Societal values and mask usage for COVID-19 control in the US

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Abstract

COVID-19 has reshaped lives worldwide and societies are looking for ways to mitigate risk while reopening to stimulate economic recovery. Facial covering (mask) usage reduces the risk of disease spread by preventing transmission by even asymptomatic individuals. Yet, particularly in the U.S. where mask wearing is divisive and politicized there is limited understanding of public beliefs with regard to mask usage. We find that 83% (±3%) of U.S. respondents in our nationally representative sample believe masks have a role in U.S. society related to the spread of COVID-19. However, 11-24% of those same respondents report not wearing a mask themselves in some public locations. Beliefs about mask wearing and usage vary by respondent demographics and their level of agreement with a variety of societal value statements referencing personal freedoms and societal expectations. As cases are rising throughout the summer 2020 many regions of the U.S. are fearful of reintroduction of movement restrictions to slow disease spread. While many more agree that masks have a role in society, only 47% indicated that "Wearing a mask will help prevent future lock-downs in my community related to COVID-19." Public perception of the importance of mask usage revealed the top three locations in order of importance as public transportation, grocery/food stores, and schools, indicating a possible mismatch in areas public health entities reference as highest risk for spread versus locations the public sees as most important for mask usage.

COVID-19 has undeniably affected daily lives worldwide and is challenging healthcare systems in even the most medically advanced nations [1]. The COVID-19 pandemic is a health crisis but also an economic crisis. Economic decline is known to yield negative health outcomes as tax

revenue and public health funding availability declines on the macro level, while individuals experiencing unemployment face devastation on the micro level [2]. The complex nature of global supply chains is expected to magnify losses further beyond the direct impacts of COVID-19 [3]. Economic and societal impacts arise from impaired flows of people, goods, and services. Direct impacts may be more acutely experienced by those facing longer or more intense local shutdowns; but it remains to be seen how COVID-19-related personal experiences relate to perceptions of risk and/or adoption of risk mitigating practices.

Masks are effective in preventing illness and in asymptomatic transmission of COVID-19 [4]. Covering one's face in public, via medical masks, scarves, decorative cloth masks, or other garments is a practice which elicits strong responses in the U.S., whether in response to mandate or by choice [5,6]. Currently the CDC recommends "everyone wear cloth face coverings when leaving their homes, regardless of whether they have fever or symptoms of COVID-19." [7]. Asian cultures and societies have long embraced mask usage in public, driven at least in part by experiences with SARS [8]. Personal costs to mask wearing may include discomfort, expense of obtaining/maintaining masks, and potential lack of communication efficiency involving facial expression [9]. The CDC states that mask wearing protects those around the wearer, more so than the wearer [10]. Benefits of wearing a mask in 2020 in response to the spread of COVID-19 in the U.S. are fundamentally accrued at the societal level by preventing disease spread.

A U.S. nationally representative sample in terms of age, household income, region of residence, and respondent sex was obtained in response to an online survey conducted on June 12^{th} – 20^{th}, 2020 and n=1,198 completed responses were obtained. It was hypothesized that COVID-19 impacts experienced prior to June 2020, societal values held, personal behaviors outside of COVID-19, and demographic differences were related to beliefs about the role of

masks in societal reopening. We collected data on the impacts of COVID-19 on households, levels of agreement with societal value statements, self-reported engagement in risky personal behaviors, and knowledge about mask wearing recommendations. A best-worst scaling (BWS) discrete choice experiment was used to elicit the perceived relative importance of mask wearing in various locations (grocery/food stores, home improvement/hardware stores, other retail settings, religious services, schools, restaurants, public transportation) among respondents who felt masks had a role to play in society's response to COVID-19.

Methods

Survey Instruments and Data Collection

Data collection took place June 12, 2020 to June 20, 2020, which was intentionally during the beginning of relaxation of social distancing, as residents returned to some public places, in much of the U.S.. Kantar, a company which hosts a large opt-in panel database [11], was used to obtain survey respondents, who were required to be 18 years of age or older to participate. The research process was approved by Oklahoma State University IRB (number: 20-283). Quotas set within Qualtrics, an online survey tool [12], were used to target the proportion of respondents to match the U.S. census proportions for sex, age, education, income, and U.S. region of residence [13]. The test of proportions was used to evaluate if there were statistical differences between the proportions of respondents in each demographic category in the sample obtained versus the U.S. census, as well as between subsamples of those who did and did not self-report a role for facial coverings/masks in U.S. society in the second half of 2020. The one and two tailed tests of population proportion, assuming a normal distribution is calculated as:

$$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} \quad (1)$$

where p_0 is the hypothesized proportion (for example the census percentage), $\hat{P}$ is the sample proportion, and n is the sample size [14]. Equation 1 was used to compare the sample to the U.S. population. A test of the difference of two proportions $\widehat{p_1}$ and $\widehat{p_2}$, for example comparing the demographics within a subsample, can be calculated as:

$$z = \frac{\widehat{p_1} - \widehat{p_2}}{\sqrt{\widehat{p_p}(1-\widehat{p_p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} \quad (2)$$

given:

$$\widehat{P_p} = \frac{x_1+x_2}{n_1+n_2} \quad (3)$$

where x_1 and x_2 are the total number of successes in the two populations [14]. The tests of proportion were conducted using STATA/SE16 [15].

