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# Investigating the Relationship Between SES and Fear of COVID-19 in a Sample of Adults with and without Asthma

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# INVESTIGATING THE RELATIONSHIP BETWEEN SES AND FEAR OF COVID-19 IN A SAMPLE OF ADULTS WITH AND WITHOUT ASTHMA

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While health challenges introduced by the coronavirus-19 disease (COVID-19) pandemic impacted the general population, individuals living with both asthma and low socioeconomic status (SES) may have been particularly vulnerable to health-related stress. For example, the CDC announced that a diagnosis of asthma increased one's risk of severe COVID-19, emergency room closures restricted access to reliable disease management resources, and many lost health insurance after losing employment. Further, many essential or blue-collar workers could not protect themselves from disease by isolating themselves or quarantining at home. For these individuals, the pandemic may have introduced or exacerbated feelings of being "out of control" of one's own health. Therefore, we predicted that this unique combination of factors would lead to higher levels of COVID-19-related fear in low-SES individuals with asthma during the pandemic.

This thesis aimed to investigate the relationship between SES, asthma status, and fear of COVID-19. We also explored whether this fear existed over and above generalized anxiety and depression symptoms. Finally, we investigated the roles of coping style, asthma control, and asthma severity in the relationship between asthma, SES, and fear of COVID-19.

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# Chapter 1

# INTRODUCTION

Socioeconomic status (SES) is a predictor of physical and psychological health, and low-SES Americans experience higher rates of chronic diseases and lower life expectancies than those in higher socioeconomic brackets (NCHS, 2018; Signorello et al., 2014). Economic security benefits health directly by providing access to secure housing and the resources required for pro-health behaviors such as a healthy diet and regular exercise. Indirectly, economic security reduces the stress associated with job and housing insecurity, familial conflict, and lack of access to healthcare when needed (Landsbergis et al., 2003; Richman et al., 2011). The effect of SES on health is also uniquely amplified in the U.S. due to the inability to afford healthcare services financially. Indeed, low income or health insurance coverage predicts less frequent use of healthcare services among Americans regardless of health status (Blackwell et al., 2009).

In asthma, SES has been shown to interact with disease status to predict health outcomes. For example, individuals living with both low SES and asthma will experience worse health outcomes than those living with only low SES or asthma (Cardet et al., 2018; Mielck et al., 1996; Sahni et al., 2016). It is believed that the intrinsic and extrinsic sources of stress faced by low-SES individuals contribute to chronic inflammatory dysregulation, resulting in more severe asthma (Miller & Chen, 2007; Thakur et al., 2014). Further, low-SES environments are associated with increased exposure to indoor and outdoor triggers (Canino et al., 2009; Wright & Subramanian, 2007), restricted access to asthma

control medication (Adams et al., 2002), and higher rates of co-morbidities such as obesity, diabetes, and psychological disorders (Huovinen et al., 2003; Lam et al., 2021). In addition, repeated response to risky environments in a low-SES environment has been shown to result in dysregulated inflammatory response to threatening stimuli in those with asthma, a link so robust that it has been posited as a psychosocial link between SES and asthma control disparities (Chen et al., 2003; Chen & Schreier, 2008). Unfortunately, for those with asthma, this combination of factors often leads to a disparity in inflammatory markers between lower and higher-SES patients that continues to widen over the lifespan, leading asthma to be named disease particularly affected by individual-level SES in the U.S. (Backman et al., 2017; Bacon et al., 2009; Kozyrskyj et al., 2010). The myriad direct and indirect pathways linking SES to health outcomes in asthma support Phelan and Link's argument that SES qualifies as a fundamental cause of disease – that is, the detrimental health effects of low-SES exist independent of biological predispositions and persist in the U.S. despite progression of science and longitudinal societal change (Phelan et al., 2010).

In terms of psychological health, negative affect is intimately linked with asthma. For example, anxious and depressive symptoms increase alongside asthma severity, and depression is predictive of poor asthma control and asthma-related mortality (Amelink et al., 2014; Lin et al., 2022; Urrutia et al., 2012). Further, as both asthma and psychopathology are independently linked to SES, low-SES asthmatics are particularly vulnerable to mental health challenges. Unfortunately, evidence suggests that the relationship between asthma and psychological factors is reciprocal. While psychological stress often results from symptom exacerbation, it is also a frequently reported trigger for asthma symptoms in adults (Ritz et al., 2016). Further, asthma's characterization by life-threatening exacerbations of symptoms that may require emergency

intervention leaves asthmatics in a uniquely stressful situation if access to healthcare becomes limited due to financial or environmental circumstances.

While health challenges introduced by the coronavirus-19 disease (COVID-19) pandemic impacted the general population, low-SES individuals with asthma found themselves at the intersection of multiple additional stressors. For example, although the CDC reported that a diagnosis of asthma was associated with a higher risk of severe COVID-19, the emergency rooms on which many relied for disease management closed or restricted services, and many essential or blue-collar workers were unable to protect themselves from disease by quarantining at home (Karmakar et al., 2021; McCormack et al., 2020; Quan et al., 2021). As a result, many individuals with asthma feared that illness, psychological stress, and loss of easily accessible healthcare would negatively impact their health and control over their asthma symptoms. As a result, qualitative data has shown that individuals with asthma reported more COVID-19-related fear than the general population (Philip, 2020). Thus, it is important to consider the level of control over asthma symptoms as a unique contributor to stress when investigating the psychological impact of the pandemic on individuals with asthma, particularly if they already faced barriers to care due to low SES.

The differential predictive value of how one perceives their own SES versus objective SES (OSES) must be noted. Indeed, a tendency towards health-compromising coping mechanisms is observed in those with lower *perceived* SES but does not necessarily translate to objective indicators of SES (e.g., income level) (Hoog et al., 2020). This finding suggests that perceived SES may be more salient than OSES in research linking SES to psychological health and coping style during stress. During a national health emergency, it is justified for individuals to experience a shift in their health locus of control (HLOC). The added health dangers in the

environment may introduce or increase feelings of being "out of control" of one's own health. Unfortunately, such beliefs have been shown to contribute to a rise in circulating inflammatory markers -- a finding that lends particular significance to the HLOC of those managing an inflammation-based disease such as asthma (Chen et al., 2003).

