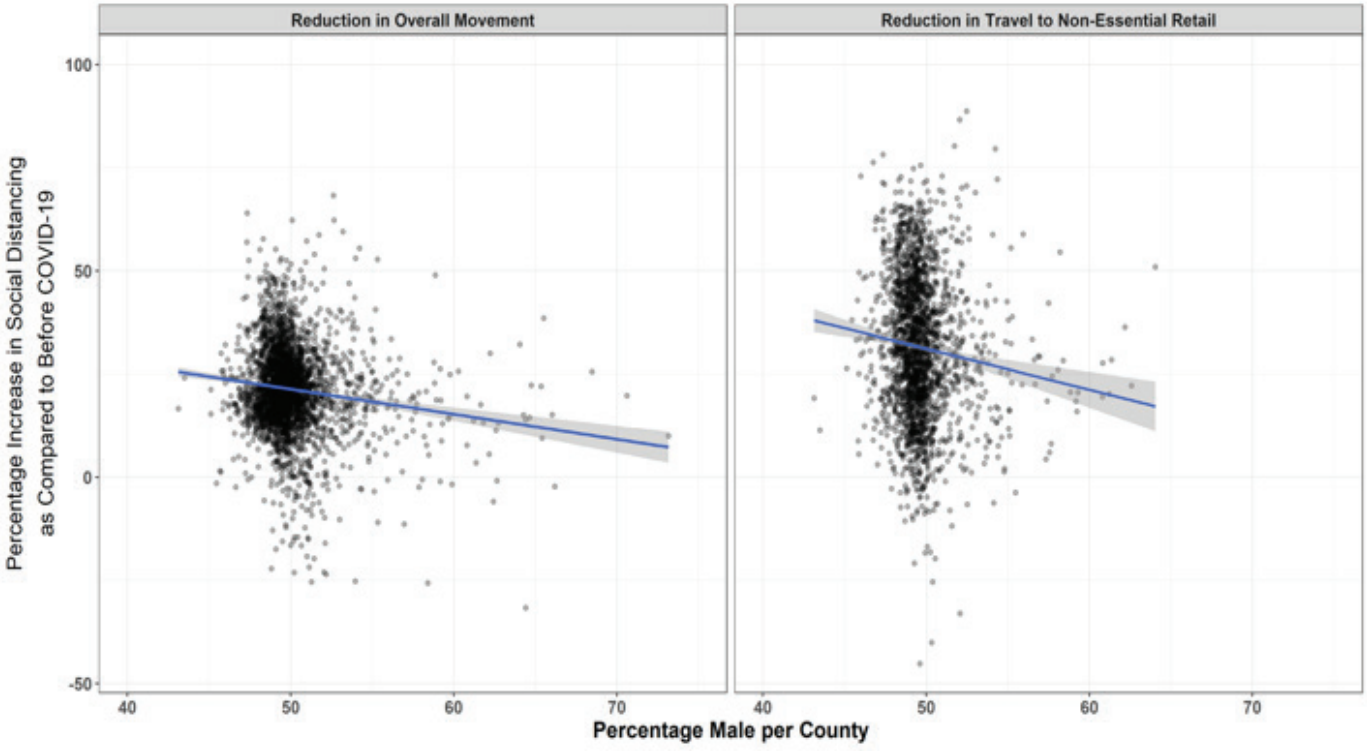
Results

We examined whether the percentage of men versus women in a county predicted an individual county's degree of social distancing between March 9 and May 29, 2020. We took into account that social distancing policies were instituted around mid-March and loosened toward the middle and end of April; thus, social distancing increased and then decreased over time. For more details on how we conducted all the data analyses discussed in this Results section, see the Supplemental Material.

