Social Pressure, Altruism, Free-Riding, and Non-Compliance in Mask Wearing by U.S. Residents in Response to COVID-19 Pandemic

Abstract

Human behavior, such as wearing a mask in public, affects the trajectory of the COVID-19 pandemic. A nationally representative survey of 1,198 U.S. residents was used to study demographics, perceptions, and stated beliefs of residents who indicated they believe masks have a role in society in response to COVID-19 but self-reported not wearing masks in at least one public place studied. Individuals who believed wearing masks protected others were more likely to report voluntarily wearing them, showing evidence of altruism. Perceiving social pressure negatively impacted the probability of voluntary mask wearing amongst those who believed masks have a role in society, suggesting social shaming won't increase compliance among these individuals. Free-riding is one possible explanation for why an individual respondent may self-report belief that mask wearing has a role in society and simultaneously self-report not voluntarily wearing a mask in public locations. Alternatively, incomplete knowledge, confusion about the role of masks in controlling spread of COVID-19, or fatigue are all possible explanations for why adults who believe masks play a role demonstrate less than optimal compliance themselves with mask wearing. Promotion of altruism, rather than social shaming, is likely to increase mask wearing based on this analysis. Tactics to improve public health initiative compliance and participation may change throughout the duration of the pandemic and/or may differ in segments of the population. Increased understanding of human behavior as it relates to mask wearing can inform public health communications and construction of incentive-aligned messaging to improve public health-related behaviors and associated outcomes.

Keywords: altruism; human behavior; mask wearing; public health; resource allocation

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Introduction

Pandemic-relevant social and behavioral sciences include work related to threat perception, leadership, individual and collective interests, science communication, social context, and stress and coping (Bavel et al., 2020). Human behavior of individual people within communities ultimately influences or determines the spread and eventual course of the pandemic within a population. Public health outcomes and the spread of disease in the human population is an epidemiological question (CDC A, 2012). One could delve into the differentiation between descriptive epidemiology (CDC B, 2012) versus analytical epidemiology to identify factors associated with disease and inform targeting of public health prevention and control (CDC C, 2012). However, human behavior including the allocation of finite resources like time, money, emotional capacity, or mental attention is a critical component of COVID-19 response and recovery.

A variety of human behavior explanations exist for sub-optimal individual behaviors in response to COVID-19, especially after many months of coping and confusion in response to public health messaging. Free-riding, altruism, and bandwagoning behaviors have been studied in health-related practices prior to the COVID-19 pandemic, including notably in vaccination decisions (Hershey et al., 1994). Free-riding means fundamentally that an individual is taking advantage of the efforts by others to establish some collective good without actually contributing oneself, which is often used in the contexts of economics, psychology, and political science to refer to the negative impacts of this behavioral problem (Van den Hoven, 2012). Altruism, the selfless concern for others or general caregiving for others beyond oneself, is a powerful psychological factor or trait that has been studied in great depth with regard to how it can influence human behavior and decision making (Andreoni, 1990; Cornes & Sandler, 1984; Shim

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et al., 2012). Framed in the context of game theory and vaccination for influenza, Shim et al. (2012) have found that contrary to the assumption that individuals maximize their personal payoffs when making decisions and act according to self-interest, that altruism indeed plays a role in vaccination decisions (Shim et al., 2012). Altruism bas been referenced with respect to mask wearing in response to COVID-19 (Cheng et al., 2020) although there are undoubtedly a number of frameworks for understanding such behavior, of which altruism is only one. Bandwagoning behavior reflects an activity or action that is currently fashionable or socially supported, often recognized as peer pressure or some amount of societal inertia. Bandwagoning is rooted in conformity and group think in social psychology, fundamentally suggesting that the rate of acceptance of behavior or belief goes up the more that those behaviors or beliefs have already been adopted by others, irrespective of the individual's own views or opinions (Colman, 2003; Cantarelli et al., 2018). Bandwagoning in medicine has been described by Cohen and Rothschild (1979) as "the overwhelming acceptance of unproven but popular ideas" that are often disproved, abandoned, and replaced by another bandwagon (or sometimes proven valid and justified, albeit after the fact) (Cohen & Rothschild, 1979). Indeed, bandwagoning and the want to conform to social pressures was found to impact nursing personnel decisions in an experimental survey conducted in-the-field by Canterelli et al. (2018), which also included other factors such as denominator neglect, zero-risk effects, halo effects, and anchoring (Cantarelli et al., 2018).

The possibility for for free-riding, altruism, peer-pressure (i.e. bandwagoning behavior), and protest/angry resistance to impact mask wearing behaviors by individuals in the U.S. has been recognized. In June 2020 a survey was administered to a nationally representative sample of U.S. residents over the age of 18 to collect data on their beliefs and behaviors with regard to

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facial masks in response to COVID-19. This analysis seeks to gain insight into the behaviors of a specific segment of the population, namely adults who direct-stated agreement that masks have a role in the U.S. response to the COVID-19 pandemic, but also report not wearing a mask in one or more public locations visited during the pandemic. Stated beliefs by those who wear/do not wear masks in various public locations (including in-person religious services, big box grocery store/supermarket, specialty grocery store, gym, home improvement store, restaurant, workplace, school, clothing store, and retail store other than grocery clothing or home improvement) are summarized to offer insights into what beliefs were prevalent among those wearing masks voluntarily versus those not. The potential for externalities in one's behaviors protecting or threatening others, in addition to the possibility of legitimate misunderstandings about masks and/or perceived risks based on geographical location are discussed.