Further, the Reserve Capacity model hypothesizes that negative emotionality resulting from a perceived lack of control depletes motivation and resources to engage in pro-health behaviors (Gallo & Matthews, 2003). This model is often used to explain the link between perceived SES (PSES) and engagement in avoidant coping strategies (e.g., substance use), and it considers the many health conditions and environmental stressors resulting from reportedly low SES as additional "drains" on an individual's Reserve Capacity. In this model, the cycle of negative emotionality and PSES continues until either a change occurs in perceived access to environmental resources or psychological resources become available to cope effectively with stress. Indeed, engaging in avoidant methods of coping during the COVID-19 pandemic (e.g., substance use, behavioral avoidance) caused by intolerance of uncertainty results in more pandemic-related psychological distress (Rettie & Daniels, 2020), while engaging in approach-focused methods of coping (e.g., planning, positive reframing) has been shown to reduce such distress (Ye et al., 2020). More research is needed to understand how coping style and health status may interact with one's perceived SES level when appraising and reacting to the threat of a health challenge like COVID-19.

The current study aimed to address this topic by investigating the relationship between SES, asthma status, and fear of COVID-19. Our first research objective was to investigate the main effects of both SES and asthma on scores of a validated measure of fear of COVID-19 as well as the effect of the interaction between SES and asthma (SES*Asthma Interaction) on such

fear. We also explored whether these effects existed over and above generalized anxiety and depression symptoms. Next, we utilized two separate moderator analyses to study the role of coping style in the relationship between asthma, SES, and COVID-19 threat perception. We predicted that asthma, SES, and the SES*Asthma Interaction would each display a significant main effect on Fear of COVID-19 Scale (FCV-19S) scores when controlling for potential confounds and OSES, with the SES*Asthma Interaction having the strongest effect on these scores. We also predicted that an "approach" coping style would attenuate the effect of SES and asthma on FCV-19S scores, while an "avoidant" coping style would amplify this effect. Finally, we sought to examine whether factors specific to asthma, such as asthma severity and asthma control, altered the association between perceived SES (PSES) and fear of COVID-19.

# Chapter 2

# METHODS

## 2.1. Participants

Participants completed an online survey administered from July to November 2020 (3–7 months after the implementation of regional COVID-19-restrictions). Recipients were invited by email to complete a RedCap survey exploring lifestyle changes experienced by adults during the COVID-19 pandemic. Participants were recruited from social media advertisements and a research participant database that oversampled for volunteers with asthma. Advertisements and invitations recruited for both individuals with asthma and non-asthmatic controls to avoid motivational biases for reporting a diagnosis of asthma. All participants were located within the southern United States. Participants were required to e-sign an informed consent before survey initiation. As an incentive for participation, they could enter their email address into a raffle for ten online retailer gift cards. Data from 234 participants were eligible for analysis. Of eligible participants, 111 endorsed a current physician's diagnosis of asthma and 123 denied having asthma. Asthma was categorized as "intermittent" or "persistent" severity based on symptom and medication self-report according to 2020 NHLBI guidelines (NHLBI, 2020). Persistent asthma could not be further subcategorized into mild, moderate, or severe, as most participants had initiated asthma management and medication details to achieve asthma control were not accessible. This cross-sectional, two-group study was preregistered on the Open Science

Framework (osf.io/zt5kg/) and approved by the Southern Methodist University Institutional Review Board (Protocol #H20-103-RITT).

## 2.2. Measures

### *2.2.1. Fear of COVID-19*

The dependent variable in our analysis, Fear of COVID-19, was represented by FCV-19S scores (Ahorsu et al., 2020). The FCV-19S was developed in March 2020 to assess fear related to the novel coronavirus-19 and resulting disease, and the seven-item scale has since shown good to robust psychometric properties in multiple representative samples across cultures (Cronbach's alpha ≥0.80) (Bitan et al., 2020; Perz et al., 2020).

### *2.2.2. Perceived SES*

The Macarthur Scale of Subjective Social Status assessed participants' PSES (Adler et al., 2000). This survey asks participants to place themselves on a ladder with ten rungs to indicate where they see themselves falling within the social structure of the United States, with instructions stating: *"At the top of the ladder are the people who are the best off - those who have the most money, the most education, and the most respected jobs. At the bottom are the people who are the worst off…. The higher up you are on this ladder, the closer you are to the people at the very top"*. This measure has been widely used in literature and has demonstrated strong psychometric properties. A 2013 investigation of the measure found adequate construct, convergent, and discriminant validity. It also demonstrated that psychosocial risk and resilience factors mediated the relationship between PSES and self-reported health (Cundiff et al., 2013). These findings suggest that the scale may capture the aspects of SES that we aim to investigate in addition to those captured in OSES measures.

### *2.2.3. Objective SES*

As we did not collect participant income data in this study, we utilized reported zip codes to derive OSES data for individuals in our sample. Using the Area Deprivation Index (ADI), we assigned corresponding values representative of the average level of economic and social "disadvantage" experienced by individuals in that zip code compared to all zip codes within the United States (1.0= lowest level of "disadvantage," 100.0= highest level of "disadvantage") (Kind & Buckingham, 2018). The ADI is a publicly available composite index of 17 SES indicators, including income, education, employment, and housing conditions averaged over the five years before publication (i.e., the 2019 ADI data is derived from 2014-2019 data). The ADI has been highly cited in literature since its original publication over 20 years ago. It has been linked to health outcomes such as 30-day hospital readmission rates, childhood asthma rates, cancer deaths, and all-cause mortality. The most recent ADI (published in 2019) is calculated at the Census Block Group level, but we averaged ADI values across five-digit zip codes as this is the only geographic variable available in our survey data.

### *2.2.4. Coping*

Coping was measured using the Brief COPE, a validated measure consisting of 28 items that assess several responses to environmental stress known to be either effective or ineffective (Carver, 1997). For this study, we based our hypothesis on a 2-factor structure that has been replicated in stressful situations before the pandemic and recently found in multiple pandemic-era samples of middle-aged to older adults (Carver et al., 1989; Eisenberg et al., 2012; Kavčič et al., 2022; Minahan et al., 2020). This structure groups individuals' scores on the 14 Brief COPE subscales into "approach" and "avoidant" coping styles.