Not surprisingly, social distancing—in terms of both reduced general movement and reduced visits to nonessential retailers—was higher in places with higher per capita rates of infection, on the weekends, in high-income counties (where people are more likely to be able to work from home), and when stay-at-home policies were in place (see Figure S2 in the Supplemental Material). Regarding counties' gender distribution (calculated as [total # of males]/[total # of males + total # of females]*100; *M* = 50.07%, *SD* = 2.26%, minimum value = 43.13%, maximum value = 73.16%), we found, as shown in Figure 2, that counties with a higher proportion of males (by 2 standard deviations above the mean) reduced general movement 4.02 percentage points less and reduced their visits to nonessential retailers 9.08 percentage points less than did counties with an average gender distribution (See note C for statistical details. Also see the base model statistics in Tables S6 and S7 of the Supplemental Material.)

We further examined how the link between gender distribution and social distancing changed over time during the study period. Then, to examine the robustness of this relation, we reran the test while controlling for several potential covariates. These variables included COVID-19 cases per capita (cumulative cases divided by county population, measured for each specific day in the included date range), state policy (whether a stay-at-home order was

Figure 2. Study 3 results: Increase in social distancing (March 9, 2020–May 29, 2020) at the county level as a function of the percentage of male raw scores



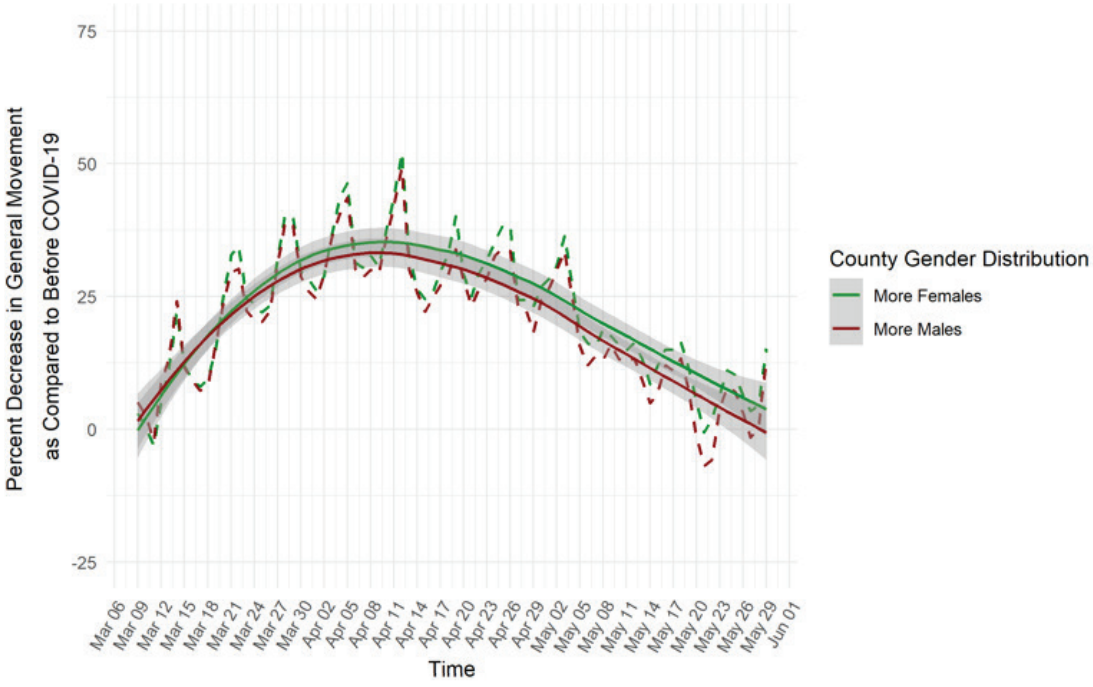
Note. Social distancing was assessed by degree of overall movement and visits to nonessential retailers (stores and services) in the United States as measured by anonymous GPS data from more than 3,000 counties. Counties with a higher percentage of men had lower levels of social distancing.

in effect in a specific state on a specific day), whether a day fell on a weekend or weekday, median income, median age, population density (in terms of population per square mile of land area), religiosity (rate of religious adherents per 1,000 people), percentage of employed residents, economic inequality, percentage of adults who only have a high school diploma, percentage of adults with a college degree, and percentage of adults who have at least a bachelor's degree (See Table S4 in the Supplemental Material for descriptions of and sources for the variables).

