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Divergent Attitudes Regarding the Benefits of Face Masks in Aviation Colleges and Universities

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Opinions and practices regarding face masks (FM) to attenuate COVID-19's spread remains polarized across the United States. We examined whether these attitudes extend to the aviation collegiate community. A 14-question survey was sent to 90 aviation colleges and universities throughout the country. Responses were solicited from students, faculty, and staff. Of the 598 respondents, 77% were students, 13% were faculty, and 10% were staff. Pilots comprised 66% of the respondents. A Principal Component Analysis reduced the questions to two scales: Benefits and Inconvenience. Females, non-pilots, and older respondents reported greater benefits to wearing a FM and fewer inconveniences. A multiple regression showed aviation colleges and universities located in states which had FM mandates, higher likelihood of community compliance, lower rates of COVID-19 in their state, and reports of less inconvenience predicted attitudes of greater benefits of wearing a FM. Additional comments were provided by 28% of the respondents, showing strongly polarized attitudes about the benefits of FMs. Respondents who had negative attitudes about the benefits of wearing FMs, nevertheless reported compliance on college campus. As leaders in education, collegiate aviation has a responsibility to educate their students, faculty, and staff of the importance of public health measures, dispelling misinformation, and modelling behavior to increase compliance with wearing FMs.

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The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes the pandemic disease COVID-19. This highly contagious novel coronavirus arrived in the United States (US) in January 2020. In February 2021, there were over 28.3 million confirmed cases and over 500,000 deaths in the US. (The New York Times [NYT], 2021). The pandemic has also resulted in severe societal, economic, and political disruptions globally and domestically (Reiner et al., 2021).

The U.S. Food and Drug Administration (FDA) issued the first emergency use authorization for a vaccine for the prevention of COVID-19 in people 16 years of age and older in December 2020 (FDA, 2020). Vaccine approval occurred after this study was conducted. Nevertheless, despite the rapid development of vaccines, all public health measures recommended by the World Health Organization (WHO) and U.S. Department of Health and Human Services' Centers for Disease Control (CDC) remain in effect at the time of this writing (CDC, 2021).

Vaccines, therapeutics, and non-pharmaceutical interventions provide layers of protection against the pandemic. The latter measures include wearing a face mask (FM), frequent hand washing, cleaning surfaces, social distancing (e.g., keeping 6 feet apart, avoiding crowds), and frequent testing and contact tracing. These recommendations evolved since the start of the pandemic with varying adherence patterns (CDC, 2021; WHO, 2021). Wearing FMs is a simple, effective technique, with few economic and social consequences, yet it has divided the US socially and politically (Kessel & Quinn, 2020). The purpose of this study was to examine attitudes about FMs among US aviation colleges and universities.

Transmission

According to WHO (2021) and CDC (2021), the pathogens are spread from an infected person's mouth or nose in liquid particles, ranging from larger respiratory droplets to smaller aerosols, when they talk, cough, sneeze, sing, or breathe heavily. Infections occur when the virus gets into another person's mouth, nose, or eyes, which is more likely to happen when people are in close contact; in indoor, crowded and inadequately ventilated spaces; when infected people spend more than 15 minutes with others; or when people touch contaminated surfaces and then their faces without cleaning their hands first (CDC, 2021; Nishiura et al., 2020; WHO, 2021).

Transmission of the disease occurs in the symptomatic phase, pre-symptomatic phase and among asymptomatic cases (Buitrago-Garcia et al., 2020; Furukawa, Brooks & Sobel, 2020). The CDC (2021) reports that about half of new infections come from people who are unaware they are infectious. Some transmission has occurred when enough airborne virus remains in the area to cause infections in others who are further away than 6 feet or pass through the space shortly afterwards (Burnett & Sergi, 2020).

Unlike most commercial aircraft that have sophisticated air filtration systems (American Airlines, 2020; Janzen, 2020), general aviation trainers do not. Pilots in general aviation trainer cockpits will be in an indoor setting; usually for long periods; sitting closer together than 6 feet; and frequently touching several surfaces throughout the flight. Similarly, traditional college classes are usually held in indoor spaces for long time periods. The risks of morbidity and mortality increases with older age, minority ethnic status, lower socio-economic status, and males (CDC, 2021). Pilots tend to be male (CAPA, 2018; Twombly, 2019); many students tend to be younger and have less income than faculty and staff (Semega, Kollar, Shrider, & Creamer, 2020). Thus, the major sub-populations in collegiate aviation are represented in several risk categories for contracting COVID-19.

Prevention

To target the transmission of COVID-19 by respiratory droplets, FMs that cover the nose and mouth are among the recommendations of public health authorities worldwide (WHO 2021, CDC 2021). There is a large body of research, based on a variety of methodologies that demonstrate the effectiveness of FMs to reduce the transmission of respiratory viruses, including SARS-CoV-2 (Burnett & Sergi, 2020).

Sharma, Mishra, and Mudgal (2020) searched a variety of databases on the effectiveness of homemade FMs. They found that the effectiveness of cloth FMs' filtration varied, depending on the type of material, number of layers, fit, and amount of moisture in the FM.

Scheid, Lupien, Ford, and West , (2020) found that the physiological effects of wearing FMs for prolonged periods of time, including special considerations, such as during exercise or for those with pre-existing, chronic diseases do not appear to cause any harmful physiological alterations. Dattel, O'Toole, Lopez, and Byrnes(2020) found that Instructor Pilots suffered no respiratory health effects or issues with the safety of flight. They were slightly more comfortable wearing cloth than paper FMs at simulated altitudes of 5000 feet (Dattel et al., 2020). Over time, the pilots found the nuisance of wearing FMs decreased (Dattel & Agha, Unpublished Manuscript).