Materials and Methods

The demographics of the survey respondents were targeted to be representative of the U.S. population (U.S. Census) for the demographic categories of gender, age, income, education, and region of residence. Region of residence was as defined by the U.S. census (U.S. Census Bureau, 2016). The survey questions, which were designed to gain a better understanding of the impact of COVID-19 as well as the beliefs surrounding and usage of masks, were developed and distribute using Qulatrics (Qualtrics, 2020). Data collection took place during the beginning of the relaxation of social distancing in many regions of the U.S., from June 12, 2020 to June 20, 2020. Kantar, a company which hosts an opt-in online panel of potential respondents was used to recruit and contact respondents (Kantar, 2020) . All methods were carried out in accordance with relevant guidelines and regulations. Study procedures were approved by the Oklahoma State

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Institutional Review Board (IRB-20-283). Informed consent was obtained by the respondents. A total of 1,198 completed responses were obtained and analyzed.

In addition to traditional demographics, three state-specific classifications of COVID-19 were assigned on the basis of what was deemed high case counts at the time of data collection. States that had over 40,001 cases as of June 17th 2020 (high case states), the top 9 states with the highest number of per-capita cases of COVID-19 (high number of cases by population states), and 6 states that experienced a high spike in cases after the U.S. holiday Memorial Day 2020 (high increase in cases states). According to the CDC (CDC D, 2020), 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. To obtain the states with the highest per-capita case load, the number of COVID-19 cases as of June 17, 2020 was divided by the estimated 2019 population (U.S. Census Bureau, 2016). 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. Six states had record numbers of new cases (high increase in cases states) namely, Florida, Texas, Arizona, Oklahoma, Oregon, and Nevada (CBS News, 2020).

In order to gauge general perceptions of facial coverings in response to the pandemic, 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?* Answer choices provided included *NO - they have absolutely no role whatsoever in U.S. society* or *YES - they have some potential role in U.S. society.* The test of proportions, conducted using STATA/SE16 (StataCorp, 2019), was used

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to compare the demographics of the respondents who selected yes, and those that selected no. The test of the difference of two proportions $\hat{p_1}$ and $\hat{p_2}$, was calculated as:

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

given:

$$\hat{P_p} = \frac{x_1 + x_2}{n_1 + n_2} \quad (2)$$

where x_1 and x_2 are the total number of successes in the two populations (Acock, 2018).

Respondents that indicated they believed masks had some potential role in U.S. society were also asked to indicate the locations they visited and their mask wearing status while at that location. Locations included in-person religious services, big box grocery store/supermarket, specialty grocery store, gym, home improvement store, restaurant, workplace, school, clothing store, and retail store other than grocery clothing or home improvement. The percentage of respondents that visited a location and voluntarily wore a mask was statistically compared among locations using the test of proportions (Eq 1-2). Whether the respondent visited a location and voluntarily wore a mask was further broken down and statistically compared by gender, income, education, child status, and state COVID-19 classification. Income was condensed to higher income (an income of $50,000 or higher) and lower income (an income of $49,999 or lower). Education was condensed to college or more and less than college education. The test of proportions (Eq 1-2) was used to compare demographics and voluntary mask wearing. For example, the percentage of women versus men who voluntarily wore a mask at an in person religious service.

Respondents were asked to indicate on a scale from 1(not impacted) to 5(impacted) the level of COVID-19 related impact they experienced for four different activities outside of

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work/school, specifically respondent's daily activities outside of work/school, ability to buy paper products (e.g. toilet paper, paper towels), ability to find meat, milk, and perishable grocery items, and activities related to work/school. Respondents were also permitted to select *this activity does not apply to me*; those responses were not included in this analysis. Activities included: the respondent's daily activities outside of work/school, ability to buy paper products (e.g. toilet paper, paper towels), ability to find meat, milk, and perishable grocery items, and activities related to the respondent's work/school. The mean score between those who voluntarily wore a mask and did not voluntarily wear a mask were statistically compared using a t-test for those locations that pertained to a particular activity. For example, the mean responses to the impact COVID-19 had on the respondent's daily activities outside of work/school were statistically compared between those who went to and voluntarily wore a mask at an in-person religious service and those that did not voluntarily wear a mask. 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 (Gosset, 1908):

$$t = \frac{(\overline{x} - \overline{y})}{\left(\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}\right)^{\frac{1}{2}}} \tag{3}$$

where $\overline{x}$ is the mean of sample *x*, $\overline{y}$ is the mean for sample *y*, *s* is the standard deviation and *n* is the sample size. The result of Equation 3 has a Student's *t* distribution with *v* degrees of freedom given by (Welch, 1947):

$$-2 + \frac{\left(\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}\right)^2}{\frac{\left(\frac{s_x^2}{n_x}\right)^2}{n_x + 1} + \frac{\left(\frac{s_y^2}{n_y}\right)^2}{n_y + 1}}. \tag{4}$$

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Respondents were asked to indicate if they agreed with a series of 7 statements regarding mask usage. The statements included: *masks help prevent the spread of COVID-19*, *masks help prevent me from getting COVID-19*, *masks help prevent me from spreading COVID-19*, *masks will help prevent future lock-downs in my community*, *there is social pressure in my community to wear a mask*, *masks do not prevent the spread of COVID-19*, and *masks have negative health consequences for the mask wearer*. The percentage of respondents who indicated they visited a location, voluntarily wore a mask there, and agreed with the COVID-19 mask statement was compared using the test of proportions to the percentage of respondents who indicated they visited a location, did not voluntarily wear a mask, and agreed with the COVID-19 mask statement.