**2.2.4.1. Psychometric properties of the Brief COPE.** We averaged items within the 14 subscales of the Brief COPE and performed subscale-level PCA to determine if methods of coping grouped into hypothesized "approach" and "avoidant" coping styles as determined by prior literature (Carnahan et al., 2022; Eisenberg et al., 2012). After excluding the "humor," "venting," "self-distraction," and "religion" subscales due to lack of fit (i.e., loading <.40 on all factors) or precedent in the literature (Hanfstingl et al., 2021; Solberg et al., 2022), the best overall solution included two Varimax rotated factors and accounted for 49.48% total variance. Each factor contained 4-6 subscales and displayed adequate internal consistency: approach (active, instrumental support, planning, positive reframing, acceptance, and emotional support; α=.85) and avoidant (behavioral disengagement, denial, self-blame, and substance use; α=.76) (See supplement Table S1 for details on Brief COPE Factor Analysis).

### *2.2.5. Pandemic-specific adverse events*

To control for confounding experiences specific to the pandemic that may result in increased distress, we utilized bivariate (Yes/No) variables indicating whether a participant has experienced a variety of pandemic-specific adverse events indicated by literature to be particularly stressful (Mousavi et al., 2020). This ad-hoc item list queried 30 events including loss of employment, loss of home, and death of a close friend or family member due to COVID-19. An experiential variable was only included in analyses if it was endorsed by >=10% of the sample. Reliability analysis revealed high Cronbach's α with low Average Interitem Correlation (AIC) (α=.81, AIC=.12), indicating a likely low correlation between the experience of these events.

#### *2.2.6. General Anxious and Depressive Symptoms*

As an added measure of sensitivity, scores from the Anxiety and Depression subscales of the Brief Patient Health Questionnaire (PHQ-4) were added as control variables in an additional exploratory analysis (Kroenke et al., 2009).

### 2.3. Procedure

Participants completed an online battery of questionnaires, including multiple self-report measures of psychological distress related to the COVID-19 pandemic, surveys of demographics and recent life changes, and measures of physical health and health behaviors (including a survey specific to asthma for those with asthma.

#### *2.3.1. Data analysis*

Statistical analyses were performed using SPSS v.28 (IBM Corp., 2022). Participants missing >50% of all data were excluded (10.3% of total sample; 3.5% of asthma, 15.8% of control), leaving 234 out of 261 total surveys eligible for analysis. For eligible participants, individual items on scales with <50% missing data were imputed using thirty rounds of multiple imputation (MI) (11.1% total; 10.8% asthma, 11.4% control had at least one scale with imputed items). Imputation was performed separately for those with and without asthma since participants with asthma had additional measures related to their asthma. Coefficients and significance testing were derived from pooled MI analyses, and sensitivity analyses were performed on original non-imputed data to confirm pooled results. Means, standard deviations (S.D.), and frequencies were calculated for questionnaire scores, and the internal consistency of the scales was compared to prior literature by calculating Cronbach's $\alpha$ and mean inter-item correlations. No outliers were identified (defined as >3 S.D. from the mean). All variables were

tested for skewness and kurtosis, and continuous variables used as predictors or mediators were centered at their respective mean.

The dimensional structure of the Brief COPE was explored by Principal Component Analysis (PCA) followed by orthogonal Varimax rotation as employed by SPSS-25. The number of symptom subscale components to extract was informed by prior literature, statistical values (eigenvalues >1, scree plot, primary factor loadings >.40), and interpretability. Multiple regression (M.R.) analyses controlling for demographics and pandemic-specific adverse events investigated the effect of the SES*Asthma Interaction, the main effects of PSES, and the main effect of asthma on FCV-19S scores during the COVID-19 pandemic. All analyses controlled for age, gender (man/woman), race (white/non-white), and ADI. To account for discrepancies in health literacy (Stormacq et al., 2018), years of education were used in addition to OSES as a control variable. Mediator analyses controlling for demographics and pandemic-specific adverse events then investigated different coping styles as mediators of the relationship between asthma diagnosis, PSES, and FCV-19S scores. The significance of mediation was tested with R*Mediation open-source software (Tofighi & MacKinnon, 2011). Moderator analyses were conducted using the PROCESS v4.1 extension for SPSS (Hayes, 2022).

With our sample of 234 participants, a post-hoc G*power analysis revealed that our final multiple regression would have .94 power to detect a small-to-medium effect size assuming 15 predictors ($f^2$=.05, α=.05) (Faul et al., 2007; Goodwin et al., 2003; G. Ye et al., 2021) ). This effect size is consistent with effect sizes obtained in the prior literature on psychological symptoms in asthma.

# Chapter 3

# RESULTS

As can be seen in Table 1, a total of 234 participants (111 with asthma, 123 without asthma) provided were predominately white (76.1%), female (82.5%), and college-educated (16.1±2.4 yrs of school) with a mean age of 55.7±9.5 years. Participants displayed a mean PSES of 6.12 out of 10 on the MacArthur Scale of Subjective Social Status (Adler et al., 2000). Participants with asthma represented all levels of asthma control and intermittent versus persistent severity, with 61.3% of patients' scores on the ACT indicating "well-controlled" asthma (score >=20) and 74.8% meeting NHLBI standards for persistent asthma according to self-reported symptoms and medications (NHLBI, 2020).

## 3.1. Preliminary analyses

We computed descriptive statistics for each experiential variable within both asthma and non-asthma groups. We found that experience endorsement was equally distributed across both groups for all experiential variables except "Death of close friend or family member due to COVID-19", which individuals with asthma endorsed significantly more often than individuals without asthma ($\chi^2(1)=6.77$, $p=.009$). To investigate the utility of our PSES predictor, we employed two individual ANCOVAs to determine whether FCV-19S scores in this sample were more robustly predicted by OSES or PSES when utilizing demographics and years of education

as covariates. In line with our prediction, this analysis confirmed our prediction that PSES ($F(233)$=2.06, $p$=.034) is a more robust predictor of FCV-19S scores than OSES ($F(118, 233)$=.097, $p$=.57).