In order to analyze the potential impact the number or severity of cases of COVID-19 had on respondent's self-reported beliefs, states were grouped by three different criteria: (1) number of cases over 40,001, (2) the top 10 states as defined by COVID-19 cases per capita, and (3) the top 6 states that experienced a rapid increase in COVID-19 cases after the U.S. holiday Memorial Day 2020. According to the CDC [16], as of June 17th 2020, 17 states had over 40,001 cases of COVID-19: California, Texas, Louisiana, Florida, Georgia, North Carolina, Virginia, Maryland, New Jersey, New York, Connecticut, Massachusetts, Pennsylvania, Ohio, Indiana, Michigan and Illinois. Many of the states with the highest number of COVID-19 cases also have relatively higher populations. Therefore, the number of COVID-19 cases as of June 17, 2020, was divided by the estimated 2019 population according to the U.S. census [13] to ascertain a measure of state cases relative to state population. The top 10 states with the highest number of COVID-19 cases per capita were New Jersey, Massachusetts, Rhode Island, District of Colombia, Connecticut, Delaware, Illinois, Maryland, and Louisiana. In response to reopening

plans and post-memorial weekend, six states had record numbers of new cases including Florida, Texas, Arizona, Oklahoma, Oregon, and Nevada [17].

In addition to demographic information, respondents were asked a series of questions related to the impact COVID-19 had on their lives, their beliefs and use of masks in response to COVID-19, and participated in a best worst scaling (BWS). The BWS discrete choice experiment was designed to determine the relative rank of the locations respondents believed were most important (and least important) to wear a mask. Respondents were asked to indicate on a Likert scale from 1 (not impacted) to 5 (impacted) the level of impact COVID-19 had on their life ranging from their ability to find paper products and other grocery staples, travel, work and go to school. Respondents also had the option to select *does not apply to me*. The mean for respondents who did not select *does not apply to me* was calculated, and a t-test was completed to compare the mean level of impact across the lifestyle areas studied using STATA/SE16 [15]. The test for μ_x (sample x) =μ_y (sample y) for unknown σ_x (standard deviation) and σ_y and $\sigma_x \neq \sigma_y$ is [18]:

$$t = \frac{(\bar{x} - \bar{y})}{\left(\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}\right)^{\frac{1}{2}}} \quad (4)$$

where $\bar{x}$ is the mean of sample *x*, $\bar{y}$ is the mean for sample *y*, *s* is the standard deviation and *n* is the sample size. The result of Equation 4 has a Student's *t* distribution with *v* degrees of freedom given by [19]:

$$-2 + \frac{\left(\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}\right)^2}{\frac{\left(\frac{s_x^2}{n_x}\right)^2}{n_x+1} + \frac{\left(\frac{s_y^2}{n_y}\right)^2}{n_y+1}}. \quad (5)$$

Respondents that indicated there was a member of their household under the age of 18 were asked to select all that apply among four COVID-19 impact child-relevant statements,

namely *My child was no longer able to attend daycare, stay with a family member etc. for childcare, I had to take on schooling activities for my child, I was not able to continue working or had to cut back on work hours due to childcare responsibilities,* and *my childcare and educational routine did not change due to COVID-19.* Respondents who did versus did not select each statement were compared with respect to sex, household income, and residence in a high case count, high case count relative to population, or high spike in cases after Memorial Day 2020 using the test of proportions.

All respondents were asked *do you agree that masks (meaning any face covering that covers your nose and mouth) have any role in U.S. society related to the spread of viral disease, especially COVID-19, in the June - December 2020 time frame* and could select from the answer choices: *NO - they have absolutely no role whatsoever in U.S. society* or *YES - they have some potential role in U.S. society* (the order of possible responses was randomized). All respondents were also presented a series of seven statements regarding mask usage in response to COVID-19, and were asked to select all statements they agreed with. Statements included both positive and negative statements commonly associated with mask wearing such as: *wearing a mask helps prevent the spread of COVID-19, there is social pressure in my community to wear a mask, and wearing a mask does not prevent the spread of COVID-19.* The percentage of respondents who selected each statement and the percentage of respondents who did not select each statement was statistically compared using the test of proportions (Eq. 2-3) for the full sample. In order to better understand respondent beliefs, 5 categories were created: sex (male/female), income (higher/lower), COVID-19 total cases (high total cases/not high total cases), high per-capita cases states (high per capita cases/not high per capita cases), and high spike in cases states (high spike in cases/not high spike in cases). Within each category the proportion of respondents was

compared, for example the proportion of women vs the proportion of men, and the proportion within that group who agreed with statement vs those who did not, for example the percentage of women who said yes vs the proportion of women who said no.