A series of logit models of the probability a respondent visited a location and voluntarily wore a mask were estimated. Logit models were chosen because the probability the person visited and voluntarily wore a mask took on the form of either 1 or 0. The latent utility (V_{in}) for location *i* and respondent *n* can be represented by the equation:

$$V_{in} = \beta_1 Income_{in} + \beta_2 HighCase_{in} + \beta_3 HighIncrease_{in} + \beta_4 HighPop_{in} + \beta_5 ActivityImpact_{in} + \beta_6 PaperImpact_{in} + \beta_7 PreventSpread_{in} + \beta_8 PreventMe_{in} + \beta_9 PreventMeSpread_{in} + \beta_{10} LockDown_{in} + \beta_{11} Pressure_{in} + \beta_{12} NoPrevent_{in} + \varepsilon_{in.} \quad (5)$$

$Income_{jn}$ is a continuous variable ranging from 1 (income of $0-$24,999) to 5 (income of $100,000 or greater), $HighCase_{in}$ indicates the person is from a state with greater than 401,000 COVID-19 cases, $HighIncrease_{in}$ indicates the person is from a state with a high increase in COVID-19 cases after Memorial Day 2020, $HighPop_{in}$ indicates the respondent lives in a state with a high per-capita rate of COVID-19. $ActivityImpact_{in}$ is the score from 1 (low impact) to 5 (high impact) the impact COVID-19 had on activities outside of work/school and $PaperImpact_{in}$ is the impact score on ability to buy paper products. $PreventSpread_{in}$ indicates the respondent

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agreed with the statement masks help prevent the spread of COVID-19, $PreventMe_{in}$ indicates the respondent agreed that masks help prevent them from getting COVID-19, $PreventMeSpread_{in}$ indicates the respondent agreed that masks will prevent them from spreading COVID-19, $LockDown_{in}$ indicates the respondent agreed that masks will help prevent future lockdowns, $Pressure_{in}$ indicates the respondents agrees there is social pressure in their community to wear a mask, and $NoPrevent_{in}$ indicates the respondent agrees that masks do not prevent the spread of COVID-19. The unobserved error term which is assumed independently identically, distributed extreme value is represented by e_{in} (Train, 2005). The logit probability (P_{in}) for location i and respondent n becomes:

$$P_{in} = \frac{e^{\beta_n' x_{in}}}{\sum_n e^{\beta_n' x_{in}}}. \quad (6)$$

Because coefficients from logit models can be difficult to interpret, marginal effects were estimated.

Results

Out of the 1,198 respondents obtained, 996 (83%) indicated that masks have a role in U.S. society to prevent the spread of viral disease, including COVID-19, and 202 (17%) did not (Table 1). A lower percentage of respondents who believed masks had a role were 25-34 (17%) and a higher percentage were 65+ when compared to those who did not believe 24% and 9%, respectively. A lower percentage who believed masks had a role had an income of $0-24,999 (22%) when compared to those who did not believe (33%). Conversely, a higher percentage of respondents who said yes had an income of $100,000 and higher (21%) when compared to those who said no (9%). Of those who said they believed masks had a role in society to prevent viral spread, a lower percentage graduated from high school but did not attend college (27%), when

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compared to those who did not believe (37%). A higher percentage of those who said yes attended college, associates or Bachelor's degree earned (33%) or attended college, graduate or professional degree earned (14%) when compared to those who said no (22% and 9%, respectively). Of those who said they believed masks have a role, a higher percentage were from the northeast (20%) when compared to those who did not believe (11%). Finally, a lower percentage of respondents who said yes, that masks have a role, were from high increase in COVID-19 case states (21%) when compared to those who said no (28%).

Of respondents who visited the locations studied, greater than half reported wearing a mask voluntarily in a big box grocery store/supermarket, a specialty grocery store, a home improvement store, a school, a clothing store, or a retail store other than a grocery, clothing, or home improvement store (Table 2). A higher percentage of females voluntarily wore a mask when compared to men at big box grocery stores (69% vs 57%), specialty grocery stores (66% vs 53%), home improvement stores (65% vs 55%), school (65% vs 50%), clothing stores (64% vs 54%) and other retail stores (67% vs 58%). A higher percentage of respondents with a lower income voluntarily wore a mask at all locations studied with the exception of the gym, workplace and school when compared to those with a higher income. A higher percentage of respondents without college degrees voluntarily wore a mask at an in person religious service (57%) or a clothing store (63%) when compared to those with a college degree or higher 46% and 54%, respectively. A higher percentage of respondents without children voluntarily wore a mask at a retail store other than grocery clothing or home improvement store (65%) when compared to those with children (57%). For all locations with the exception of the workplace, a higher percentage of people who were not in the high case/population states voluntarily wore a mask when compared to the high case/population states. When compared to the not high increase in

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COVID-19 states, a higher percentage of respondents in the high increase in cases states voluntarily wore a mask at the big box grocery store/supermarket (74% vs 60%), at the specialty grocery store (70% vs 57%), at the home improvement store (73% vs 56%), and at other retail stores (73% vs 60%) when compared to the not high increase in COVID-19 cases states.

Those who voluntarily wore a mask in a big box grocery store/supermarket indicated a higher mean level of impact of COVID-19 on their daily activities outside of work (3.90), their ability to buy paper products (3.66), and their ability to find meat, milk, and perishable grocery items when compared to those who did not voluntarily wear a mask, 3.65, 3.66, and 2.96 respectively (Table 3). A higher mean impact score for their daily activities outside of work/school and ability to buy paper products was found for those who voluntarily wore a mask at a specialty grocery store (4.05 and 3.69) when compared to those who did not (3.71 and 3.47). Those who voluntarily wore a mask at the gym, a restaurant, a clothing store, or other retail store all had higher COVID-19 impact scores for their daily activities outside of work/school. The impact score for ability to buy paper products was higher for those who voluntarily wore a mask at a home improvement store (3.63) when compared to those who did not (3.39). For those who voluntarily wore a mask at their workplace, the COVID-19 impact score for activities related to their work/school (4.07) was higher than those who did not voluntarily wear a mask (3.74).