We found that counties with a higher percentage of males showed comparatively less and less social distancing as the COVID-19 pandemic progressed between March 9 and May 29, 2020, as measured both by movement (see Figure 3) and by visits to nonessential retailers (see Figure 4). See note D for the statistical details. In other words, the difference between males and females increased over time. These findings were observed while including the control variables noted earlier (such as COVID-19 cases per capita and median income). The interaction between gender and time can be seen in the highlighted rows in the main model and saturated model in Tables S6 and S7 in the Supplemental Material.

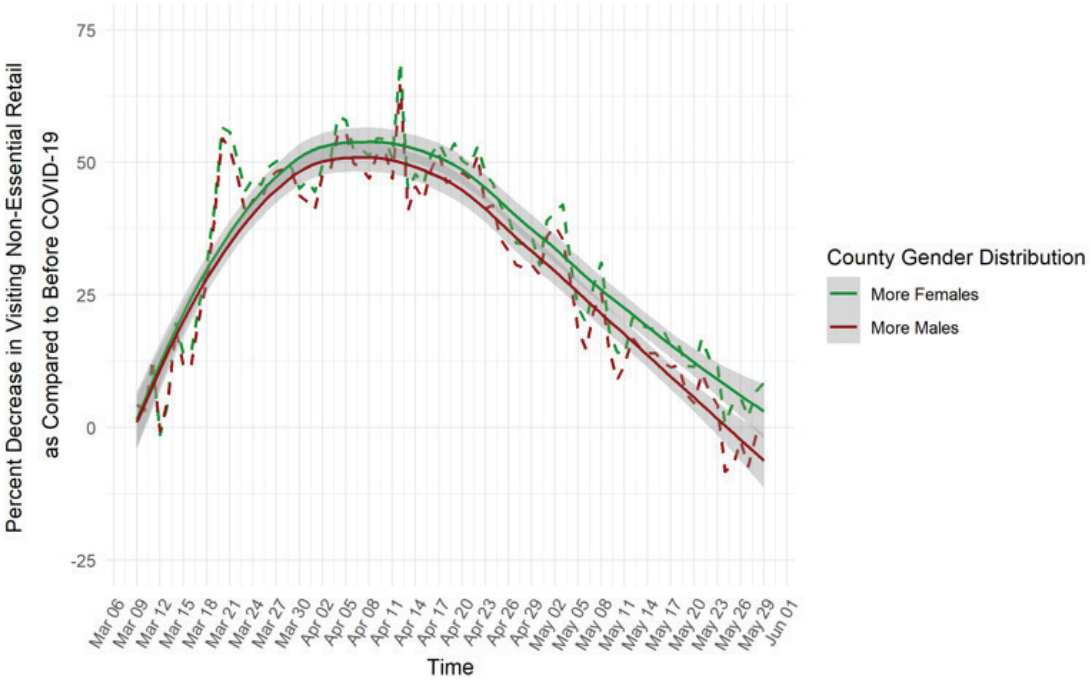
In theory, factors other than those already considered could have confounded the results. For instance, the findings could have conceivably been driven by men and women holding jobs that differ as to whether they are considered essential during the pandemic. Adding in counties' percentages of employment in various types of professions to our test, however, did not account for our findings. As is shown in Table S8 in the Supplemental Material, the results were unchanged when we controlled for counties' percentage of workers in a long list of job areas—among them, agriculture, mining,

Figure 3. Study 3 results: U.S. counties' average social distancing (percentage reduction in general movement) as a function of time & counties' gender distribution



Note. This figure compares movement in counties with more males to movement in counties with more females (split in terms of above the median of counties' gender distribution versus below the median of counties' gender distribution for the purposes of the figure). Dashed lines depict the daily average across counties. Solid lines depict these same data after smoothing (that is, after removal of random variation and plotting of the overall trend). Estimates were composed from raw scores. The analysis controlled for prepandemic social distancing (that is, distancing before March 9, 2020).