Respondents who indicated masks have at least some role in society were presented a list of 10 locations: in person religious service, big box grocery store/supermarket, specialty grocery store, gym, home improvement store, restaurant, workplace, school, and clothing store/ retail store other than grocery, clothing or home improvement. The respondent was asked to indicate (multiple selections were allowed) if they did not go to this place, if that type of business was not open in their community, if they wore a mask voluntarily, if they were required to wear a mask, and/or if they did not wear a mask. To better compare the percentages of people who did or did not wear masks in the location, the number of people who did not attend that location, or did not have that location open in their community were subtracted from the total number of respondents. This number was used as the denominator to calculate the percentage of respondents who attended or had the opportunity to attend that location and either wore or did not wear a mask.

A series of societal value and personal circumstance statements were curated to gain a better understanding of the underlying beliefs of those who choose to wear or not wear masks in response to COVID-19. Respondents were asked to indicate on a scale from 1(strongly agree) to 5(strongly disagree) their level of agreement with the statements: *Gun ownership is a right based on the U.S. Constitution, Healthcare is a human right, I always wear my seat belt when driving, I frequently drink alcohol, I frequently smoke, I believe we have a societal responsibility to protect children, I believe we have a societal responsibility to protect the elderly, Someone in my household, or that I frequently spend time, with is at higher risk of complications of COVID-19,*

and *I am in the higher risk group for complications of COVID-19*. To establish potential relationships between these statements and the belief masks have a role in U.S. society, Pearson correlations [42] were calculated in STATA/SE16 [37]. The product-moment correlation coefficient ρ is estimated as [20]:

$$\hat{\rho} = \frac{\sum_{i=1}^{n} w_i(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum_{i=1}^{n} w_i(x_i-\bar{x})^2}\sqrt{\sum_{i=1}^{n} w_i(y_i-\bar{y})^2}} \quad (6)$$

where w_i are the weights which were unspecified and assigned w_i=1. The significance level (p-value) was calculated as [20]:

$$p = 2 * ttail\left(n-2, \frac{|\hat{\rho}|\sqrt{n-2}}{\sqrt{(1-\hat{\rho}^2)}}\right). \quad (7)$$

To analyze further the relationship between the belief masks have some potential role in U.S. society, demographics, and agreement with statements regarding masks a logit model was employed. Logit model was chosen because the probability of selecting yes masks have a role takes on the value of either 1, or 0, meaning the respondent selected yes or did not select yes. The latent utility (V_i) of selecting yes masks play a role is represented by the equation [21]:

$$V_i = \beta_n' x_i + e_i \quad (8)$$

where x_i is the vector of observed variables for respondent *i* and e_n is the unobserved error term. Assuming the error term is independently, identically distributed extreme value the logit probability for respondent *i* becomes [21]:

$$P_i = \frac{e^{\beta' x_i}}{1+e^{\beta' x_i}}. \quad (9)$$

The coefficients of latent class models are not directly interpretable so marginal effects are reported (Stata, 2019).

Best-worst scaling (BWS) discrete choice experiment for prioritizing locations

Respondents who selected *YES - they have some potential role in U.S. society* to the statement *do you agree that masks (meaning any face covering that covers your nose and mouth) have any role in U.S. society related to the spread of viral disease, especially COVID-19, in the June - December 2020 time frame* participated in a BWS choice experiment designed to elicit the relative ranking of importance of locations to wear a mask. This resulted in 996 respondents participating in the BWS choice experiment. Prior to participating in the BWS experiment, respondents were shown the following information: *Thinking about societal impacts and welfare broadly speaking in June - December 2020 which locations do you feel mask usage is most important? You will choose the locations with the most important and least important roles in terms of mask usage contributing to human well-being in light of what is currently known about COVID-19. A subset of the locations below will be presented 7 times.* Each respondent saw seven choice sets, each with three locations (Figure 1). The locations provided to respondents were grocery/food stores, home improvement/hardware store, retail settings other than grocery store/home improvement store (i.e. department and other retailers), religious services (i.e. attending church or religious services or gatherings), schools, restaurants, and public transportation (in buses, airplanes, trains or other transportation interacting with any member of the public).

Prior to each of the 7 choice sets (questions) respondents were shown the prompt *from the following set of locations, where do you believe that masks have the* ***most important*** *and* ***least important*** *role in contributing to human well-being.* Each choice scenario contained combinations of three of the seven locations to select the most important and least important location. The respondents' choices of the most important and least important locations for mask usage were used to determine each location's position along a continuum from most important to

least important. The position of location *j* on the scale of most important to least important is represented by λ_j. Thus, how important a respondent views a particular attribute, which is unobservable to researchers, for respondent *i* is:

$$I_{ij} = \lambda_j + \varepsilon_{ij} \tag{10}$$

where ε_{ij} is a random error term. The probability the respondent i chooses the attribute j as the most important attribute and attribute k as the least important attribute is the probability that the difference between I_{ij} and I_{ik} is greater than all potential differences available from the choices presented. Assuming the error term is independently and identically distributed type I extreme value, the probability of choosing a given most important-least important combination takes the multinomial logit form [21], represented by:

$$Prob(j = best \cap k = worst) = \frac{e^{\lambda_j - \lambda_k}}{\sum_{l=1}^{J}\sum_{m=1}^{J} e^{\lambda_l - \lambda_m - J}}. \tag{11}$$