A higher percentage of those who voluntarily wore a mask at a big box grocery store (85%), a specialty grocery store/supermarket (83%), a home improvement store (83%) or other retail store (82%) also selected that they agreed with the statement *masks help prevent me from getting COVID-19* when compared to those who did not voluntarily wear a mask (Table 4). A higher percentage of respondents who voluntarily wore a mask at the locations studied with the exception of gym, workplace and school, agreed with the statement *masks help prevent me from*

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getting COVID-19 when compared to those who did not voluntarily wear a mask. Similarly, a higher percentage of respondents who voluntarily wore a mask at the locations studied with the exception of gym, and workplace agreed with the statement *masks help prevent me from spreading COVID-19*. For all locations studied, a higher percentage of respondents who voluntarily wore a mask agreed with the statement *masks will help prevent future lock-down*. For the statement *there is social pressure in my community to wear a mask*, lower percentages of respondents who voluntarily wear a mask at big box grocery store/supermarkets, specialty grocery stores, home improvement stores, restaurants, and other retailers agreed when compared to those not voluntarily wearing a mask. A lower percentage of respondents who voluntarily wear a mask at big box grocery stores/supermarkets (6%) or restaurants (5%) agreed with the statement *masks do not prevent the spread of COVID-19* when compared to those who did not voluntarily wear a mask, 10% for both. A lower percentage of respondents who voluntarily wore a mask at a big box grocery store/supermarket (5%), a home improvement store (5%) or other retailer (6%) agreed with the statement *masks have negative health consequences for the mask wearer* when compared to those who did not 11%, 11% and 12% respectively.

Considering the logit models predicting the probability of voluntary mask wearing, as income increased, the probability of wearing a mask at an in person religious service (-0.060), a big box grocery store/supermarket (-0.035), a specialty grocery store (-0.034), a home improvement store (-0.023), a restaurant (-0.043), a school (-0.057), a clothing store (-0.048), or other retailers (-0.039) all decreased (Table 5). Being from a high increase in cases state increased the probability of voluntarily wearing a mask at an in person religious service (0.125), a big box grocery store/supermarket (0.121), specialty grocery store (0.108), home improvement store (0.140), clothing store (0.087), or other retailer (0.101). Being from a high COVID-19 case

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per population state decreased the probability of wearing a mask at a big box grocery store (-0.197), a specialty grocery store (-0.225), a gym (-0.279), a home improvement store (-0.240), a school (-0.200), a clothing store (-0.213), or other retail stores (-0.221). As the COVID-19 impact score on activities outside of work/school increased, the probability that the respondent voluntarily wore a mask at a big box grocery store (0.025), a specialty grocery store (0.039), a restaurant (0.042), or other retail store (0.027) increased. As the COVID-19 score for impact on ability to buy paper products increased, the probability that the respondent wore a mask at an in person religious service (0.076), big box grocery store/supermarket (0.024), home improvement store (0.028), school (0.063), or clothing store (0.042) increased. Agreement that *masks help prevent me from getting COVID-19* increased the probability the respondent wore a mask at a big box grocery store (0.098), home improvement store (0.101), restaurant (0.095), or other retail store (0.108). Agreeing with the statement *masks help prevent me from spreading COVID-19* increased the probability of wearing a mask at an in person religious service (0.151), big box grocery store (0.145), specialty grocery store (0.124), home improvement store (0.118), restaurant (0.126), clothing store (0.120), or other retail store (0.135). Agreement that masks will prevent future lock-downs increased the probability that the respondent wore a mask at all locations studied. The probability that the respondent voluntarily wore a mask at an in person religious service (-0.172), big box grocery store (-0.119), specialty grocery store (-0.142), home improvement store (-0.127), restaurant (-0.156), clothing store (-0.111), or other retail location (-0.131) decreased if the respondent agreed with the statement *there is social pressure in my community to wear a mask*. Agreeing with the statement *masks do not prevent the spread of COVID-19* decreases the probability the respondent wears a mask to the gym (-0.240), or a restaurant (-0.197).

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Discussion

Voluntary mask wearing is socially and culturally complicated, and a variety of measurement and reporting issues arise that further complicate analysis of mask wearing behaviors. Voluntary mask wearing varied by demographics and the specific location in question. In order to voluntary wear a mask in a given location, the respondent had to visit that location, which was accounted for explicitly in the data collection and analysis. Yet, the potential exists that particularly concerned citizens and/or those with high-risk family members or young children who may be more likely to wear a mask did not venture to various public places studied, even after restrictions were lessened or eliminated. Media stories have highlighted the lack of return to dining out, for example, even when restaurants are allowed to legally reopen in different geographical regions (Pinsker, 2020). Thus, while mask wearing compliance and behavior was of primary focus of the analysis, other behaviors such as social distancing, staying home as much as possible, avoiding public places, limiting trips, and other more conservative practices are necessarily 'at odds' with mask wearing in public behavior since in order to wear a mask in public, the individual must have ventured into public.

Greater levels of self-reported impact on daily activities due to COVID-19 were reported among those who wore masks voluntarily in the public places studied. It was to be expected that those who reported more directly experienced negative consequences responded by taking actions themselves. Past studies have identified one's own experiences to influence probability of taking action to safeguard against illness. For example, experiencing influenza exposure in the past increased the likelihood of vaccination acceptance in an experimental study (Ibuka et al., 2014). Josef Woodman, CEO of Patients Beyond Borders recently stated "It's much harder for

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Americans to grasp the widespread harm a pandemic can cause, making them less enthusiastic about group sacrifices that can curb the disease.". In the recent Politico article in which he pointed out the recent dodging of pandemics by the U.S. or relatively light impacts of those which did arrive on U.S. soil (Kim, 2020). Lack of dire consequences seen first-hand in other nations, in particular Asian countries who now readily embrace mask wearing, may aid in explaining why U.S. residents do not subscribe as readily to taking individual actions to prevent societal harm.