Airplane cockpit and classroom settings require several new modifications, restrictions, and procedures to comply with public health measures to reduce the spread of COVID-19. FMs to reduce the spread of respiratory droplets and aerosols therefore remain a vital preventive measure against infections in collegiate aviation programs.

Attitudes

Haischer et al. (2020) observed shoppers (n = 9,935) entering retail stores in the summer of 2020. They found that those wearing FMs were older, 1.5 times more likely to be female, and about four times more likely to be in an urban or suburban setting. In June 2020, 41% of the sample wore a FM, but when FM mandates were enacted in July and August, compliance increased to over 90%. Several other studies have supported the relationship between demographics and FMs (Jarry, 2020; Kessel & Quinn, 2020; Scheid et al., 2020). Wearing FMs is also associated with attitudes, social, and psychological factors about as often as understanding

the physical benefits of doing so. These authors also note that FM mandates appear to be effective in increasing compliance (Jarry, 2020).

Public health messages may impact compliance regarding FMs. At first, there was a delay in recommending FMs, with WHO making this recommendation in early June 2020 and CDC some weeks later. WHO initially recommended that only people who were sick, or who were caring for people suspected of having COVID-19, should wear FMs. The CDC informed the public that cloth face coverings would slow the transmission of the virus, but they are not as effective as surgical or N95 FMs, which in any case, should be reserved for health care workers who are at higher risk (Burnett & Sergi, 2020). These delays may have hampered the widespread adoption of FMs with a detrimental effect (Burnett & Sergi, 2020; Morawska et al., 2020). In the US, the messaging from top-level government officials has been inconsistent, further reducing compliance (Breslow, 2020).

Kessel and Quinn (2020) of the Pew Research Center noted that wearing FMs has divided the US. They conducted an online survey of 9,220 U.S. adults between August 31-September 7, 2020, using a national, random sampling of residential addresses that was weighted to be representative of the US adult population by gender, race, ethnicity, partisan affiliation, education, and other categories. Respondents were asked to describe how their lives have been made difficult or challenging since the beginning of the pandemic. Overall, 14% of U.S. adults mentioned "face mask" when asked about the impacts of COVID-19. "Face mask" tied with "friend" as the fourth most common word mentioned, after "family" and "work", which were each mentioned by 19% of the public.

Katz, Sanger-Katz, and Quealy (2020) examined the entire US at the county level to find the likelihood of encountering five people wearing a FM when going outside one's home, based on self-reports of how often people wore them. They noted that encountering others wearing FMs varies greatly by state and county, as well as over time. Again, political affiliation appeared to be associated with the likelihood of wearing FMs.

It is well established that many factors influence the correlation between attitudes and behaviors, but it is generally accepted that specific attitudes will predict specific behaviors (Frymier & Nadler, 2017). Scheid et al., (2020) noted that the potentially life-saving benefits of wearing FMs outweigh the discomforts. However, controversy over FM wearing in the US continues. Psychological factors may explain attitudes and behaviors regarding wearing FMs, unrelated to physical impacts or public health explanations. Scheid et al. (2020) discussed three basic psychological needs including: competence where people (more often men) wish to avoid appearing to be fearful or weak by wearing a FM; autonomy, where people who want the freedom to make their own decisions feel forced to comply with authorities; and, relatedness or the need to be part of an "in-group," such as belonging to a political party.

Jarry (2020) notes that many studies report the trends of elderly people, women, more educated individuals, and certain minorities being more likely to wear a FM and wash their hands. Jarry (2020) discussed five sets of reasons that are commonly provided for not wearing FMs and offered some remedies. The most common reasons are:

- Medical, like difficulty breathing, which are incorrect (Dattel et al., 2020). Addressing misinformation is a solution.
- FMs can make people--particularly men--feel negatively about themselves, like looking weak. A remedy is to avoid shaming.
- Distorting science or pseudoscience, such as saying that COVID-19 is no worse than the flu. A remedy is to address representative heuristic fallacy.
- Reactance or balking at a perceived limit on personal freedom. Leading by example can be a remedy.
- Conspiracy theories, which are comforting during times of great social anxiety. A remedy is to address uncertainty.

Collegiate Aviation

Within state guidelines, colleges and universities have developed their own policies and communications systems for ensuring the safety of their students, faculty, and staff. For example, some schools require FMs indoors and outdoors, while others require FMs indoors only. Therefore, we expect behaviors and attitudes to wearing FMs among college students, faculty, and staff to vary, despite public health recommendations. To examine attitudes about FMs among US aviation colleges and universities we asked the following research questions:

- Do attitudes about wearing FMs differ by age?
- Do attitudes about wearing FMs differ by gender?
- Do attitudes about wearing FMs differ by status within the college/university (i.e., student, faculty, staff)?
- Do attitudes about wearing FMs differ by pilot status?
- Do attitudes about wearing FMs differ by state mandate?

Collegiate flight training faces specific challenges. The general aviation training aircraft and simulators were not designed with infection control in mind, so the spaces will necessarily exceed public health guidelines to prevent the spread of infection of limiting time spent inside, maintaining social distancing, providing excellent ventilation, etc. Those not wearing a FM would remove another layer of protection against COVID-19.