### 3.2. Relationship between asthma, SES, and fear of COVID-19.

We regressed the main effects of asthma diagnosis, PSES, and the SES*Asthma Interaction on FCV-19S scores. The effect of the SES*Asthma Interaction was not significant (b= -0.18, $t(217)$= -0.41, $p$=.68), so it was removed from subsequent analyses. Upon removal of the interaction term, the main effect of PSES became significant, but asthma remained insignificant (b=0.76, $t(218)$=0.93, $p$=.35). The final model including only PSES as a primary predictor of FCV-19S scores indicated that a one unit increase in PSES resulted in a significant 0.54 unit decrease in COVID-19 related fear (b= -0.54, $t(219)$= -2.25, $p$=.02) (Table 2).

#### *3.2.1 Approach coping*

We investigated the approach coping style as a mediator of the relationship between PSES and FCV-19S scores in this sample. We found that the reported level of approach coping did not play a key role in this relationship (a*b=-0.62, 95%CI=[-0.10,0.03]).

#### *3.2.2 Avoidant coping*

We investigated an avoidant coping style as a mediator of the relationship between PSES and FCV-19S scores. We found that the reported level of avoidant coping played a key role in this relationship. R*Mediation revealed that avoidant coping scores mediated about 44% of the effect of PSES on FCV-19S scores, a*b= -0.24, 95%CI[-0.45, -0.07], $p$<.05, $P_m$= 0.44 (Figures 1A-1B).

**Table 1.** Sample characteristics from raw, unimputed data.

| | Asthma (n=111) | Control (n=123) | All (N=234) |
|---|---|---|---|
| **Age – years** | | | |
| M±SD | 54.4±9.7 | 56.8±9.1 | 55.7±9.5 |
| Range | 31-77 | 31-79 | 31-79 |
| **Female gender (%)** | 89.2 | 76.4 | 82.5 |
| **Race (%)** | | | |
| White | 73.0 | 78.9 | 76.1 |
| Hispanic | 9.0 | 8.1 | 8.5 |
| Black/African-American | 9.0 | 5.7 | 7.3 |
| Asian | 1.8 | 2.4 | 2.8 |
| Native American | 5.4 | 0.8 | 3.0 |
| **Years of Education** | 16.3±2.7 | 16.0±2.2 | 16.1±2.4 |
| College degree (%) | 75.7 | 72.4 | 73.9 |
| High school degree (>=12) (%) | 23.4 | 27.6 | 25.6 |
| Less than high school degree (<12) (%) | 0.9 | 0.0 | 0.4 |
| **Perceived SES (MacArthur Scale)** | | | |
| M±SD | 6.1±1.8 | 6.2±1.9 | 6.2±1.9 |
| Range | 1.0-10.0 | 1.0-10.0 | 1.0-10.0 |
| **Objective SES (ADI Value)** | | | |
| M±SD | 44.4±18.1* | 43.2±17.4[a] | 43.8±17.7 |
| Range | 9.3-90.2 | 10.5-82.2 | 9.3-90.2 |
| **Employed Full-Time (%)** | 66.7 | 65.0 | 65.8 |
| **Asthma Severity (%)** | | | |
| Persistent | 74.8 | - | - |
| Intermittent | 25.2 | - | - |
| **Asthma Medications (%)** | | | |
| SABA bronchodilators | 69.4 | - | - |
| LABA bronchodilators | 36.0 | - | - |
| Anticholinergic bronchodilators | 6.3 | - | - |
| Inhaled corticosteroids | 47.7 | - | - |
| Systemic corticosteroids | 0.0 | - | - |
| Leukotriene modifiers | 20.7 | - | - |
| IgE inhibitors | 3.6 | - | - |
| Antihistamines | 8.1 | - | - |
| Unmedicated | 7.2 | - | - |
| **Asthma Control Test (%)** | | | |
| Poorly controlled (<16) | 13.5 | - | - |
| Not well controlled (19-16) | 25.2 | - | - |
| Well-controlled (25-20) | 61.3 | - | - |

[a] *Zip code data was missing for four non-asthma and three asthma participants resulting in N=227 for unimputed ADI values.*

[b] *SES= Socioeconomic Status. SABA= Short-acting b-adrenergic, LABA= Long-acting b-adrenergic.*

**Table 2.** Regression model for the "c" path in the mediation model investigating the **main effect of PSES on fear of COVID-19**.

| | **B** | ***t*** | ***% Variance*** |
|---|---|---|---|
| **Age** | 0.01 | 0.13 | 0.01% |
| **Gender** | 0.05 | 0.05 | 0.00% |
| **Race** | 1.75 | 1.77 | 1.27% |
| **Pandemic-specific adverse events** | | | |
| Loss of employment | 1.27 | 1.33 | 0.70% |
| Inability to pay bills | 0.51 | 0.44 | 0.08% |
| Child in home needing care | 0.26 | 0.23 | 0.02% |
| Increase in home conflict | 1.32 | 1.26 | 0.63% |
| Relocated home | 1.16 | 0.70 | 0.19% |
| Improvise living conditions | 0.46 | 0.39 | 0.06% |
| Unable to get food | 0.57 | 0.39 | 0.06% |
| Death of close friend or family member | 2.32 | 1.78 | 1.26% |
| **Years of Education** | 0.13 | 0.75 | 0.22% |
| **ADI National Rank** | -0.03 | -1.42 | 0.86% |
| **Perceived SES** | -0.54 | -2.25* | 2.05% |

** p< .05,*

*[a] PSES = Perceived Socioeconomic Status, ADI = Area Deprivation Index, % Variance: semipartial correlation ($sr^2$) represented as the percent of pooled variance explained over and above other variables.*

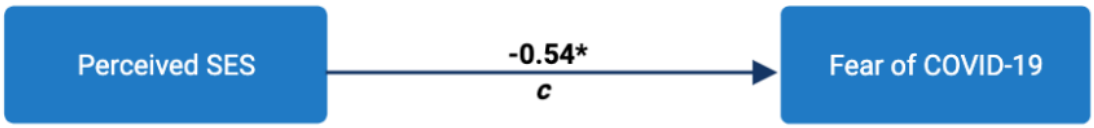


**Figure 1A.** The main effect of perceived socioeconomic status (PSES) on Fear of Covid-19 Scale (FCV-19S) scores, controlling for demographics and pandemic-specific adverse experiences. On average, a unit increase in Perceived SES resulted in a 0.54 unit decrease in FCV-19S score. * $p<.05$.