While personal negative experiences being related to future protective measures is expected, the impacts of social pressure and/or voluntary mask wearing for the protection of others, and not in response to one's own personally incurred costs, is much more complicated. There was a decrease in the probability that a respondent wore a mask to a variety of public places if they agreed that there was social pressure to do so, fundamentally reflecting 'pushing back' against social pressures to wear masks. This rebellion against mask wearing is fodder for debate in mass media. Masks are not worn for a variety of reasons in the U.S. such as seeing mask mandates as an attack on freedom, believing masks make them look weak, believing (incorrectly) masks cut off oxygen supply, or simply finding masks uncomfortable (Kim, 2020). These viewpoints differ when compared particularly to Asian countries where mask wearing is more commonly believed to be part of civic obligation in public health (Kim, 2020).

Arguments about individual rights and unconstitutional restrictions during COVID-19 indeed point to the will of individuals to continue on with chosen practices or behaviors, unfettered by public health restrictions. The Supreme Court rejected, 5 to 4, a request from a church to block enforcement of restrictions on attendance at religious services by the state (Liptak, 2020). A Pew Research Center study found that 79% of Americans believed that

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religious houses of worship should be required to follow the same social distancing and gathering rules as other organizations or businesses in the same geography, whereas the other 19% believed that they should be offered more flexibility (Pew Research Center, 2020). While the specific location, such as a church versus a grocery store, may impact views, the conversation about putting one's individual preferences ahead of public health needs remains heated and heavily rooted in cultural expectations. Individualism is proposed as one of the reasons that the U.S. is among the few developed countries in the world without a universal health care system, proposed Josef Woodman, CEO of Patients Beyond Borders in a Politico article (Kim, 2020).

Regression analysis has provided evidence, in response to hypothetical scenarios presented to subjects, that altruism, free riding, and bandwagoning were significant motivators in the decision to undergo vaccination (Hershey et al., 1994). Interestingly, that same study found that "Frames stressing the opportunity to free ride increase free riding. Frames stressing altruism do not increase altruism. If generalizable to other settings, these results suggest that public health programs to increase vaccine usage should stress high vaccination rates." (Hershey et al., 1994). Given the finding that the probability of voluntary mask wearing decreased as respondents reported social pressure around mask wearing suggests similarities to framing and presentation of public health programs as those seen in studying vaccination. Social pressure, while working in other regions of the world with a more established mask wearing practice, appears counterproductive. Taken together with past findings about encouraging vaccination, perhaps presentation of high compliance rates in mask wearing would serve public health better than shaming or attempts to convince the public of altruistic aspects of the practice.

Decision making about personal health actions have been shown to be affected by the choices of others. Vaccination produces the externality of reducing transmission of a disease, and

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can thus provide incentives for others to free-ride on the benefits while not incurring the costs of vaccination themselves (Ibuka et al., 2014). Evidence has been found that altruism, free riding, and bandwagoning were significant motivators for vaccination acceptance against a contagious disease in a hypothetical research study setting (Hershey et al., 1994). In contrast, empirical evidence of vaccination creating peer-pressure rather than free-riding has been found by other researchers in a discrete choice experiment setting (Verelst et al., 2018). Vaccination is not the only health practice to which free-riding, altruism, and bandwogoning behaviors can be hypothesized; washing of hands, various hygiene practices, wearing of facial coverings (masks), and isolating oneself from others when ill can all be considered through these lenses. Adherence to a vaccination protocol is hard to observe socially, but handwashing is more easily casually observed, albeit only while in the restroom or near handwashing facilities. Whether one chooses to isolate themselves when ill to prevent spread to others may be too extreme, as the individual has knowledge of the potential consequences, as they are verifiably ill. But not washing one's hands properly or not wearing a mask when one feels well may indeed be subject to interpretation as to why one would seek to avoid such personal costs when the potential for personal and societal consequences are known. Dating back to 1847 with Dr. Ignaz Semmelweis in Vienna (Jarvis, 1994) handwashing is a known essential component of infection control (Drankiewicz & Dundes, 2003; Larson, 1988). Social pressure applied to hand washing behaviors in individuals have demonstrated varying influence, while organizational culture interventions have shown positive results (Larson, 1988).

Interestingly, Mah et al. (2006) suggested that hand hygiene non-adherence is better addressed by social marketing than by education or policy (Mah et al., 2006). Whitby et al. (2007) highlights the self-interest consideration to motivate hand-hygiene practices (Whitby et

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al., 2006). Wilson et al. (2011) summarize Rothschild (2000) with respect to management of social issue and public health behaviors as, “In Rothschild's view, the primary benefit to one's self – the key motivator in most situations – is often vague, uncertain, and in the distant future with public health issues. Rather than education, a social marketing approach encompassing free choice, apathy, and inertia is necessary for managing public health behavior.” (Wilson et al., 2011; Rothschild, 2000). Wilson et al. (2011) conclude, with respect to hand washing behavior, “Social marketing approaches that tailor intervention messaging to an audience's beliefs, values, and unique knowledge levels should also be considered.” (Wilson et al., 2011). Thus, in order to craft meaningful social marketing, we must first understand the audience’s beliefs, values, and knowledge; arguably any given population will have multiple audiences to be considered, with varying starting points with respect to knowledge or varying viewpoints on the topic.