Methodology

Participants

Following Institutional Review Board approval (21-043), the survey request was emailed to all University Aviation Association (UAA) US points of contract (POC). There are approximately 90 UAA POCs in the US as a few institutions have more than one POC. Several POCs reportedly did not see the email requests. The POCs were requested to forward the Google Form questionnaire link to their students, faculty, and staff in each of the collegiate aviation programs. Responses were received from 598 (408 male, 148 female) people associated with 14 programs from November 20 - December 2, 2020, with 80% received during the first 5 days of this period.

Instrument

The survey contained 14 questions on attitudes to wearing FMs (see Appendix A). These questions had a 10-point response scale with only the poles labelled. The question items were generated by several researchers and independently validated by one faculty member and one staff member, who are experts in the collegiate aviation field. The question items were also tested by two samples of Pilot Instructors (n = 21 and n = 82). Additionally, a subset of these question items was tested in a subsequent study (Dattel et al., 2020). Demographic questions included age, gender, pilot status, faculty/staff status (student, faculty, staff), and institution name. About 28% of respondents chose to answer the open-ended comments section.

Data Preparation and Analyses

Because names or identifying information from respondents were not available to the researchers, we could not easily determine if respondents duplicated their submissions or if they saved their surveys often. Therefore, we eliminated individual responses with the same time stamps. Because faculty and staff constituted only about 13% and 10% of respective responses, we combined faculty and staff as one level of faculty/staff status with students being the other level.

Once two scales (Benefits and Inconvenience) were determined from a Principal Component Analysis (PCA), we conducted three mixed ANOVAs comparing the scales based on gender, pilot status, and faculty/staff status. We did not conduct multivariate factorial analyses on these demographic variables to preserve the independence of data because the same person could be represented twice in categories of gender, faculty/staff, and pilot status.

Other variables included policies (e.g., FM mandates) and environment (percentage of people wearing FMs in the community). The environment variable was based on a study by Katz et al. (2020), which reported how often a person would be likely to encounter five others wearing a FM by county. We identified the schools' counties and matched each respondent to the likelihood percentages reported by Katz et al. (2020).

Open-ended responses were reviewed independently initially, then together by the authors. Each response was categorized as positive, negative, or neutral attitudes to the benefits of wearing FMs. There were very few discrepancies, which were discussed where agreement was easily reached.

Results

The mean age of all respondents was 27.63 years (SD = 13.65). The median age of all respondents was 21. About 77% of the respondents were students (n = 462), 13% of the respondents were faculty (n = 75), and 10% of the respondents were staff (n = 61). Approximately 66% of the respondents identified as pilots. The mean age of the students was 22.58 years (SD = 6.90), staff was 38.64 years (SD = 14.76), and faculty was 49.81 years (SD = 16.52).

A PCA using Varimax (orthogonal) rotation showed 13 of the 14 questions loaded on two factors (see Table 1), which explained 63.84% of the total variance. Kaiser-Myer-Olkin was .926 and Bartlett's Test of Sphericity was significant $\chi^2(91) = 5618.87$, $p < .001$. The first factor, labeled *Benefits*, explained 51.7% of the variance, with a Cronbach's α of .94. The second factor, labeled *Inconvenience*, explained 12.15% of the variance, with a Cronbach's α of .88. See Table 2 for additional descriptive statistics.

Table 1
Principal Component Analysis of Face Mask Survey Factor loadings and Communalities (n = 598)

	Benefits	**Inconvenience**	**Communalities**
What is your current experience with wearing a face mask?	**.776**	-.279	.680
Does wearing a face mask help to prevent the spread of airborne illnesses like Covid-19 to others?	**.852**	-.324	.832
Does wearing a face mask protect you from catching an illness like Covid-19?	**.836**	-.221	.747
Does wearing a face mask cause decreases in O_2 saturation levels?	-.199	**.772**	.636
In general, do you feel that wearing a mask makes it harder to be heard when you talk?	-.363	**.700**	.621
Does wearing a face mask affect your comfort level?	-.446	**.657**	.631
Does wearing a face mask cause the user to inhale higher concentration of CO_2 than normal?	-.216	**.787**	.667
In general, how well does the face mask fit your face?	.407	-.012	.166
Does wearing a face mask restrict your physical movement (e.g., reaching, turning your head) in any way?	-.208	**.616**	.423
Does wearing a face mask cause you to become fatigued?	-.186	**.787**	.655
Should the college/university require students, faculty, and staff to wear face masks when INSIDE campus buildings?	**.835**	-.305	.790
Should the college/university require students, faculty, and staff to wear face masks when OUTSIDE campus buildings, but still on campus?	**.753**	-.330	.676
Does wearing a face mask make your body feel warmer/hotter?	-.123	**.717**	.530
Overall, do the advantages of wearing a face mask outweigh the disadvantages?	**.851**	-.440	.885
Eigenvalue	7.237	1.700	

Table 2
Descriptive Statistics of Face Mask Survey

	# of items	*M (SD)*	Skewness	Kurtosis
Benefits	6	6.67 (2.78)	-.49	-1.08
Inconvenience	7	5.07 (2.21)	.17	-.89

ANOVAs by College University Status/Pilot Status/Gender

From reducing the FM survey to two scales (Benefits and Inconvenience), we conducted ANOVAs and *t*-tests between gender, pilot status, and faculty/staff status (i.e., student; faculty and staff combined). A 2 (Scale) x 2 (Gender) mixed ANOVA showed a main effect for *Scale*, $F(1,596) = 112.71$, $p < .001$, partial $\eta^2 = .158$, a main effect for *Gender* $F(1,596) = 59.40$, $p < .001$, $\eta^2 = .041$, and an interaction $F(1, 596) = 33.27$, $p < .001$, $\eta^2 = .053$. Post hoc analyses, using a Bonferroni adjustment showed females reported greater *Benefits* than males and that females reported fewer *Inconveniences* than males (see Figure 1).