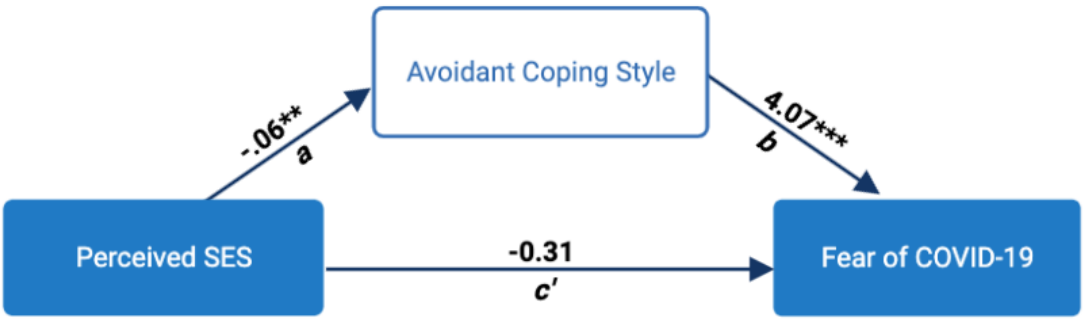


**Figure 1B.** Mediation effect of avoidant coping on FCV19S scores. The effect of an avoidant coping style accounted for a significant proportion of the association between Perceived SES and FCV-19S score ($P_m$=.44). ** $p<.01$, *** $p<.001$.

### 3.3. Asthma-specific Factors in the Association Between Perceived SES and Fear of COVID-19.

Our survey utilized multiple disease-specific measures administered to the asthma group, including an investigation of asthma control as measured by ACT scores. To investigate whether PSES was differentially associated with FCV-19S scores in individuals with and without asthma, we separated our sample by asthma grouping and performed the above analysis. Interestingly, the significant effect of PSES on FCV-19S scores was found in the asthma subgroup (b= -0.85, $t$= -2.39, $p$=.017) but not in the control group (Figure 2A). As we investigated several disease-specific factors within this sample, we aimed to explore how asthma control and asthma severity may have contributed to the relationship between PSES and fear of COVID-19 within the asthma subgroup.

#### *3.3.1. Asthma control*

**3.3.1.1. Moderator Analysis.** Asthma control did not moderate the cross-sectional relationship between PSES and fear of COVID-19 physical health. A moderator analysis using PROCESS revealed that while individuals with well-controlled asthma reported less fear of COVID-19 than individuals whose asthma was not well-controlled ($t(102)$= -2.39, $p$=.019), the association between PSES on FCV-19S scores was not moderated by asthma control level, ($t(102)$= -0.33, $p$=.74).

**3.3.1.2. Mediator Analysis.** Mediation analysis indicated that asthma control (as measured by ACT scores) played a key role in the relationship between PSES and fear of COVID-19 in participants with asthma. R*Mediation revealed that ACT scores mediated about 34% of the effect of PSES on FCV-19S scores, a*b= -0.29, 95%CI[-0.63, -0.01], $p$< .05, $P_m$= 0.34 (Figure 2B, Figure 3).

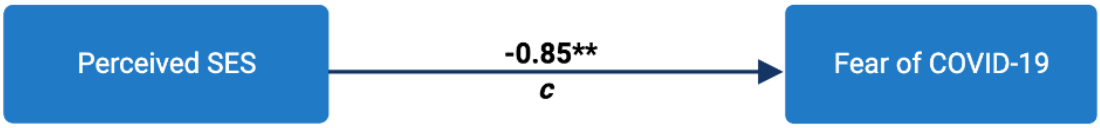


**Figure 2A.** The main effect of perceived socioeconomic status (PSES) on fear of Covid-19 (FCV-19S scores) within the asthma subgroup (N=111), controlling for demographics and pandemic-specific adverse experiences. On average, a unit increase in Perceived SES resulted in a 0.85 unit decrease in FCV-19S score. ** $p<.01$.

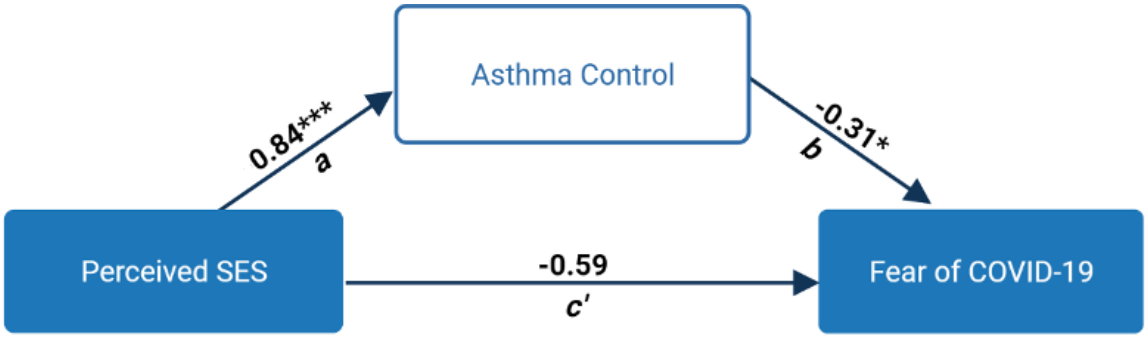


**Figure 2B.** Mediation effect of Asthma Control (ACT scores) on fear of COVID-19 within the asthma subgroup. The effect of asthma control accounted for a significant proportion of the association between Perceived SES and FCV-19S score ($P_m$=.34). * $p<.05$, *** $p<.001$.