Conclusions and Implications

Overarching conceptually to this analysis is the notion that individual behaviors have spillover effects to public health outcomes, in addition to (potentially) influencing an individual’s personal health. Free-riding behavior was observed quite readily in the sense that U.S. residents reported a belief that masks have a role in society in responding to the COVID-19 pandemic crisis, yet those same individuals reported not wearing masks in various public places. Admittedly, free-riding is only one possible explanation for this finding, which applies in the sense that respondents believe that there is a role for masks, but that the role did not extend to them as individuals in all of the public places studied and/or at all times. Alternative explanations include incorrect or incomplete knowledge about suggested mask wearing in public which could lead to a mis-match in reporting that they indeed believe that masks have a role in the public health

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response but that they legitimately did not understand what that role was suggested to be at the time data was collected. Alternatively, it is possible that individuals viewed specific locations, such as religious gatherings, as exempt in some way and/or that they prefer to avoid mask waring in some locations (i.e. gyms) due to personal comfort or preference, although they still agree that masks have a role in other places.

Mask wearing (or lack thereof) in public is visually observable and thus a practice that is easily socially responded to through shaming, ostracizing, or positive recognition. In contrast to the readily observed mask wearing, hand washing after using the restroom is observable only to those present in the restroom for that short period of time and vaccination decisions are not readily observable to a casual passerby. Even though mask wearing is easily observed we do not find evidence of bandwagoning behavior in the sense that respondents do not seem to respond positively to social pressures in their community to wear masks by an increase in mask wearing. In fact, a decrease in the probability of voluntary wearing was discovered. There are a variety of reasons why social pressure may not yield positive changes in behavior, including fear in the U.S. surrounding such pressure due to violence in response to masks, including physical violence against, and even the killing of, those attempting to apply pressure on others in national news events, who are often retail workers (MacFarquhar, 2020). Some evidence of altruism in mask wearing was found as individuals who self-reported beliefs that mask wearing could help others and their communities reported greater voluntary wearing personally. Shim et al. (2012) incorporated altruism into game-theoretic models of vaccination for influenza and conclude that promoting altruism could be a potential strategy to improve public health outcomes (Shim et al., 2012). Given the negative finding surrounding the use of social pressure and positivity associated

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with altruism, this analysis lends support the notion that altruism promotion may be a potential strategy to improve voluntary mask wearing.

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Table 1. Demographics for respondents who reported masks have a role in U.S. society to prevent viral spread and those who do not.

	Do masks have a role in U.S. society to prevent viral spread	
Demographic Variable	**Yes n=996**	**No n=202**
Gender		
Male	47	51
Female	53	49
Age		
18-24	10	10
25-34	17Ψ	24Ψ
35-44	16	19
45-54	18	21
55-65	17	16
65 +	22Ψ	9Ψ
Income		
$0-$24,999	22Ψ	33Ψ
$25,000-$49,999	25	26
$50,000-$74,999	18	18
$75,000-$99,999	13	13
$100,000 and higher	21Ψ	9Ψ
Education		
Did not graduate from high school	3	3
Graduated from high school, Did not attend college	27Ψ	37Ψ
Attended College, No Degree earned	23	29
Attended College, Associates or Bachelor's Degree earned	33Ψ	22Ψ
Attended College, Graduate or Professional Degree earned	14Ψ	9Ψ
Region of residence		
Northeast	20 Ψ	11 Ψ
South	38	44
Midwest	21	24
West	21	21
State COVID status		
High number of cases	68	63
High number of cases by population	15	12
High increase in cases	21 Ψ	28 Ψ

ΨIndicates the percentage or mean of respondents who indicated there had children in their household and those that did not is statistically different at the <0.05 level

[1]Indicated on a scale from 1 (strongly disagree) to 5 (strongly agree).

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Table 2. Percent (%) of respondents who reported that masks have a role in U.S. society in response to COVID-19 who can and do visit various public locations and voluntarily wear a mask. N given in table and specific to each location.

	Voluntarily wears a mask	Gender		Income		Education		Child Status	
		Female	Male	Lower[3]	Higher	No college	College or more	No Kids	Kids
In person religious service	52ab[1,2] N=325	54 N=137	51 N=188	58 †Ψ N=151	47Ψ N=174	57†Ψ N=176	46Ψ N=149	51 N=202	54 N=123
Big box grocery store/supermarket	63c† N=884	69†Ψ N=460	57†Ψ N=424	69 †Ψ N=400	59†Ψ N=484	64† N=459	62† N=425	64† N=624	61† N=260
Specialty grocery store	59cd† n=655	66†Ψ N=333	53Ψ N=322	65 †Ψ N=289	55†Ψ N=366	62† N=335	57† N=320	61† N=449	57† N=206
Gym	49ae N=236	52 N=91	48 N=145	54 N=100	46 N=136	53 N=128	44 N=108	45 N=139	55 N=97
Home improvement store	60cf† n=729	65†Ψ N=363	55†Ψ N=366	65 †Ψ N=317	56†Ψ N=412	62† N=364	58† N=365	61† N=520	56† N=209
Restaurant	51a N=525	54 N=248	49 N=277	57 †Ψ N=232	47Ψ N=293	55† N=273	48 N=252	52 N=362	50 N=163
Workplace	42e† n=463	43† N=210	41† N=253	44 † N=200	40† N=263	43† N=248	41† N=215	40† N=289	45 N=174
School	56abc† n=199	65†Ψ N=80	50Ψ N=119	63 † N=89	50 N=110	61† N=105	50 N=94	59† N=104	53 N=95
Clothing store	59bdf† n=578	64†Ψ N=284	54†Ψ N=294	66 †Ψ N=172	53Ψ N=318	63†Ψ N=323	54Ψ N=255	59† N=386	58† N=192
Retail store other than grocery, clothing, or home improvement	62cf† n=754	67†Ψ N=374	58†Ψ N=380	68 †Ψ N=347	58†Ψ N=407	64 † N=400	60† N=354	65†Ψ N=525	57†Ψ N=229

[1]Percentage of respondents who said no for each category was dropped for brevity.