Maximum likelihood estimation (MLE) is used to estimate the parameter λ_j, which represents how important attribute j is relative to the least important attribute. One attribute must be normalized to zero to prevent multicollinearity [21]. A random parameters logit (RPL) model was specified to allow for continuous heterogeneity among individuals as opposed to the multinomial logit model (MNL) which assumed homogenous preferences. The coefficients are not directly intuitive to interpret, so shares of preferences are calculated to facilitate the ease of interpretation [21]. The shares of preferences are calculated as:

$$share_j = \frac{e^{\lambda_j}}{\sum_{k=1}^{J} e^{\lambda_k}} \tag{12}$$

and necessarily sum to one across the 7 locations. The calculated preference share for each attribute is the forecasted probability that each attribute is chosen as the most [22]. Estimation was conducted using NLOGIT 6.0 [23]. For the RPL model, which was deemed most

appropriate for this data set, confidence intervals for each preference share were estimated using the Krinsky-Robb method [24]. The confidence intervals were then used to determine if there were statistical differences between preference shares using the overlapping confidence interval method, which is a conservative method [25].

Results

The percentage of total respondents (n=1198) closely matched the U.S. census with few exceptions (Table 1). The U.S. census had a higher percentage of those 18-24 (13%), with an income of $100,000 and higher (26%), did not graduate from high school (13%), and from the west (24%) when compared to the sample (10%, 19%, 3%, 21% respectively). The U.S. census had a lower percentage of respondents that attended college no degree earned (21%), and attended college Associates or Bachelor's degree earned (27%) when compared to this sample 24% and 31% respectively. The states were broken down into states with the highest COVID-19 cases (68%), states with the highest per capita cases of COVID-19 (15%) and states with record new COVID-19 cases as of Memorial Day 2020 (22%).

Table 1. Sample demographics and comparison to U.S. Census N=1,198

Demographic Variable	Percentage (%) of respondents n=1,198	U.S. Census
Sex		
Male	48	49
Female	53	51
Age		
18-24	10†	13
25-34	18	18
35-44	16	16
45-54	18	17
55-65	17	17
65 +	20	19
Income		
$0-$24,999	24	22
$25,000-$49,999	25	23
$50,000-$74,999	18	17
$75,000-$99,999	13	12
$100,000 and higher	19†	26
Education		
Did not graduate from high school	3†	13
Graduated from high school, Did not attend college	29	28
Attended College, No Degree earned	24†	21
Attended College, Associates or Bachelor's Degree earned	31†	27
Attended College, Graduate or Professional Degree earned	13	12
Region		
Northeast	18	18
South	39	38
Midwest	22	21
West	21 †	24
COVID-19 Cases		
States with highest cases	68	
States with highest per capita	15	
States with record new cases	22	

†indicates the percentage of respondents is statistically different than the U.S. census (percentage of population) at a level of <0.05

COVID-19 had the highest impact on respondents' ability to execute travel plans (mean 3.89, n=935) (Table 2). COVID 19 had the next highest impact on daily activities outside of

work/school (mean 3.56, n=1106), the ability to buy paper products (e.g. toilet paper, paper towels) (mean 3.47, n=1172), and activities related to work /school (mean 3.54, n=880), none of which were statistically different. COVID-19 had the lowest impact on respondents' ability to find meat, milk, and perishable grocery items (mean 3.01, n=1167). Respondents with children were asked questions specific the effects of the pandemic on child-related tasks (Table 3). Three hundred and forty-seven respondents reported having at least one child in their household. For the statement *my child was no longer able to attend daycare, stay with a family member etc. for childcare* a higher percentage of lower income respondents (24%, n=195) agreed with the statement when compared to higher income respondents (15%, n=152). For the statement *I had to take on schooling activities for my child* a higher percentage of women (58%, n=203) indicated they agreed when compared to the percentage of men (47%, n=144). A higher percentage of respondents whose state of residence qualified as a state with a high spike in COVID-19 cases (37%, n=75) agreed with the statement *I was not able to continue working or had to cut back on work hours due to childcare responsibilities* when compared to non-high COVID-19 spike states (25%, n=272). Only 21% of respondents with children agreed with the statement *my childcare and educational routine did not change due to COVID-19*; no statistical differences were found between gender, income, or COVID-19 impact.

289 Table 2. The impact COVID-19 has had on the respondent, percentage of respondents (N=1198) and mean impact score for
290 respondents who did not select *Does not apply to me* (n=given in table).