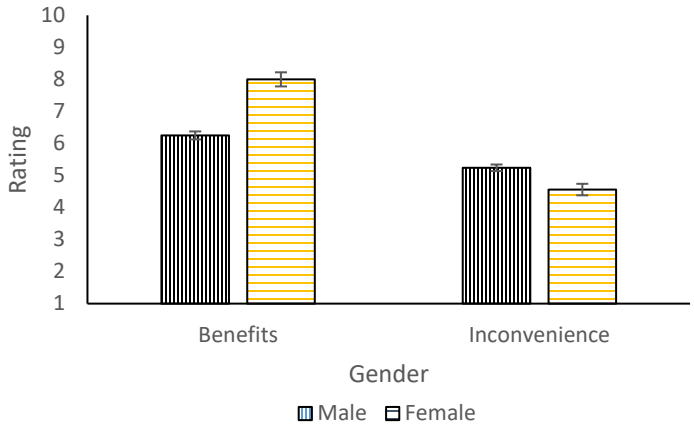

Figure 1. Ratings of Benefits and Inconveniences of Wearing a Face Mask by Gender

A 2 (Scale) x 2 (Pilot status) mixed ANOVA showed a main effect for *Scale*, $F(1,589) = 90.18$, $p < .001$, partial $\eta^2 = .133$, a main effect for *Pilot Status*, $F(1,589) = 21.22$, $p < .001$, $\eta^2 = .035$, and an interaction $F(1, 589) = 18.34$, $p < .001$, $\eta^2 = .030$. Adjusting for age of pilot did not change the results for *Pilot Status*. Post hoc analyses, using a Bonferroni adjustment, showed non-pilots reported greater *Benefits* than Pilots and that non-pilots reported fewer *Inconveniences* than Pilots (see Figure 2).

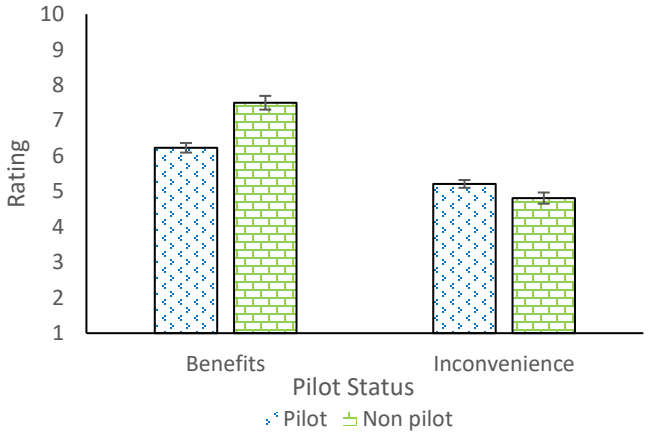

Figure 2. Ratings of Benefits and Inconveniences of Wearing a Face Mask by Pilot Status

A 2 (Scale) x 2 (Status: Student/Non Student) mixed ANOVA showed a main effect for *Scale*, $F(1,596) = 94.26$, $p < .001$, partial $\eta^2 = .137$, and an interaction $F(1, 596) = 18.69$, $p < .001$, $\eta^2 = .030$. The main effect for *faculty/staff status* was not significant $F(1,596) = 3.74$, p = .054. Post hoc analyses using a Bonferroni adjustment showed non-students reported greater *Benefits* than males and that non-students reported fewer *Inconveniences* than males. However, after controlling for age for the faculty/staff status analysis, none of the variables remained significant.

ANOVAs by Policies/Environment

ANOVAs were conducted with various environmental and FM state mandates by *Scale*. A 2 x 2 mixed ANOVA of *Scale* (based on FM state mandate) and the college/university was located found an interaction, $F(1,591) = 10.984$, $p = .001$, $\eta^2 = .018$. Post hoc analyses showed that respondents of schools located in states with state FM mandates reported greater *Benefits* of wearing FMs (see Figure 4). Respondents from schools located in states with state mandates reported higher Inconveniences than respondents from schools located in states that did not have state FM mandates. (see Figure 3).

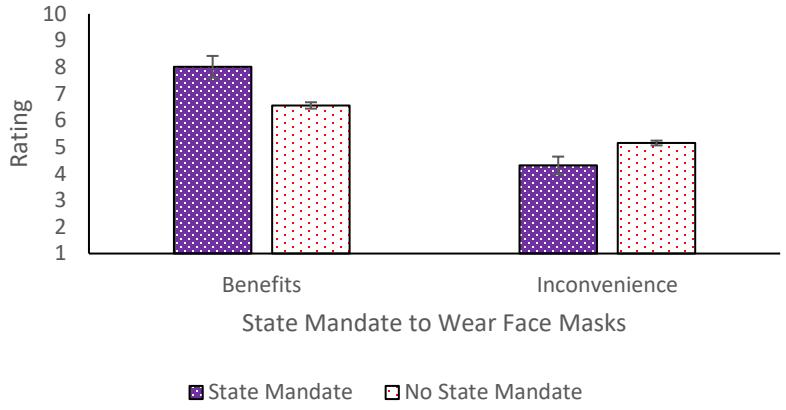

Figure 3. Ratings of Benefits and Inconveniences State Mandate

Correlations

Correlations were conducted between *Benefits*, *Inconveniences*, *State mandate*, *Percent of people in community who wear masks*, and reported COVID-19 *Raw cases* and *Cases per million* leading up to the last 7 days before the survey was distributed (see Table 3). *Benefits* were positively related to state mandates and encountering others wearing a FM. *Benefits* were negatively correlated with ratings of *Inconvenience* and reported *Cases per Million* population.