†Indicates the percentage who said yes is statistically different than the percentage that said no.

[2]Matching lowercase letters indicates the percentage is the same down the column. For example the percentage who voluntarily wear a mask in an in person religious service is equal to the percentage who voluntarily wear a mask to the gym, but statistically different from the percentage who wear a mask in a big box grocery store/supermarket.

ΨIndicates the percentage of respondents within the category are statistically different for that location. For example, the percentage of woman who voluntarily wore a mask in a big box grocery store/supermarket is statistically different than the percentage of men.

[3]Lower income is defined as $49,999 or less, higher income is defined as $50,000 or greater.

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Table 3. Mean reported level of impact from COVID-19 on activities compared between those who voluntarily wear a mask and do not voluntarily wear a mask at specific locations. Impact scale was from 1(not impacted) to 5(impacted). N given in table.

	Voluntarily wears mask	Your daily activities outside of work/school	Ability to buy paper products (e.g., toilet paper, paper towels)	Ability to find meat, milk, and perishable grocery items	Activities related to your work/school
In person religious service	Yes n=170	3.88 (1.43)			
	No n=155	3.80 (1.33)			
Big box grocery store/supermarket	Yes n=559	3.90Ψ (1.42)	3.66Ψ (1.34)	3.17Ψ (1.39)	
	No n=325	3.65Ψ (1.41)	3.41Ψ (1.33)	2.96Ψ (1.38)	
Specialty grocery store	Yes n=390	4.05Ψ (1.38)	3.69Ψ (1.38)	3.23 (1.44)	
	No n=265	3.71Ψ (1.32)	3.47Ψ (1.30)	3.07 (1.34)	
Gym	Yes n=116	4.01Ψ (1.35)			
	No n=120	3.65Ψ (1.35)			
Home improvement store	Yes n=437	3.88 (1.44)	3.63Ψ (1.36)		
	No n=292	3.68 (1.39)	3.39Ψ (1.35)		
Restaurant	Yes n=270	3.95Ψ (3.95)			
	No n=255	3.62Ψ (1.38)			
Workplace	Yes n=195				4.07Ψ (1.45)
	No n=268				3.74Ψ (1.55)
School	Yes n=111				4.09 (1.40)
	No n=88				3.90 (1.29)
Clothing store	Yes n=341	3.93Ψ (1.43)			
	No n=237	3.59Ψ (1.38)			
Retail store other than grocery, clothing, or home improvement	Yes n=471	3.93Ψ (1.43)			
	No n=283	3.61Ψ (1.34)			

ΨIndicates the mean response for the statement is statistically different between those who voluntarily wear a mask and that location and those who do not. For example the mean response that COVID-19 impacted the respondent's daily activities outside of work/school was greater for those who voluntarily wore a mask at a big box grocery store/supermarket when compared to those who do not voluntarily wear a mask at that location.

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Table 4. Comparison of agreement with mask-related statements between respondents who do and do not voluntarily wear a mask. N given in the table and specific for each specific location.

	Voluntarily wears mask	Masks help prevent the spread of COVID-19	Masks help prevent me from getting COVID-19	Masks help prevent me from spreading of COVID-19	Masks will help prevent future lock-downs	There is social pressure in my community to wear a mask	Masks do not prevent the spread of COVID-19	Masks have negative health consequences for the mask wearer
In person religious service	Yes n=170	74	60Ψ	73Ψ	58Ψ	28	8	11
	No n=155	71	46Ψ	59Ψ	39Ψ	36	10	13
Big box grocery store/supermarket	Yes n=559	85Ψ	67Ψ	80Ψ	60Ψ	25Ψ	6Ψ	5Ψ
	No n=325	73Ψ	50Ψ	65Ψ	46Ψ	34Ψ	10Ψ	11Ψ
Specialty grocery store	Yes n=390	83Ψ	66Ψ	79Ψ	62Ψ	27Ψ	6	6
	No n=265	75Ψ	54Ψ	66Ψ	49Ψ	37Ψ	9	10
Gym	Yes n=116	75	58	65	63Ψ	33	7	10
	No n=120	68	48	66	42Ψ	30	12	15
Home improvement store	Yes n=437	83Ψ	66Ψ	79Ψ	61Ψ	26Ψ	7	5Ψ
	No n=292	74Ψ	51Ψ	67Ψ	48Ψ	35Ψ	10	11Ψ
Restaurant	Yes n=270	78	66Ψ	77Ψ	61Ψ	26Ψ	5Ψ	8
	No n=255	74	51Ψ	63Ψ	45Ψ	36Ψ	10Ψ	12
Workplace	Yes n=195	74	59	73	61Ψ	32	12	88
	No n=268	72	51	64	43Ψ	29	8	11
School	Yes n=111	69	56	64Ψ	62Ψ	31	12	14
	No n=88	64	49	48Ψ	37Ψ	27	11	9
Clothing store	Yes n=341	79	63Ψ	76Ψ	58Ψ	29	7	9
	No n=237	73	52Ψ	63Ψ	43Ψ	35	9	10
Retail store other than grocery, clothing, or home improvement	Yes n=471	82Ψ	66Ψ	78Ψ	58Ψ	26Ψ	7	6Ψ
	No n=283	72Ψ	49Ψ	64Ψ	44Ψ	36Ψ	10	12Ψ

ΨIndicates the percentage of respondents is statistically different between those who voluntarily wear a mask and those who do not voluntarily wear a mask and agree with the stamen regarding mask wearing. For example a higher percentage of respondents who voluntarily wear a mask at in person religious services believe that masks help prevent me from getting COVID-19 when compared to those who do not voluntarily wear a mask.