	1 (Not impacted)	**2**	**3**	**4**	**5 (Impacted)**	**Does not apply to me**	**Mean response for respondents for which the statement applied[1] (Standard Deviation)**
Respondents daily activities outside of work/school	13%	8%	18%	22%	32%	8%	3.56a (1.39) n=1106
Ability to buy paper products (e.g., toilet paper, paper towels)	14%	10%	19%	25%	30%	2%	3.47a (1.38) n=1172
Ability to find meat, milk, and perishable grocery items	20%	16%	22%	22%	17%	3%	3.01b (1.38) n=1167
Ability to execute travel plans	10%	4%	10%	14%	40%	22%	3.89c (1.42) n=935
Activities related to respondent's work/school	14%	6%	9%	14%	31%	27%	3.54a (1.55) n=880

291 [1]Matching letters indicate that the means for the statements are not statistically different at the <0.05 level, differing letters indicate
292 they are statistically different. For example the means impact for *respondents daily activities outside of work/school* and *ability to buy*
293 *paper products* are not statistically different while the mean impact for *respondents daily activities outside of work/school* and *the*
294 *ability to find meat, milk and perishable grocery items* are statistically different.

295

Table 3. Childcare related impacts of COVID-19, percentage (%) of respondents who indicated a child in the household for that category. N given in column.

		Sex		Income[1]		State COVID-19 Status					
	Full sample	Male	Female	Higher income	Lower income	High total cases	Not high total cases	High per capita cases	Not high per capita cases	High spike in cases	Not high spike in cases
N=	347	144	203	152	195	229	118	47	200	75	272
My child was no longer able to attend daycare, stay with a family member etc. for childcare	20	22	19	15$^{\Psi}$	24$^{\Psi}$	18	24	13	21	25	19
I had to take on schooling activities for my child	53	47$^{\Psi}$	58$^{\Psi}$	52	54	53	53	53	53	45	55
I was not able to continue working or had to cut back on work hours due to childcare responsibilities	28	28	27	32	25	27	30	26	28	37$^{\Psi}$	25$^{\Psi}$
My childcare and educational routine did not change due to COVID-19	21	23	20	19	23	22	19	19	21	21	21

[1]lower income is defined as less than $49,999 and high income is $50,000 and greater

$^{\Psi}$indicates the percentage of respondents is statistically different within that category at a level of <0.05. For example, a higher percentage of females indicated they had to take on schooling activities for their child.

A statistically higher percentage of respondents (82%) indicated masks had at a potential role in U.S. society related to the spread of COVID-19 than the proportion who said masks had no role (17%) (Table 4). For all statements regarding mask wearing in response to COVID-19, the percentage who indicated they agreed with the statement was statistically different from those who said they did not agree. A higher percentage of respondents with lower incomes (21%, n=588) and from a high spike in cases state (21%, n=269) did not believe masks had a role in society related to the spread of COVID-19 when compared to higher income (13%, n=610) and not from a high spike in cases state (16%, n=929), respectively. For the statement *wearing a mask helps prevent the spread of COVID-19* a higher percentage of respondents who believed masks had a place in society (80%, n=996), and from high case number states (72%, n=810) agreed with the statement when compared to those who did not believe masks had a place (21%, n=202), and non-high case number states (66%, n=388), respectively. A higher percentage of those who believed masks had a place in society (61%, n=996), and of women (56%, n=629) agreed with the statement *wearing a mask helps prevent me from getting COVID-19* when compared to those who did not believe masks had a place (16%, n=202) and men (50%, n=569). A higher percentage of respondents who believed masks had a place in society (74%, n=996) compared to those who did not (15%, n=202) agreed with the statement *wearing a mask helps prevent me from spreading COVID-19.* Additionally a higher percentage who were female (68%, n= 629) compared to male (60%, n=569), had higher income (69%, n=610) compared to lower (59%, n=588) and were a resident of a high total number of cases state (66%, 810) compared to non-high total number of cases state residents (60%, n=388) agreed with the statement. For the statement *wearing a mask will help prevent future lock-downs in my community related to COVID-19* a higher percentage of those who believed masks had a role (55%, n=996) compared

to those who did not believe (10%, n=202), higher income (51%, n=610) when compared to lower income (43%, n=588) and residents from high total number of COVID-19 case states (51%, n=810) when compared to non-high total number of COVID-19 case states (41%, n=388) agreed. A higher percentage of people who believed masks did not have a place in society (42%, n=202), men (35%, n=569) and higher income respondents (34%, n=610) agreed with the statement *there is social pressure in my community to wear a mask.* This is in comparison to those who believed masks had a place (29%, n=996), women (27%, n=629) and lower income respondents (28%, n=588), respectively. For both the statements *wearing a mask does not prevent the spread of COVID-19* and *wearing a mask has negative health consequences for the mask wearer* a lower percentage of respondents who believed masks had a place in society (8% and 7%, n=996) agreed when compared to those who did not believe masks had a place (44% and 38%, n=2020). Additionally, higher percentages from high COVID-19 case states (12% and 11%, n=810) agreed with the statement when compared to non-high COVID-19 states (17% and 16%, n=388).