Table 3
Correlation Table of Ratings of Benefits, Inconvenience, Environment, and Policy

	1	2	3	4	5
1. Benefits	-	-	-	-	-
2. Inconvenience	-.633*	-	-	-	-
3. State mandate	.14*	-.10	-	-	-
4. Raw # of cases last 7 days	.05	.04	-.21*	-	-
5. Cases per million last 7 days	-.133*	-.018	-.14*	-.81*	-
6. Percent of people who wear face masks in community	.156*	-.046	.75*	.21*	-.62*

* $p < .01$

A stepwise multiple regression entering age, faculty/staff status, gender, pilot status, percent of people in community likely to wear a FM, state mandates, cases per million, and ratings of *Inconvenience* to predict ratings on *Benefits* of wearing FMs was conducted. A significant model, $F(5, 571) = 98.21$, $p < .001$ was found where *Age* ($p = .014$), *Gender* ($p < .01$), *Pilot Status* ($p = .012$), and ratings of *Inconvenience* ($p < .01$), and *Percentage of Others Wearing a FM* ($p = .004$) predicted 46% of how respondents rated the *Benefits* of wearing a FM. Faculty/staff Status, *Cases per Million*, and *State Mandates* were not included in the model (see Regression equation below).

> Benefits = 10.20 + (017(Age)) + (-1.05(Gender)) + (-.503(Pilot status)) + (-.74(Ratings of Inconvenience)) + (.02(Percent Wear))

Qualitative Data

Most of the open-ended comments were about attitudes toward wearing FMs. Regardless of their attitudes, several respondents said that they appreciated the opportunity to discuss their opinions concerning FMs. An approximately equal number of positive ($n = 69$) and negative ($n = 73$), with fewer ($n = 25$) neutral comments were made. Most of the positive and negative comments were strongly polarized (see Table 4).

Table 4
Selected Positive and Negative Respondents' Comments Regarding Wearing Face Masks

Positive Comments	Negative Comments
• Don't confuse politics with science. Wear a mask. Stay safe. :) • I don't like 'em but I'll wear 'em for the sake of others. • No matter the inconveniences to me, it would be a lot worse to come down with COVID and end up with lasting effects that could invalidate my medical and ruin my career. It is absolutely worth it. • Wearing mask is one of the best way to stop spreading COVID-19. Even though it is really uncomfortable, it is our duty to keep our mask on until the pandemic ends • It should be required world-wide. If not, then at least nation-wide. • Should be enforced more • The only way we are still able to do our jobs is by wearing the face masks and implementing safety precautions. Without them, we would still be out of work and our students would not be able to continue their ratings. Masks are not the cure all, but they greatly reduce the chance of catching the virus. They should be mandated to keep the students and staff safe. • Wish more people would wear masks correctly, I've seen too many people have it not cover their nose or mouth • My hope is that masks become a common courtesy even beyond the pandemic. In the future, I will certainly wear a mask when I feel sick but need to go out in public.	• All wearing a mask does is inconvenience me. I shouldn't have to worry about the health of a few old fogies that I have no relation to. If they catch the virus it doesn't effect my life in any way so why should I care. I don't doubt masks are helpful in reducing the amount of cases the thing is I just couldn't care less about people I don't know. • Mandatory mask wearing is tyranny. Stay inside if you can't handle the risks of everyday life. • Mask mandates are unconstitutional and proven to not work. • We all have the power to govern ourselves. That is why the creator gave us humans the gift to make choices. It harms no one to not wear a mask. However, being forced to do something you don't agree with is slavery. Comparable to rape, assault, and murder. How well I strengthen my immune system is what I can control. I can't make someone else healthy by wearing a mask, nor can someone else stop me from contracting a virus if my immune system is in poor condition. If a mask was a natural form of protection from foreign substances, the creator would have designed a built-in mask that we all have access to attached to our faces. Thank You for conducting this survey. • While the face mask may indeed help for brief distanced interactions inside buildings, it has very little effect outside and especially no effect whatsoever when crammed in a cockpit with another person. If the student and instructor are both comfortable with it, they should be able to take their masks off in flight. I do feel like my mask restricts my head head movement insofar that it messes with my mic boom. Apart from that, I'm ok with wearing a mask inside buildings, but forcing people to wear them outside and in close prolonged situations feels like a big stretch. • The mask is a false-safety. Frankly, I'm sure requiring it to be worn is just for show. "we care about your safety." • It is very hard to breath when flying. It is definitely a huge danger since it's letting pilots become more susceptible to Hypoxia. • It should be up to the person who wants to "protect" themselves. My university is a private institution, they have every right to enact rules (however ridiculous) on their

	property. It is up the the university to remain profitable from their students and therefore should consider the student's feedback if they wanted to remain profitable. The mask wearing is optional according to the state of Florida. I can tell you that people in my age group can care less about COVID. • Stop trying to make people believe in this nonsense.