Figure 4. Study 3 results: U.S. counties' average social distancing (percentage reduction in visits to nonessential retailers) as a function of time & counties' gender makeup



Note. This figure compares visits to nonessential retailers in counties with more males to visits in counties with more females (split in terms of above the median of counties' gender distribution versus below the median of counties' gender distribution for the purposes of the figure). Dashed lines depict the daily average across counties. Solid lines depict these same data after smoothing (after removal of random variation and plotting of the overall trend). Estimates were composed from raw scores. The analysis controlled for prepandemic social distancing (that is, distancing before March 9, 2020).

utilities, construction, manufacturing, wholesale trade, retail trade, health care and social assistance, and accommodation and food services (*ps* < .001).

We also explored the effect of political orientation. The effect of gender distribution on reduced physical distancing over time did not substantially decrease when we accounted for counties' percentage of votes for Donald Trump over Hillary Clinton in 2016 (except in one specific analysis, in which the effect was reduced but remained significant). See Tables S9 and S10 in the Supplemental Material for details.

The findings in Study 3 could potentially have been driven by gender differences in behavior within households during the pandemic (such as men doing more of the grocery shopping than women were). To test this possibility, we examined counties' total number of families versus single people. Overall, household type did not consistently moderate the influence of gender on social distancing across the study period, as is illustrated in Tables S11 and S12 and Figures S4–S7 in the Supplemental Material.

Discussion

In three studies, we observed gender differences in preventive practices meant to limit the spread of COVID-19. In Study 1, we found that women are more likely than men to report engaging in social distancing and handwashing, as well as to listen to data-driven and internal sources (such as medical experts and feelings of responsibility to themselves and others) when making social distancing decisions.

Because of the potential limitations of self-report survey measures (gender differences may occur more in reporting than in actual behavior),

we used behavioral methodologies in two other studies to investigate the links between gender and preventive behavior. Specifically, Study 2 extended the findings of Study 1 to actual preventive behavior in the form of wearing masks in public. We observed that a greater percentage of women than men wore masks in public in three different locations of the northeastern United States (New Haven, Connecticut; New York, New York; and New Brunswick, New Jersey).

Study 3 extended these results to the group level. We examined whether the gender distribution of U.S. counties predicted the degree of social distancing behavior in these counties as assessed by the movements of approximately 15 million GPS smartphone coordinates per day across the United States between March 9 (close to the start of the pandemic in the United States) and May 29, 2020. Our analyses revealed that U.S. counties with more male constituents exhibited less social distancing, as measured by general movements and visits to nonessential retailers, and this pattern became more pronounced as the pandemic progressed.

Exploratory analyses in Study 1 suggested that political ideology might be one factor underlying the reported gender differences in preventive health measures. Consistent with this suggestion, other research has recently documented that political conservatives, as compared with more politically liberal respondents, engage in less social distancing, feel more in control over their own COVID-19 preventive actions, and feel less responsible for the prevention of the spread of the virus.[27–29] Although political ideology only partly accounted for the gender differences observed in Study 1 (at the individual level) and did not account for the link between counties' gender distribution and social distancing in Study 3 (at the group level), future research could involve a systematic investigation of the exact role that ideology and other ideology-relevant constructs (such as masculinity and endorsement of traditional gender roles) may play in people's adherence to public health recommendations for limiting the spread of COVID-19.