339Table 4. Beliefs regarding mask wearing regarding COVID-19, percentage (%) of respondents for that category. N given in column.

		Believes that masks have a role in U.S. Society		Sex		Household Income[1]		State COVID-19 status					
	Full sample	Yes	No	Male	Female	Higher income	Lower income	High total	Not high total	High per capita	Not high per capita	High spike in cases	Not high spike in cases
N=	1198			569	629	610	588	810	388	178	1020	269	929
NO - masks have absolutely no role whatsoever in U.S. society related to the spread of viral disease	17†	0	100	18†	16†	13†ψ	21†ψ	16†	19†	13†	17†	21†ψ	16†ψ
YES - masks have some potential role in U.S. society related to the spread of viral disease	83†	100	0	82†	84†	87†ψ	79†ψ	84†	81†	87†	83†	79†ψ	84†ψ
Wearing a mask helps prevent the spread of COVID-19	70†	80†ψ	21†ψ	68†	72†	71†	69†	72†ψ	66†ψ	76†	69†	67†	71†
Wearing a mask helps prevent me from getting COVID-19	53†	61†ψ	16†ψ	50ψ	56†ψ	54†	52	55†	50	57†	53†	54	53†
Wearing a mask helps prevent me from spreading COVID-19	64†	74†ψ	15†ψ	60†ψ	68†ψ	69†ψ	59†ψ	66†ψ	60†ψ	70†	63†	59†	66†
Wearing a mask will help prevent future lock-downs in my community related to COVID-19	47†	55†ψ	10†ψ	47†	48	51ψ	43†ψ	51†ψ	41†ψ	52	47†	43†	49
There is social pressure in my community to wear a mask	31†	29†ψ	42†ψ	35†ψ	27†ψ	34†ψ	28†ψ	32†	28†	33†	30†	30†	31†
Wearing a mask does not prevent the spread of COVID-19	14†	8†ψ	44†ψ	14†	14†	14†	14†	12†ψ	17†ψ	10†	15†	17†	13†
Wearing a mask has negative health consequences for the mask wearer	13†	7†ψ	38†ψ	12†	13†	12†	13†	11†ψ	16†ψ	11†	13†	12†	13†

340 [1]lower income is defined as less than $49,999 and high income is $50,000 and greater

341 †indicates the percentage of respondents is statistically different between those who selected they agreed with the statement and those
342 who did not at the <0.05 level. Those who did not select that they agreed with the statement and those who did sum to 100% within a
343 category (i.e. men) and were not included for brevity with the exception of the role of masks in society.

344 ψindicates the percentage of respondents between the two levels within a category, for example men vs women, or high total vs not
345 high total are statistically different at the <0.05 level

Between two and 28% of respondents who indicated they believed masks had a role in society (n=996) also indicated religious services, gyms, home improvement stores, and schools were not open in their community (Table 5). Of those who could have and did attend the listed locations and believed masks had a role in society, between 42% and 63% of respondents voluntarily wore a mask. Only 42% (n=463) of respondent who went to work indicated they wore a mask in the workplace. Surprisingly, 22% and 24% of respondents who believed masks had a role in society and who could have and did go to the gym, and restaurants (respectively) did not wear a mask.

Table 5. Locations that respondents who indicated masks have at least some role in society wear a mask. Multiple selections permitted, percentage (%) of respondents

	Percentage of respondents n=996		Percentage who can and do attend this location (location-specific n provided)			
	I do not go to this place	This type of business is not open in my community	n	I wear a mask voluntarily	I am required to wear a mask	I do not wear a mask
In person religious service	49	20	325	52	38	16
Big box grocery store/supermarket	9	2	884	63	35	12
Specialty grocery store	30	5	655	59	39	11
Gym	55	23	236	49	36	22
Home improvement store	22	4	729	60	34	13
Restaurant	32	16	525	51	34	24
Workplace	43	11	463	42	51	19
School	54	28	199	56	40	13
Clothing store	29	13	578	59	33	16
Retail store other than grocery, clothing, or home improvement	18	7	754	62	34	14

Respondents indicated on a scale from 1 (strongly disagree) to 5 (strongly agree) their level of agreement with a series of social statements (Table 6). Agreement with the statement *gun ownership is a right based on the U.S. Constitution* (mean 3.78) was negatively correlated (-0.113, p-value <0.0001) with the belief masks had a role in society related to the spread of COVID-19. Agreement with the statements *healthcare is a human right* (mean 4.01) and *I always wear my seat belt when driving* (mean 4.01) were positively correlated with the belief masks had a role in society 0.234 (p-value <0.0001) and 0.113 (p-value <0.0001), respectively. Belief that we have a societal responsibility to protect children (mean 4.37) and the elderly (mean 4.25) both were positively correlated with the belief masks had a role in society 0.193 and 0.195, respectively (both p-value <0.0001). Having either someone in the household or someone that the respondent frequently spends time with at a higher risk of COVID-19 (mean 2.92) or being of higher risk themselves (mean 2.86) of COVID-19 was positively correlated with belief masks had a role in society 0.133 and 0.186, respectively (both p-value <0.0001).