Discussion

The PCA showed excellent results for reducing attitudinal responses to the *Benefits* and *Inconvenience* factor scales. Female respondents rated *Benefits* of FMs significantly higher than males, and more males rated FMs as *Inconvenient*. These gender differences in attitudes toward FMs reinforce those of Haisher et al. (2020), who found women are more likely to wear FMs in public.

Pilots reported fewer *Benefits* and greater *Inconveniences* of FMs than non-pilots. Although age predicted opinions about *Benefits* of FMs overall, age had no effect on pilots' opinions. That pilots reported fewer *Benefits* and greater *Inconveniences* of FMs is concerning, given that pilots are usually in close contact and longer than 15 minutes in the cramped space of an often poorly ventilated cockpit. Given the evidence of effectiveness of FMs (CDC, 2021; WHO, 2021), it seems one would recognize that the FM "might" be effective.

Dattel et al. (2020), Jarry (2020), Scheid et al. (2020) reported easily-remedied negative attitudes towards FMs, supporting the results that pilots, males, and others reported difficulty breathing, being heard, and threatened autonomy. Dattel et al. (2020) stated that students and Instructor Pilots will most likely adapt to FMs. Humans have a natural inclination toward sensory adaptation where one's perception of a stimulus becomes less sensitive with repeated exposure (Bartley, 1950).

Authorities' contradictory, misleading, or unscientific messaging (Breslow, 2020; Burnett & Sergi, 2020) were mirrored by respondents. Attitudes like invincibility or less social responsibility may explain younger respondents' seeing fewer *Benefits* of FMs. These attitudes may also have arisen from reports of fewer COVID-19 infections among youth (Barone, 2020a, 2020b; CDC, 2020, 2021). This reasoning is flawed because many younger people who become exposed to or ill with COVID-19 and survive, are indisposed for considerable amounts times, or must quarantine (CDC, 2021).

Although it has been recommended that no more than 10 people gather (CDC, 2021), a flight trainer cockpit typically has space for two people. Pilots may have a false sense of security in the cockpit because there are fewer people present.

Despite claims that wearing FMs is politically motivated, (Chiacu, 2020; Feuer & Higgins-Dunn, 2020) we found that when a college/university was in a state with a FM mandate, respondents reported greater *Benefits* and fewer *Inconveniences* of FMs. Similarly, and as found by Katz et al. (2020), respondents reported more *Benefits* of wearing FMs when their

college/university was in an area with greater FM compliance. Given that FM mandates improve compliance (Haischer et al., 2020), it is possible that seeing others modeling these behaviors improves attitudes.

The regression analysis showed that respondents who were female, older, had greater likelihood of encountering others wearing FMs, non-pilots, and less *Inconvenience* predicted more *Benefits* of wearing FMs. Being a faculty/staff or student, cases per million in that state, and state FM mandates were not included in the model.

The *Benefits* and *Inconvenience* scales were negatively correlated (-.633). Respondents could have positive attitudes about *Benefits* while also reporting that they are *Inconvenient*. Fortunately, 78% of the respondents reported that they wore FMs most of the time, despite their attitudes.

Limitations and Assumptions

Although several hundred (n = 598) collegiate aviation affiliates responded to the survey, the responses came from 14 UAA member colleges and universities. It is impossible for us to know the true response rate because UAA emailed the survey requests to their POC list. Some institutions have more than one POC, some institutions may have an invalid email address, and some POCs reported anecdotally that they did not receive the request. Because the respondents were from a widely dispersed set of UAA member institutions throughout the US, we believe that this sample provided sufficient representation of affiliates at collegiate aviation programs, providing generalizable results. In addition, the large sample we did receive provided sufficient statistical power for our analyses.

We assume that respondents' answers were honest, with little response bias because the comments seemed to match the quantitative responses, both which were often polarized. Additionally, we assume that self-identified collegiate/aviation status was accurate. Because 80% of data was collected within a 5-day period, we assume media messaging was consistent at that time, thus affecting all respondents equally.

Conclusion

Our findings regarding demographics and reasons for attitudes towards FMs support the literature, including for pilots. However, the reasons for negative attitudes can be effectively addressed. This study also highlighted several findings related to FM state mandates and social modelling (e.g., likelihood of encountering others with FMs), which may improve attitudes towards FMs.

Respondents' reports about FMs were contradictory. These attitudes may be related to public health authorities' messages that have been inconsistent since the start of the pandemic, due to political pressure (Breslow, 2020), and changing knowledge about COVID-19 (CDC, 2021; WHO, 2021). Improved messaging will help to change attitudes and compliance regarding wearing FMs. Collegiate aviation educators have a responsibility to assist this effort and mitigate the spread of COVID-19.

Better management and education are needed to increase compliance with wearing FMs. The leadership within collegiate aviation has played an important role in promoting public health during the pandemic. It is now incumbent upon students, faculty, and staff to continue complying with these critical directives.

References

American Airlines. (2020, June 26). How HEPA filters have been purifying cabin air since the 1990s. http://news.aa.com/news/news-details/2020/How-HEPA-Filters-Have-Been-Purifying-Cabin-Air-Since-the-1990s-FLT-06/default.aspx

Barone, E. (2020a, October 26). U.S. COVID-19 cases are skyrocketing, but deaths are flat—so far. these 5 charts explain why. Time. https://time.com/5903590/coronavirus-covid-19-third-wave/

Barone, E. (2020b, October 28). Young adults are less likely to wear masks, take other measures against covid-19, CDC survey finds. Time. https://time.com/5904813/mask-wearing-age-breakdown/

Bartley, S. H. (1950). Adaptation to tactile stimuli. In S. H. Bartley (Ed.), Beginning experimental psychology (pp. 202-211). McGraw-Hill.