Limitations

Our studies had several limitations. First, the observed gender differences in social distancing might be explained by structural factors (such as employment conditions or family composition) rather than by individuals' personal motivation to maintain preventive health practices. In Study 1, we accounted for one such factor by demonstrating that the number of on-site workdays at the time of the study did not account for or contribute to the observed gender differences. And, in Study 3, potentially gendered behavior in families (such as shopping and childcare) did not appear to account for the observed results: the number of single versus family households in a county did not moderate our findings. Finally, controlling for factors related to socioeconomic status (SES)—that is, annual income, economic inequality, education, employment, and type of profession—at the county level in Study 3 did not change our results. Nevertheless, all these county-level factors were analyzed on the basis of prepandemic data (that is, these data did not take into account the shifts in SES that resulted from the pandemic) and therefore should be interpreted with caution. Future research should investigate the role of behaviors within households and other structural factors that could influence how gender contributed to social distancing decisions and practices as the COVID-19 pandemic was unfolding.

Second, the behavioral observations in Study 2 were restricted to the three locations where we were located while stay-at-home orders were in place. Although these locations vary in annual household income, household composition, age, and ethnicity, one should be cautious in generalizing these findings to the entire U.S. population. Also, all three locations were in "blue" counties and states that voted for Clinton over Trump in the 2016 election. Although Study 3, in which we examined millions of data points from across the entire United States (including conservative counties), largely remedies these concerns, future research should nonetheless test whether the observed gender differences in mask wearing extend to other locations and demographics.

Third, in Study 3, although the link between counties' gender distribution and social distancing was robust to a number of covariates, this link was not very strong. That is, including further covariates in the analyses would likely at some point eliminate the observed effects of counties' gender distribution on social distancing. We note, though, that this would not be particularly surprising, because the added variables would probably pick up on the psychological influences that underlie the reasons why maleness is linked to reduced social distancing in the first place (such as the tendency to react to perceived threats to one's masculinity and a propensity for risk-taking).

Finally, the present studies do not eliminate the potential role of biological factors in gender differences in the severity of COVID-19 cases and mortality, such as the greater prevalence of hypertension, cardiovascular diseases, and other relevant health problems among men than women. That is, our findings are more relevant to understanding gender differences in the potential spread of COVID-19 (due to differences in engaging in preventive health practices) than to understanding gender differences in the severity of the cases and mortality rates.

Policy Implications

Collectively, our results suggest that failing to engage in preventive practices may be putting men at higher risk of catching and spreading COVID-19. As such, alerting men in particular to the protective power of social distancing, handwashing, and mask wearing may be helpful in reducing the spread of the virus. To fine-tune preventive health policies so that they do a better job of influencing men, policymakers might target men's illusions of invulnerability (which are supported by traditional views of masculinity)[20,30] and remind them of their responsibilities to others and themselves during this critical period.[8,31] Disseminating prevention messages particularly in places where men frequently get together can be an effective strategy.[32,33]

Alternatively, interventions that target perceptions of masculinity by inviting men to critically reflect on the social norms of manhood may make them aware of the obstacles that might stand in the way of their taking preventive actions during COVID-19.[34] Research has shown that educational sessions that are led by male role models and allow young men to discuss masculinity norms have been effective in improving other preventive health behaviors.[35] Similar strategies could be applied in the service of COVID-19 prevention, perhaps through interactive online platforms.

A self-regulation strategy called WOOP (wish, outcome, obstacle, plan) may also be helpful, as it has been shown to facilitate behavior changes in various domains, including the health domain.[36,37] WOOP includes four simple steps: (a) identifying a wish, (b) identifying and imagining the best outcome of attaining this wish, (c) identifying and imagining the internal obstacle (such as an emotion, an irrational belief, or a bad habit) that stands in the way of fulfilling the identified wish, and (d) forming an if-then plan to overcome the identified obstacle ("if my obstacle occurs, then I will act in a way that will overcome this obstacle"). In the current context, people could be asked to identify a wish related to reducing the spread of COVID-19, the best outcome of fulfilling this wish (such as "My family will remain healthy"), and the internal obstacle that stands in their way (such as "I may look like a coward if I wear a mask"). Finally, they can form a specific if-then plan to overcome their inner obstacle and engage in preventive health behaviors (as in, "If I think I will look like a coward, then I will remember my family and wear a mask"). In light of the finding that hospitalization and fatality rates from COVID-19 have so far been higher among men,[38–40] interventions focused on men may be particularly effective at attenuating the number of people who fall ill and die from the disease.