Table 6. Agreement with social statements and correlation with belief that masks have a place in society (N=1198; percentage (%) of respondents)

Personal, Social, and Societal Statement Presented	1 (strongly disagree)	2	3	4	5 (strongly agree)	Mean (Standard Deviation)	Correlation between level of agreement and belief that masks have a place in society
	Percentage (%) of Respondents (n=1198)						
Gun ownership is a right based on the U.S. Constitution	8	8	25	16	43	3.78 (1.30)	-0.113***
Healthcare is a human right	5	6	19	22	48	4.01 (1.17)	0.234***
I always wear my seat belt when driving	4	3	8	11	74	4.49 (1.01)	0.113***
I frequently drink alcohol	47	13	19	12	8	2.20 (1.35)	0.054*
I frequently smoke	67	5	8	7	13	1.95 (1.49)	-0.037
I believe we have a societal responsibility to protect children	3	3	12	19	64	4.37 (1.00)	0.193***
I believe we have a societal responsibility to protect the elderly	3	4	13	24	55	4.25 (1.03)	0.195***
Someone in my household, or that I frequently spend time, with is at higher risk of complications of COVID-19	30	12	18	17	23	2.92 (1.55)	0.133***
I am in the higher risk group for complications of COVID-19	30	14	18	18	21%	2.86 (1.52)	0.1857***

Note: *indicates statistically significant at the 0.10 level **at the 0.05 level *** at the <0.0001 level

In the logit model estimating the probability a respondent believed masks had a role in society, sex or agreement to the statement *there is social pressure in my community to wear a mask* was not statistically significantly associated (Table 7). As income increased, the probability the respondent believed masks had a place in society increased (0.018). Agreeing with the statements *wearing a mask helps prevent the spread of COVID-19* (0.079), *wearing a mask helps prevent me from getting COVID-19* (0.032), *wearing a mask helps prevent me from spreading COVID-19* (0.091), and *wearing a mask will help prevent future lock-downs in my community related to COVID-19* (0.068) increased the probability that the respondent believed masks had a role in society. Agreement with the statements *wearing a mask does not prevent the spread of COVID-19* (-0.054) and *wearing a mask has negative health consequences for the mask wearer* (-0.058) decreased the probability the respondents believed masks had a role in society.

386 Table 7. Factors/Beliefs related to belief that masks have a place in society, demographics and beliefs regarding masks regarding
387 COVID-19 in the Logit Model. N=996

	Marginal effect	**Standard error**	**P-value**
Male	-0.00901	0.012359	0.4660
Income	0.017565	0.004754	<0.0000
Wearing a mask helps prevent the spread of COVID-19	0.078937	0.0154	<0.0000
Wearing a mask helps prevent me from getting COVID-19	0.032513	0.014699	0.0270
Wearing a mask helps prevent me from spreading COVID-19	0.091317	0.015667	<0.0000
Wearing a mask will help prevent future lock-downs in my community related to COVID-19	0.068202	0.015962	<0.0000
There is social pressure in my community to wear a mask	-0.00595	0.013399	0.6570
Wearing a mask does not prevent the spread of COVID-19	-0.05382	0.016986	0.0020
Wearing a mask has negative health consequences for the mask wearer	-0.05786	0.016734	0.0010

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In the BWS experiment estimation, public transportation had the highest mean preference share (32%), indicating it was the most important location to wear a mask (Table 8). Grocery/food stores were the second most important (19%) followed by schools (16%). Religious services (13%), retail settings (8%), and home improvement/hardware store (3%) all had statistically smaller preference shares indicating they were less important locations.

Table 8. Multinomial logit model and random parameters logit model results for most important location to wear a mask. N=996

	MNL	RPL			
Locations	Coefficient	Coefficient	Standard Deviation	Estimated mean preference share [confidence interval]	Rank
Grocery/ food stores	-0.446***	-0.537***	0.695***	19%	2
	0.033	0.044	0.056	[0.178, 0.200]	
Home improvement/ hardware store	-1.642***	-2.314***	0.952***	3%	6
	0.038	0.063	0.063	[0.029, 0.035]	
Retail settings	-1.064***	-1.387***	0.514***	8%	5
	0.034	0.045	0.064	[0.076,0.086]	
Religious services	-0.711***	-0.941***	1.294***	13%	4
	0.033	0.056	0.059	[0.117, 0.138]	
Schools	-0.559***	-0.688***	1.199***	16%	3
	0.033	0.054	0.059	[0.150, 0.177]	
Restaurants	-1.039***	-1.365***	0.967***	8%	5
	0.034	0.050	0.058	[0.076, 0.089]	
Public transportation	-	-	-	32%	1
	-	-	-	[0.310, 0.339]	

Discussion

Shorter but stricter restrictions on movement, social distancing enforcement, and use of personal protective measures such as hand washing and facemasks are highly successful in containing epidemic spread [26]. But Leung et al. [27] highlight the relative scarcity of work regarding the efficacy of facemasks. Most findings come from in vitro experiments with nonbiological particles [28,29] and thus may not be directly applicable to understanding infectious respiratory virus droplets. Seventy percent of respondents believed mask wearing prevented spread, but only 64% correctly identified that masks prevent spread to others. Fifty-three percent of respondents self-reported their belief that masks helped prevent oneself from catching COVID-19.