Breslow, J. (2020, July 1). Fauci: Mixed messaging on masks set U.S. public health response back. NPR. https://www.npr.org/sections/health-shots/2020/07/01/886299190/it-does-not-have-to-be-100-000-cases-a-day-fauci-urges-u-s-to-follow-guidelines

Buitrago-Garcia D., Egli-Gany D., Counotte M.J., Hossmann S., Imeri H., Ipekci A.M., Salanti, G., & Low, N. (2020). Occurrence and transmission potential of asymptomatic and presymptomatic SARS-CoV-2 infections: A living systematic review and meta- analysis. Plos Medicine, 17(9). https://doi. org/10.1371/journal.pmed.1003346

Burnett, M. L., & Sergi, C. M. (2020). Face masks are beneficial regardless of the level of infection in the fight against COVID-19. Disaster Medicine and Public Health Preparedness, 14(5), 47-50. https://doi.org/10.1017/dmp.2020.320

CAPA. (2018, August 7). Women airline pilots: a tiny percentage, and only growing slowly. https://centreforaviation.com/analysis/reports/women-airline-pilots-a-tiny-percentage-and-only-growing-slowly-432247

Centers for Disease Control and Prevention. (2021). Things to know about the COVID-19 pandemic. Retrieved January 30, 2021, from https://www.cdc.gov/coronavirus/2019-ncov/your-health/need-to-know.html

Chiacu, D. (2020, June 29). 'Wear a mask!' Republicans split with Trump as virus cases surge. Reuters. https://www.reuters.com/article/us-health-coronavirus-congress-masks/wear-a-mask-republicans-split-with-trump-as-virus-cases-surge-idUSKBN24027P

Dattel, A. R. & Agha, R. D. (Unpublished Manuscript). Changes in instructor pilots' opinions before a simulated flight and after wearing a face mask in simulated flight. Internal Report prepared for the Flight Department, *Embry-Riddle Aeronautical University*.

Dattel, A.R., O'Toole, N.M., Lopez, G., & Byrnes, K.P. (2020). Face mask effects of CO2, heart rate, respiration rate, and oxygen saturation on instructor pilots. Collegiate Aviation Review International, 38(2), 1-11. http://ojs.library.okstate.edu/osu/index.php/CARI/article/view/8038/7412

Feuer, W., & Higgins-Dunn, N. (2020, November 9). President-elect Biden implores Americans to wear a mask: It's 'not a political statement'. CNBC. https://www.cnbc.com/2020/11/09/president-elect-biden-implores-americans-to-wear-a-mask-its-not-a-political-statement.html

Frymier, A. B., & Nadler, M.K. (2017). Persuasion: Integrating theory, research, and practice (4th ed.). Kendall Hunt.

Furukawa, N.W., Brooks, J.T., & Sobel J. (2020). Evidence supporting transmission of severe acute respiratory syndrome coronavirus 2 while presymptomatic or asymptomatic. Emerging Infectious Diseases. https://doi.org/10.3201/eid2607.201595

Haischer, M. H., Beilfuss, R., Hart, M. R., Opielinski, L., Wrucke, D., Zirgaitis, G., Uhrich, T. D., & Hunter, S. K. (2020). Who is wearing a mask? Gender-, age-, and location-related differences during the COVID-19 pandemic. Plos One, 15(10). https://doi.org/10.1371/journal.pone.0240785

Janzen, J. (2020, August 10). Air travel remains a safe way to travel during covid-19; advanced HEPA filters constantly clean the air onboard, limiting the risk of virus transmission and providing a safe environment. Airlines for Europe. Retrieved January 30, 2021, from https://a4e.eu/publications/air-travel-remains-a-safe-way-to-travel-during-covid-19-advanced-hepa-filters-constantly-clean-the-air-onboard-limiting-the-risk-of-virus-transmission-and-providing-a-safe-environment/

Jarry, J. (2020, September 3). Why some people choose not to wear a mask. McGill. https://www.mcgill.ca/oss/article/covid-19-health/why-some-people-choose-not-wear-mask

Katz, J., Sanger-Katz, M., & Quealy, K. (2020, July 17). A Detailed Map of Who Is Wearing Masks in the U.S. The New York Times. https://www.nytimes.com/interactive/2020/07/17/upshot/coronavirus-face-mask-map.html

Kessel, P. V., & Quinn, D. (2020, October 29). Both Republicans and Democrats cite masks as a negative effect of COVID-19, but for very different reasons. Pew Research Center. https://www.pewresearch.org/fact-tank/2020/10/29/both-republicans-and-democrats-cite-masks-as-a-negative-effect-of-covid-19-but-for-very-different-reasons/

Morawska, L., Tang, J. W., Bahnfleth, W., Bluyssen, P. M., Boerstra, A., Buonanno, G., Cao, J., Dancer, S., Floto, A., Franshimon, F., Haworth, C., Hogeling, J., Isaxon, C., Jimenez, J. L., Kurnitski, J., Li, Y., Loomans, M., Marks, G., Marr, L. C., … Yao, M. (2020). How can airborne transmission of COVID-19 indoors be minimised? Environment International, 142. https://doi.org/10.1016/j.envint.2020.105832