end notes

A. Editors' note to nonscientists: For any given data set, the statistical test used—such as the chi-square (χ^2), the *t* test, or the *F* test—depends on the number of data points and the kinds of variables being considered, such as proportions or means. The *p* value of a statistical test is the probability of obtaining a result equal to or more extreme than would be observed merely by chance, assuming that there are no true differences between the groups under study (this assumption is referred to as the *null hypothesis*). Researchers traditionally view $p < .05$ as the cutoff for statistical significance, with lower values indicating a stronger basis for rejecting the null hypothesis. Statistical tests such as the *F* test and *t* test are *parametric:* they make some assumptions about the characteristics of a population, such as that the compared groups have an equal variance on a compared factor. In cases where these assumptions are violated, researchers make adjustments in their calculations to take into account dissimilar variances across groups. A 95% confidence interval (CI) for a given metric indicates that in 95% of random samples from a given population, the measured value will fall within the stated interval. Standard deviation (SD) is a measure of the amount of variation in a set of values. Approximately two-thirds of the observations fall between one standard deviation below the mean and one standard deviation above the mean. In addition to the chance question, researchers consider the size of the observed effects, using such measures as Cohen's *d* or Cohen's *h*. Cohen's *d* or *h* values of 0.2, 0.5, and 0.8 typically indicate small, medium, and large effect sizes, respectively.

B. The percentage of White individuals in our sample in Study 1 matched the proportion in the U.S. population (which, in 2018, was 60.4%).[41] However, compared with the U.S. population, our sample was younger (*Mdn* = 38.2 years),[41] and included a higher proportion of Asian individuals (U.S. population in 2018: 5.9%) and lower proportions of Black (U.S. population in 2018: 13.4%) and Hispanic individuals (U.S. population in 2018: 18.3%).

C. In Study 3, we found that people in counties with a higher proportion of males reduced general movement 4.02 percentage points less and reduced their visits to nonessential retailers 9.08 percentage points less than did people in counties having an average gender distribution. The statistical results were as follows: $B_{movement} = -2.01$, 95% CI [–2.79, –1.21], $p < .001$, and $B_{visitation} = -4.54$, 95% CI [–5.89, –3.18], $p < .001$. *B* values here indicate the change in the predicted variable (reduction in general movement or reduction in visits to nonessential retailers) as a function of a unit change in the predicting variable. One unit change in the predicting variable in these statistical models captures a change of 2.26 (1 standard deviation) because gender distribution was *z* scored in the models. So, for instance, for general movement, the *B* coefficient can be interpreted as follows: A change of 2.26 percentage points in gender distribution (for example, 50.00% male versus 52.26% male) is linked to a 2.01 percentage point decrease in social distancing (see the negative *B* value of –2.01 for general movement). In other words, counties with a greater male percentage (by 2.26 percentage points) were significantly less likely to reduce general movement (that is, 2.01 percentage points less).

D. In Study 3, we found that counties with a higher percentage of males showed comparatively less and less social distancing as the COVID-19 pandemic progressed (between March 9 and May 29, 2020), as measured both by movement and by visits to nonessential retailers. The statistical results were as follows: $B_{movement} = -0.42$, 95% CI [–0.47, –0.38], $p < .001$, and $B_{visitation} = -0.35$, 95% CI [–0.46, –0.25], $p < .001$.

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supplemental material

- https://behavioralpolicy.org/publication
- Methods & Analyses

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