Recent findings on masks find them to be more effective than originally thought [30] with respect to reducing COVID-19 transmission. Eighty-three percent of respondents indicated that masks have a role in society, but even among that group, 22% do not wear masks in gyms, 24% do not wear them in restaurants, and 19% don't wear them in the workplace. Agreement on the statement/belief masks have a role in U.S. society is thus not equivalent to consistent mask usage from the very same people. Importantly given the politicization and polarization around masks in media, and in particular on social media, the consistency of mask wearing by even those who agree that masks have a role in US society and/or mask usage could aid in preventing future lockdowns is particularly interesting and worthy of further investigation.

Hypothetical scenarios have suggested near universal (80%) adoption of even moderately effective masks (50%) could prevent 17-45% of projected deaths and decrease peak daily death rate by 34-58% over two months in New York, holding constant other changes in epidemic dynamics [31]. There is some evidence that masks and gloves, along with hand hygiene and

419 ‘shelter in place’ mandates reduce transmission and the number of active contacts for COVID-19
420 [32]. Given the amount of economic, financial, social, and societal stress instigated by forced
421 lock-downs in the U.S. thus far, it could be hypothesized that just the fear of lockdowns may
422 impact behaviors and the economic marketplace. Extending beyond beliefs about spread of
423 COVID-19 itself and asking respondents to extrapolate to beliefs about how masks play a role in
424 keeping their communities/societies functional, 47% believed wearing a mask would help
425 prevent future lock-downs.

426 Data for this analysis was collected well into the pandemic period. Optimism bias, in
427 which one has the belief negative consequences are less likely for themselves than others, is a
428 challenge when considering behaviors that impact COVID-19 risk and spread [33]. However,
429 optimism bias helps people avoid experiencing difficult negative emotions, which may aid
430 people in coping while simultaneously leading people to underestimate their probability of
431 catching a disease [33]. Already by May 2020, mask usage in grocery stores was reportedly
432 declining [34]. Around the same time, scientific advances regarding public places and situations
433 where spread is most likely are reaching societies and informing public policy. The CDC
434 updated guidance on June 15, 2020 to aid people in deciding whether to go out or not by
435 assessing relative riskiness of activities, saying “In general, the more closely you interact with
436 others and the longer that interaction, the higher the risk of COVID-19 spread.” [35]. Results
437 from the BWS experiment conducted found mask usage most important for the top three
438 locations of public transportation, grocery/food stores, and schools. Public views on where
439 masks are most valuable may not align with what public health entities advise.

440 Emerging insights into the transmission of COVID-19 by children now suggests
441 relatively small improvements from school closures [36]. Far and long reaching implications of

school closures exist in particular, surrounding equity of children from households with lower income and resources [37]. School and childcare closures give rise to challenges for working parents. Acute societal challenges emerge when critical employees, such as medical professionals, must balance childcare and family needs alongside health-care work [36]. More women than men reported having taken on schooling activities for children, although both sexes reported impacts on loss of childcare and schooling for their children [38,39,40], suggesting far-reaching societal impacts for loss of childcare and educational opportunities. CDC offers guidance for schools and childcare settings, including promoting the value of cloth face coverings [41]. The American Academy of Pediatrics released guidance for schools on June 26th, 2020 which encourages returning to physical presence in schools and discusses social distancing and mask usage by age group [42]. Recent work by Davies et al. [43] estimated "susceptibility to infection in individuals under 20 years of age is approximately half that of adults aged over 20 years…" concluding interventions aimed at children may have relatively small impacts. Recent modeling efforts predict school closures alone would be less effective in reducing deaths than other social distancing interventions, preventing only 2-4% of deaths [36]. Masks for children remain debated as schools reopen; Esposito and Principi [44] recently suggested healthy children be prepared for mask wearing through support and education, along with properly fitting masks and instruction for removal. AAPs recent guidance documents the need for cost-benefit assessment for elementary aged children with respect to mask usage in schools reducing spread but raising risks of touching one's mouth/nose more [42].

While people's physical health depends on pandemic control measures and mental and economic health depends on successful reopening of world economies, COVID-19 and mask usage have been politicized. President Trump refused to wear a mask indicating, "I didn't want to

give the press the pleasure of seeing it," [45]. The politicization of pandemics is not new in U.S. society, having been recognized as a significant factor in the final death rates and counts in the 1918 Spanish Flu [46]. Many COVID-19 myths appear to be politically motivated [47] irreparably linking conversations about public health and societal economic survival with political agendas.

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