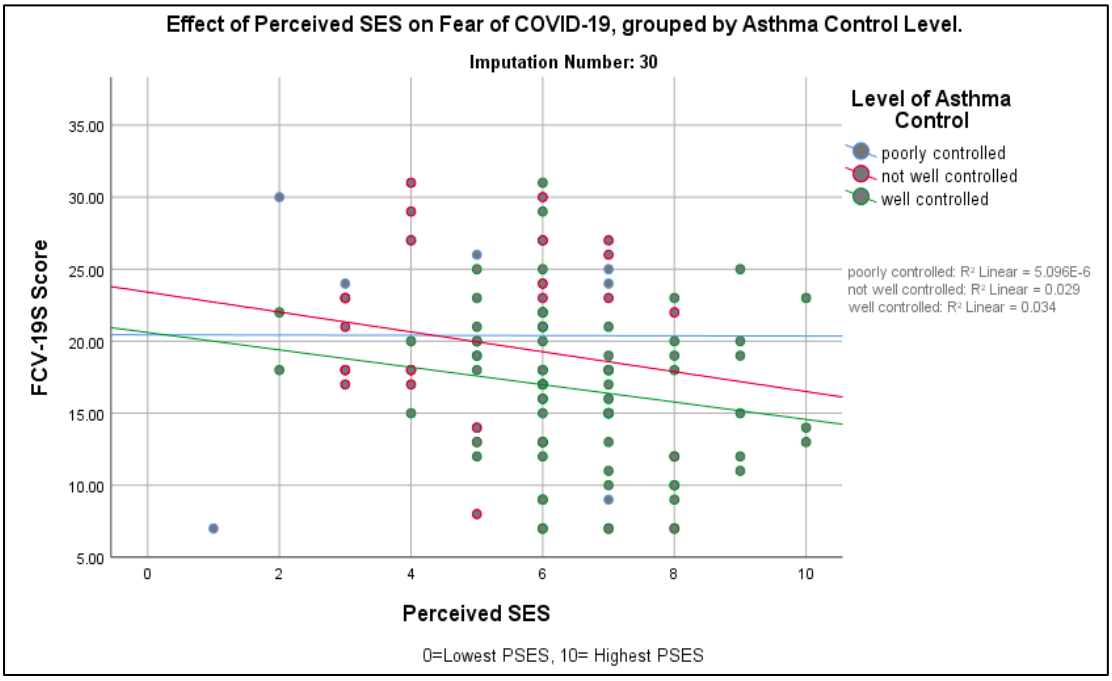


**Figure 3. The effect of perceived SES (PSES) on Fear of COVID-19 (FCV-19S) score, grouped by level of asthma control*.** The effect of asthma control accounted for a significant proportion of the association between PSES on FCV-19S scores ($P_m$=.34).

[a] *Asthma Control Test scores; <16= Poor, 16-19= Not well controlled, >20= Well controlled.*

### *3.3.2. Asthma severity*

**3.3.2.1. Moderator Analysis.** Asthma severity did not moderate the cross-sectional relationship between PSES and fear of COVID-19. A moderator analysis using PROCESS revealed that while there was a difference in fear of COVID-19 between individuals with intermittent versus persistent asthma ($t(102) = -2.67$, $p = .041$), the association between PSES and FCV-19S scores was not moderated by asthma severity, ($t(102) = 1.16$, $p = .25$) (Figure S1).

## *3.4. Exploratory analysis*

**3.4.1. Sensitivity Analysis.** As an additional sensitivity analysis, PHQ-4 scores were added as control variables to the C-path model (Figure 1A) to assess group differences in COVID-19-related fear over and above general anxiety and depression. The main effects of both anxiety (b=1.31, $t(219)=6.23$, $p<.001$) and depression (b=1.10, $t(219)=4.51$, $p<.001$) subscale scores were significant predictors of COVID-19 related fear. Further, when either subscale score was added to the C-path model, the effect of PSES on COVID-19-related fear became nonsignificant ($p>.05$) *(Table S2A-B).*

# Chapter 4

# DISCUSSION

The present study aimed to investigate the effect of asthma and SES on fear of COVID-19. As predicted, a measure of perceived socioeconomic status (PSES) demonstrated a more robust association with fear of COVID-19 than a measure of objective socioeconomic status (OSES). However, contrary to our hypothesis, neither the SES*Asthma Interaction nor the main effect of asthma alone was significantly associated with fear of COVID-19. Within the total sample of control and asthma participants, the main effect of PSES on fear of COVID-19 was partially mediated by an avoidant coping style. Additionally, within asthma participants, this main effect was partially mediated by level of asthma control, and those with more severe asthma were more fearful of COVID-19.

Our results replicate prior research suggesting that measures of perceived SES are more useful in predicting one's perception of their own health than measures of objective SES such as the Area Deprivation Index (Cundiff et al., 2013). This finding reaffirms that PSES may capture individual-level aspects of SES worth investigating, such as locus of control, in addition to those captured in OSES measures when studying the connection between SES and health. The way that individuals cope with stress is demonstrated to impact psychological health, and our results add to recent studies that implicate avoidant methods of coping in response to pandemic-related stress have been shown to increase negative affect (Carnahan et al., 2022; Rettie & Daniels, 2020; Taha et al., 2014). Though we expected that employing an approach coping style would

also significantly protect individuals from COVID-19-related fear, the sole contribution of avoidant coping is not unprecedented. Prior research on pandemic-era samples has also found that an avoidant coping style, but not an approach coping style, plays a key role in an individual's ability to tolerate uncertainty - a predecessor of psychological health during a national crisis (Rettie & Daniels, 2020). It is important to consider that the coping style utilized by an individual in the face of a national emergency may vary depending on their perceived available resources, making PSES a rational precursor to the coping style. The limitations on participating in classic adaptive coping activities such as socializing, exercising, and gathering with a religious group outside of the home rendered approach coping strategies less accessible than avoidant coping styles while quarantined at home.

Higher levels of psychopathology in the general population during the COVID-19 pandemic may have reflected a reaction to novel sources of stress alongside reduced access to adaptive social-centered coping mechanisms – that is, the pandemic resulted in a widespread reduction in the capacity to manage stress effectively (Boals & Banks, 2020). The Reserve Capacity model hypothesizes that individuals who report living with low SES are predisposed to avoidant coping mechanisms more frequently than higher-SES individuals due to depleted motivation for pro-health behaviors (Gallo & Matthews, 2003). This model posits that the challenges associated with low SES increases negative emotionality and reduces the experience of reward, thus predisposing individuals with lower PSES to engage in avoidant coping strategies during times of stress versus expending more resources to engage in approach coping strategies. Further, a lack of reward experience can lend to more negative self-evaluation and a lack of perceived self-efficacy when confronted with challenges.