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Table 5. Estimated marginal effects (from logit models) of respondent demographics, self-reported COVID-19 impacts, and beliefs regarding masks on voluntary mask wearing in 10 public locations. N given in table and specific to each location based on the number of respondents voluntarily wearing masks to that location.

Explanatory Variables / **Public Location**	Household income	High case state	High increase in cases state	High case per pop. state	COVID-19 impact on activities outside of work/ school	COVID-19 impact on Ability to buy paper products	Masks help prevent the spread of COVID-19	Masks help prevent me from getting COVID-19	Masks help prevent me from spreading of COVID-19	Masks will help prevent future lock-downs	There is social pressure in my communit y to wear a mask	Masks do not prevent the spread of COVID-19
	Marginal Effect (SE)											
In person religious service n=325	-0.060**	0.007	0.125*	-0.078	-0.021	0.076**	-0.074	0.060	0.151*	0.223***	-0.172**	0.136
	(0.022)	(0.067)	(0.072)	(0.087)	(0.024)	(0.026)	(0.071)	(0.064)	(0.067)	(0.063)	(0.066)	(0.104)
Big box grocery store/ supermarket n=884	-0.035**	-0.021	0.121**	-0.197***	0.025*	0.024*	0.064	0.098**	0.145**	0.068*	-0.119**	-0.066
	(0.012)	(0.038)	(0.040)	(0.051)	(0.013)	(0.013)	(0.047)	(0.0378	(0.043)	(0.038)	(0.040)	(0.070)
Specialty grocery store n=655	-0.034**	-0.008	0.108**	-0.225***	0.039**	0.019	0.039	0.056	0.124**	0.101**	-0.142**	-0.068
	(0.013)	(0.047)	(0.049)	(0.056)	(0.016)	(0.016)	(0.055)	(0.045)	(0.050)	(0.046)	(0.046)	(0.082)
Gym n=236	-0.033	-0.039	-0.007	-0.279**	0.041	0.034	-0.024	0.038	-0.129	0.267***	-0.038	-0.240**
	(0.024)	(0.077)	(0.082)	(0.097)	(0.029)	(0.030)	(0.083)	(0.075)	(0.078)	(0.074)	(0.079)	(0.104)
Home improvement store n=729	-0.023*	-0.002	0.140**	-0.240***	0.012	0.028*	0.055	0.101**	0.118**	0.078*	-0.127**	-0.018
	(0.013)	(0.043)	(0.054)	(0.056)	(0.014)	(0.015)	(0.052)	(0.042)	(0.047)	(0.043)	(0.044)	(0.074)
Restaurant n=525	-0.043**	0.008	0.075	-0.112	0.042**	0.003	-0.062	0.095*	0.126**	0.158**	-0.156**	-0.197**
	(0.016)	(0.052)	(0.055)	(0.070)	(0.018)	(0.018)	(0.059)	(0.050)	(0.053)	(0.051)	(0.050)	(0.084)
Workplace n=463	-0.019	0.070	0.097	-0.074	0.013	0.019	-0.050	0.030	0.048	0.164**	-0.000	0.073
	(0.017)	(0.051)	(0.059)	(0.070)	(0.020)	(0.020)	(0.059)	(0.052)	(0.054)	(0.051)	(0.053)	(0.083)
School n=199	-0.057**	0.026	0.095	-0.200*	-0.024	0.063*	-0.015	-0.047	0.106	0.225**	-0.007	-0.052
	(0.026)	(0.084)	(0.089)	(0.115)	(0.034)	(0.037)	(0.086)	(0.083)	(0.085)	(0.079)	(0.086)	(0.125)
Clothing store n=578	-0.048**	0.011	0.087*	-0.213**	0.025	0.042**	-0.002	0.046	0.120**	0.125**	-0.111**	-0.056
	(0.015)	(0.048)	(0.051)	(0.064)	(0.016)	(0.017)	(0.055)	(0.047)	(0.051)	(0.048)	(0.048)	(0.084)
Retail store other than grocery, clothing, or home improvement n=754	-0.039**	0.007	0.101**	-0.221***	0.027*	0.023	0.037	0.108**	0.135**	0.100**	-0.131**	-0.066
	(0.013)	(0.042)	(0.044)	(0.056)	(0.014)	(0.015)	(0.049)	(0.041)	(0.040)	(0.041)	(0.043)	(0.073)

Note from top to bottom pseudo R squared is: 0.1037, 0.0952, 0.0883, 0.0967, 0.0871, 0.0823, 0.0446, 0.1008, 0.0885, 0.0959

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Social Pressure, Altruism, Free-Riding, and Non-Compliance in Mask Wearing by U.S. Residents in Response to COVID-19 Pandemic

By Courtney Bir[1] and Nicole Olynk Widmar[2]

[1] Oklahoma State University
Dept. of Agricultural Economics
529 Ag Hall
Stillwater, OK 74078
405-744-9813
courtney.bir@okstate.edu
ORICID 0000-0003-0862-8241

[2] Purdue University
Dept. of Agricultural Economics
403 West State Street
West Lafayette, IN 47907
765-494-2567
nwidmar@purdue.edu
ORICID 0000-0002-6574-5295

* Corresponding author: nwidmar@purdue.edu

Keywords: altruism; human behavior; mask wearing; public health; resource allocation

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