Nishiura, H., Oshitani, H., Kobayashi, T., Saito, T., Sunagawa, T., Matsui, T., Wakita, T., MHLW COVID-19 Response Team, & Suzuki, M. (2020). Closed environments facilitate secondary transmission of coronavirus disease 2019 (COVID-19). medRxiv. https://doi.org/10.1101/2020.02.28.20029272

Reiner, R. C., Barber R. M., Collins, J. K., Zheng, P., Adolph, C., Albright, J., Antony, C. M., Aravkin, A. Y., Bachmeier, S. D., Bang-Jensen, B., Bannick, M. S., Bloom, S., Carter, A., Castro, E., Causey, K., Chakrabarti, S., Charlson, F. J., Cogen, R. M., Combs, E., … Murray, C. J. L. IHME COVID-19 Forecasting Team. (2021). Modeling COVID-19 scenarios for the United States. Nature Medicine, 27, 94-105. https://doi.org/10.1038/s41591-020-1132-9

Scheid, J. L., Lupien, S. P., Ford, G. S., & West, S. L. (2020). Commentary: Physiological and psychological impact of face mask usage during the COVID-19 pandemic. International Journal of Environmental Research and Public Health, 17(18), 6655. https://doi.org/10.3390/ijerph17186655

Semega, J., Kollar, M., Shrider, E. A., & Creamer, J. (2020). Income and poverty in the United States: 2019. U.S. Census Bureau. https://www.census.gov/library/publications/2020/demo/p60-270.html

Sharma, S. K., Mishra, M., & Mudgal, S.K. (2020, October 19). Researchers at all India institute of medical sciences (AIIMS) release new data on COVID-19 (efficacy of cloth face mask in prevention of novel coronavirus infection transmission: A systematic review and meta-analysis). Journal of Education and Health Promotion. https://doi.org/10.4103/jehp.jehp_533_20

The New York Times. (2021). Coronavirus in the U.S.: Latest map and case count. Retrieved January 4, 2021, from https://www.nytimes.com/interactive/2020/us/coronavirus-us-cases.html

Twombly I. J. (2019, April 1). The 7 percent. Aircraft Owners & Pilots Association. https://www.aopa.org/news-and-media/all-news/2019/april/pilot/the-seven-percent

U.S. Food and Drug Administration. (2020, December 11). FDA Takes Key Action in Fight Against COVID-19 By Issuing Emergency Use Authorization for First COVID-19 Vaccine. https://www.fda.gov/news-events/press-announcements/fda-takes-key-action-fight-against-covid-19-issuing-emergency-use-authorization-first-covid-19

U.S. Food and Drug Administration. (2021, January 28). Pfizer-BioNTech COVID-19 Vaccine Frequently Asked Questions. https://www.fda.gov/emergency-preparedness-and-response/mcm-legal-regulatory-and-policy-framework/pfizer-biontech-covid-19-vaccine-frequently-asked-questions

World Health Organization. (2021). Coronavirus Disease (COVID-19) pandemic. Retrieved January 30, 2021, from https://www.who.int/emergencies/diseases/novel-coronavirus-2019

Appendix A
Survey Instrument

Please take a few moments to provide feedback on your opinions about wearing a face covering.

Please state your age (in years) _____

Please select your gender _____ Male _____ Female

Please state the College/University you are affiliated with _____

Please select one of the following _____Student _____Faculty _____ Staff

Are you a pilot or student pilot? _____Yes _____No

Please respond to the following questions based on a range of 1 to 10.

Questions for All Respondents

1. What is your current experience with wearing a face mask?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
I never wear a face mask I wear a face mask every time I leave my house

2. Does wearing a face mask help to **prevent the spread** of airborne illnesses like COVID-19 to others?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Not at all Definitely decreases the spread of airborne illnesses

3. Does wearing a face mask **protect you** from catching an illness like COVID-19?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Provides no protection Provides great protection

4. Does wearing a face mask cause decreases in oxygen saturation levels?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Not at all Definitely decreases oxygen saturation levels

5. In general, do you feel that wearing a mask makes it harder to be heard when you talk?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Not at all Extremely difficult to be heard

6. Does wearing a face mask affect your comfort level?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Has no effect on my comfort level Makes me extremely uncomfortable

7. Does wearing a face mask cause the user to inhale higher concentrations of carbon dioxide than normal?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Not at all Definitely increases carbon dioxide levels

8. In general, how well does the face mask fit your face?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Extremely loose Extremely tight

9. Does wearing a face mask restrict your physical movement (e.g., reaching, turning your head) in any way?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Has no effect on my movement Greatly restricts my movement

10. Does wearing a face mask cause you to become fatigued?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Has no impact on my fatigue Cause me to become very fatigued

11. Should the college/university require students, faculty, and staff to wear face masks when **inside** campus buildings?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Not at all Definitely require face masks to be worn

12. Should the college/university require students, faculty, and staff to wear face masks when **outside** of college/university buildings, but still on campus?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Not at all Definitely require face masks to be worn

13. Does wearing a face mask make your body feel warmer/hotter?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
Wearing the mask has no effect on my perceived body temperature — Wearing the mask makes me feel extremely hot

14. Overall, do the advantages of wearing a face mask outweigh the disadvantages?

1----------2----------3----------4----------5----------6----------7----------8----------9----------10
No advantages — Many advantages

Thank you for completing the survey. Please feel free to add any additional comments here.

_____
_____
_____