Aside from SES, personality and affective experience have been shown to correlate with coping style (see Beautler et al., 2018 for a review). Thus, these individual-level factors cannot be ignored when investigating how one decides to cope with novel stress – particularly when habitual ways of coping may be restricted in a pandemic environment. The Reserve Capacity model would predict that individuals already living in lower SES environments are uniquely susceptible to negative emotionality and thus would experience higher levels of psychological stress. However, one's tendency towards internalization – that is, worry and self-criticism – would also play a prominent role in appraising one's self-efficacy when faced with a novel stressor. Two individuals may have access to the same resources, but the judgment of their self-efficacy with such resources may ultimately decide whether to choose an "approach" or "avoidant" style of coping (Beautler et al., 2018). Indeed, research has shown that while the use of avoidant coping mechanisms such as substance use increased in the general population after COVID-19 restrictions compared to pre-pandemic levels, this effect was particularly strong in those with a high level of worry about the personal socioeconomic impact of COVID-19 (Taylor et al., 2021). However, if one did not tend to internalize and had a more positive view of their own self-efficacy before the pandemic, they may be more likely to anticipate reward from a more taxing "approach" coping style when faced with novel restrictions. However, recent literature has suggested that SES may moderate the effect of approach coping on health and that traditional approach coping may be less adaptive than "shift and persist" strategies for those with lower SES (Lam et al., 2018). However, avoidance strategies outlined in the Brief COPE show detrimental health effects regardless of reported SES. Indeed, turning to avoidance in the face of novel stress may prevent the disconfirmation of feared outcomes, thus perpetuating the cycle of negative emotionality and avoidant coping (Hoffart et al., 2022). Since we controlled for OSES in our

analyses, such individual-level factors captured by PSES may explain how "avoidant" coping could mediate the relationship between PSES COVID-19 fear while "approach" coping does not.

Particularly relevant to this sample is the suggestion that motivation could be even more depleted in those managing asthma symptoms in a low-SES environment, as negative affectivity is also related to experience of asthma symptoms (Richardson et al., 2006). Our finding that avoidant coping played a key role in an individual's level of COVID-19-related fear highlights the importance of coping behaviors when navigating higher levels of environmental stress. Prior literature has implicated avoidant coping as a mediator between SES and reports of poor health, and it must be emphasized that if coping through avoidance translates into neglect of one's health during a deadly pandemic, the consequences for a population that is already more prone to complications due to SES and underlying disease could be dire.

Exploratory analyses within the asthma subgroup revealed that level of asthma control explained a significant portion of the relationship between PSES and fear of COVID-19. Due to the sudden life-threatening exacerbations that characterize many forms of asthma and vulnerability to severe disease due to underlying conditions, individuals with asthma may be uniquely affected by a pandemic environment that introduces novel threats to both health and healthcare access (Abrams et al., 2020). In a pandemic environment, asthma patients reporting restricted access to means due to their SES could justifiably perceive more threat from COVID-19 than their higher SES counterparts. When viewed through the lens of the Reserve Capacity Model, the same negative emotionality and low PSES that predisposes individuals to engage in avoidant coping may also decrease motivation to engage in the pro-health behaviors required to regulate asthma symptoms, resulting in worse asthma control (Chen et al., 2003; Chen & Schreier, 2008). Studies before the COVID-19 pandemic suggest that individuals who report

lower SES are more likely to report higher levels of allergic symptoms and exacerbations requiring medical intervention than their higher-income counterparts (Brite et al., 2020; Schyllert et al., 2020). The results of this study suggest that the strong main effect between low perceived SES and fear of COVID-19 is representative of the effect of perceived SES on one's health through avenues such as achieving control over chronic conditions and engagement in avoidance coping strategies.

On a grander scale, it has been suggested that fear related to COVID-19 may be adaptive. Indeed, health anxiety has been shown to increase compliance with preventative measures during a pandemic (González-Castro et al., 2021). However, this effect is unlikely to manifest if one cannot participate in pro-health behaviors due to a combination of low PSES, depleted Reserve Capacity, and dependence on avoidance coping. The pandemic introduced new barriers to engaging in pro-health behaviors, such as routine visits to the doctor, rendering many more patients vulnerable to suboptimal asthma control. Further, COVID-19 disproportionately affected individuals living in rural or low-SES environments by exacerbating financial, geographical, or other barriers to healthcare (Grant et al., 2022; Karmakar et al., 2021). The results of this study elucidate how perceived SES may impact psychological symptoms, such as COVID-19-related fear, by impacting one's ability to maintain their health through coping effectively with stress and achieving control of disease symptoms. According to the Reserve Capacity model, individuals reporting lower SES are already at risk for experiencing high levels of negative emotionality, which results in a lower "capacity" to engage in pro-health behaviors (Gallo & Matthews, 2003). It could be argued that any perceived decline in SES due to the pandemic may exacerbate negative emotionality further and that this change in environmental and psychological status may further strain individuals' capacity to care for their health. While interventions aimed at coping

style or improving symptom control may assist in reducing psychological symptoms during a national emergency, results suggest that improving one's capacity to engage in pro-health behaviors by increasing perceived socioeconomic resources may be more effective in improving the ability to adapt to environmental stress and care for their own health. Investigating the effect of interventions aimed at PSES, such as supplementing income with stimulus checks or increasing the accessibility of healthcare, on indicators of psychological and physical health may assist in understanding how the results of this study can translate into protecting lower-SES individuals from particularly harsh psychological effects during a national emergency like the COVID-19 pandemic.

### 4.1. Study Limitations

Several limitations to our study should be considered. First, the generalizability of our results is hindered by a self-selected sample with a higher representation of white, urban, female individuals. However, a mean age of 55.7 years was an advantage of our study because it represents an older adult demographic traditionally underrepresented in asthma research. These patients were at risk for more severe COVID-19 symptomology, and our cross-section of psychological health 3-6 months into pandemic restrictions provided insight into the potential effects of sustained versus initial, more acute stress (Teague et al., 2018). Additionally, it is difficult to determine the specificity of the observed elevations in distress to the pandemic without a pre-COVID-19 baseline measurement. In addition, our ADI index of OSES is not comprehensive in that it does not necessarily reflect the income level of that individual but rather the average of multiple lifestyle indicators for their zip code. The second round of our survey has attempted to address this point by explicitly asking for participants' income level. Additionally,

because of pandemic-related considerations, relying on self-reported asthma diagnosis and mental health conditions versus in-person medical screening was necessary. Though not ideal, self-reported diagnosis of asthma has been demonstrated to be reliable and valid by previous research (Iversen et al., 2007; Mirabelli et al., 2014).

It is important to note that without a measure of baseline anxiety and depression, it is difficult to determine how much of the FCV-19S scores may be accounted for by more generalized anxious and depressive symptoms that are independent of pandemic effects. When PHQ-4 scores were added to the analysis for added sensitivity, the effect of PSES on FCV-19S scores was no longer significant. However, due to the substantial impact of the COVID-19 pandemic on many facets of life and the cross-sectional nature of this study, a measure of "general" anxiety and depression may have been impossible to achieve. Thus, the results of this sensitivity analysis must be interpreted with caution. We anticipate that a second round of data collection one year after the current study may clarify the distinction between individuals' baseline psychological symptoms and those specific to the COVID-19 pandemic.

### 4.2. Conclusion

The results of this study on a sample of individuals with and without asthma suggest that the link between perceived socioeconomic status (PSES) and fear of COVID-19 is mediated by variables such as an avoidant style of coping and level of control over asthma symptoms. Findings expand on literature suggesting that treating avoidant coping mechanisms may improve mental well-being for those living with low SES in a pandemic setting. Further, asthma control accounted for a significant portion of the relationship between PSES and COVID-19-related fear for individuals with asthma. This finding could represent the burden of asthma symptoms while

encountering barriers to healthcare that the COVID-19 pandemic may have exacerbated. When providing care to asthma patients during a pandemic, clinicians should consider the link between low-SES and asthma control and the psychological stress accompanying asthma symptom burden while living with increased threats to health and reduced access to healthcare. Additionally, attention to a patient's ability to cope with stress effectively could have implications for symptom management – particularly if avoidance coping strategies lead to a lack of attention to changing health guidelines, turning to behaviors that are detrimental to long-term health (i.e., substance use), or neglect of one's day-to-day management of their chronic disease symptoms.

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SUPPLEMENTARY MATERIAL

**Table S1.** Item means & S.D., Varimax-rotated factor solution, and communalities ($h^2$) for symptom items.

| *2-Item Subscale* | ***M (S.D.)*** | ***Factor 1 "Approach"*** | ***Factor 2 "Avoidant"*** | ***$h^2$*** |
|---|---|---|---|---|
| 1. Active | 2.67(0.83) | **0.73** | -0.12 | 0.54 |
| 2. Instrumental Support | 2.19(0.83) | **0.72** | 0.19 | 0.56 |
| 3. Planning | 2.69(0.85) | **0.76** | 0.25 | 0.65 |
| 4. Acceptance | 3.14(0.73) | **0.54** | -0.16 | 0.31 |
| 5. Emotional Support | 2.54(0.87) | **0.70** | -0.10 | 0.50 |
| 6. Positive Reframing | 2.52(0.87) | **0.65** | -0.06 | 0.43 |
| 7. Behavioral Disengagement | 1.45(0.62) | -0.18 | **0.76** | 0.61 |
| 8. Denial | 2.22(0.67) | 0.12 | **0.64** | 0.42 |
| 9. Self-Blame | 1.65(0.74) | -0.03 | **0.80** | 0.64 |
| 10. Substance Use | 1.60(0.87) | -0.03 | **0.54** | 0.30 |

[a] *Bolded values indicate symptom cluster grouping (factor loadings >=.40) of each symptom.*

**Table S2A.** Sensitivity analysis for the "c" path in the mediation model investigating the **effect of PSES when controlling for scores of general anxiety (PHQ-4)**.

| | **B** | ***t*** | ***% Variance*** |
|---|---|---|---|
| **Age** | 0.01 | 0.13 | 0.01% |
| **Gender** | 0.64 | 0.66 | 0.15% |
| **Race** | 1.75 | 1.94 | 1.29% |
| **Pandemic-specific adverse events** | | | |
| Loss of employment | 1.20 | 1.37 | 0.63% |
| Inability to pay bills | 0.01 | 0.01 | 0.00% |
| Child in home needing care | -0.33 | -0.32 | 0.03% |
| Increase in home conflict | 0.18 | 0.19 | 0.01% |
| Relocated home | 0.31 | 0.20 | 0.01% |
| Improvise living conditions | 0.99 | 0.91 | 0.28% |
| Unable to get food | 0.43 | 0.32 | 0.03% |
| Death of close friend or family member | 0.61 | 0.50 | 0.08% |
| **Years of Education** | 0.06 | 0.36 | 0.04% |
| **ADI National Rank** | -0.02 | -1.03 | 0.38% |
| **Perceived SES** | -0.14 | -0.61 | 0.13% |
| **PHQ-4 Anxiety** | 1.31 | 6.23*** | 13.34% |

**** p< .001*

*[a] PSES = Perceived Socioeconomic Status, ADI = Area Deprivation Index, PHQ-4 = Patient Health Questionnaire 4, % Variance: semipartial correlation ($sr^2$) represented as the percent of pooled variance explained over and above other variables.*

**Table S2B.** Sensitivity analysis for the "c" path in the mediation model investigating the **effect of PSES when controlling for scores of general depression (PHQ-4)**.

| | **B** | ***t*** | ***% Variance*** |
|---|---|---|---|
| **Age** | 0.01 | 0.13 | 0.01% |
| **Gender** | 0.31 | 0.31 | 0.04% |
| **Race** | 2.07 | 2.20* | 1.79% |
| **Pandemic-specific adverse events** | | | |
| Loss of employment | 1.61 | 1.75 | 1.11% |
| Inability to pay bills | 0.44 | 0.39 | 0.06% |
| Child in home needing care | 0.52 | 0.49 | 0.09% |
| Increase in home conflict | 0.36 | 0.36 | 0.05% |
| Relocated home | 0.30 | 0.19 | 0.01% |
| Improvise living conditions | 0.59 | 0.52 | 0.10% |
| Unable to get food | -0.17 | -0.12 | 0.01% |
| Death of close friend or family member | 1.65 | 1.32 | 0.63% |
| **Years of Education** | 0.08 | 0.51 | 0.10% |
| **ADI National Rank** | -0.04 | -1.96 | 1.50% |
| **Perceived SES** | -0.25 | -1.03 | 0.39% |
| **PHQ-4 Depression** | 1.10 | 4.51*** | 7.49% |

**p< .05, *** p< .001*

[a] *See Table S1A for abbreviations.*

**Figure S1.** The effect of perceived SES (PSES) on Fear of COVID-19 (FCV-19S) score, grouped by asthma severity.