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ORIGINAL ARTICLE

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Risk of Depression and Post-Traumatic Stress Disorder among Adult Filipino Patients with Respiratory Allergies from an Allergy Unit in a Tertiary Hospital during the COVID-19 Pandemic: A Cross-sectional Study

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ABSTRACT

Objectives: This study aimed to determine the risk of depression and post-traumatic stress disorder among Filipino adults with respiratory allergies in an allergy unit during the COVID-19 pandemic. Also, we sought to identify if certain demographic variables are associated with these mental health conditions.

Methodology: Respondents from an allergy unit completed the online survey from January to May 2022. Data obtained included sociodemographic factors and the presence of respiratory allergies. Patient Health Questionnaire - 9 (PHQ-9) and Impact of Event Scale-Revised (IES-R) ratings were used to measure depression and risk of post-traumatic stress disorder (PTSD), respectively. The relative risk or risk ratio (RR) of depression and post-traumatic stress disorder (PTSD) among subjects and the influence of demographic characteristics, type, and severity on the risk of depression and post-traumatic stress disorder (PTSD) among the subjects were estimated using log-binomial regression.

Results: A total of 172 respondents were included in the study: 92 with respiratory allergies and 80 without respiratory allergies. Compared to those without allergies, those with allergies had a much higher proportion of post-graduate degree and higher monthly income. Of the individuals, 40.12% suffered from allergic rhinitis, 3.49% from asthma, and 9.88% from both allergies. The mean PHQ-9 score for all respondents was 7.80 (SD = 6.23), with a mean score of 7.89 (SD = 6.34) and 7.72 (SD = 6.29) for those without and with respiratory allergies, respectively. Among those without respiratory allergies, 41.25% had mild depression, 12.50% had moderate depression, 11.25% had moderately severe depression, and 6.25% had severe depression. Among those with allergies, 33.70% had mild depression, and 19.57% had moderate depression. The mean score for the intrusion, avoidance, and hyperarousal subscales of the IES-R were 10.32 (SD = 6.34), 11.17 (SD = 7.21), and 6.99 (SD = 5.38), respectively, and the overall mean IES-R score for the respondents was 10.32 (SD = 7.34). Among those without respiratory allergies, 31.50% had high scores for PTSD, 2.50% had probable PTSD, 20% had PTSD as a clinical concern, and 46.25% did not have PTSD. For those with allergic rhinitis, the prevalence of high scores for PTSD was 40.58%, while it was 50.00% for those with asthma. Depression was highly correlated with age and marital status. For PTSD, those who were married (OR = 0.31, p = 0.012) were 3.23 times less likely to develop the condition than their single counterparts. The type of respiratory allergies, the severity of allergic rhinitis, and the level of asthma control were not significantly associated with the severity of depression and PTSD of any degree.

Conclusion: Patients with respiratory allergies did not have an increased risk of depression and post-traumatic stress disorder in this particular population. The PHQ-9 AND IES-R scores among those with respiratory allergies and those without were shown to have no significant difference. Demographic factors found to be associated with depression were age and marital status, while for PTSD, it was only marital status. The type of respiratory allergy, control, and severity were not associated with depression and PTSD of any degree.

Keywords: allergic rhinitis, asthma, Patient Health Questionnaire-9, impact of event scale-revised

INTRODUCTION

A cluster of unusual pneumonia-like cases were recorded in Wuhan, China, in December 2019. Later, it was determined to be a new coronavirus infection (SARS-COV-2) and given the name, COVID-19. The World Health Organization (WHO) formally designated the COVID-19 pandemic as a public health emergency of global concern on March 11, 2020.[1] In the Philippines, it was March 16 when it was formally declared a state of public health emergency. Lockdowns and various travel restrictions were imposed to control the spread of the virus. Land, domestic air, and domestic sea travel to and from Metro Manila and classes were suspended. Work from home was highly encouraged. People were forced to adapt to a different lifestyle.

Public health emergencies such as the COVID-19 pandemic may have an adverse impact on the health and well-being of both individuals and communities. In addition to secondary effects including economic loss, work and school closures, insufficient resources for medical care, and insufficient distribution of essentials, it can lead to insecurity, disorientation, emotional isolation, and stigma. In both the general population and those who contract the disease, these effects may manifest as a variety of emotional reactions (such as distress or psychiatric conditions), unhealthy behaviors (such as excessive substance use), and non-compliance with public health directives (such as home confinement and vaccination). Certain populations, such as the elderly, the immunocompromised, healthcare workers, and people living or receiving care in communal settings, may be more susceptible than others to the emotional effects of pandemics. At risk for these negative effects also are those with preexisting medical and psychiatric conditions and people who have problems with substance abuse. Studies from past outbreaks also identified the following psychological responses and coping methods: anxiety, depression, loss, stigmatization, isolation, and cognitive restructuring. The degree to which these coping methods can be helpful for the individual is also influenced by demographic factors, risk of appraisal, and severity of the outbreak. These findings implicate the need for further examination of the psychological response of people across different subgroups affected by the pandemic so that a comprehensive understanding of its impact can be made.[2]

Various studies done abroad demonstrated that allergic diseases are associated with an increased risk for psychiatric disorders. In the long course, the need for chronic treatment and repeated exacerbations significantly affects patients' quality of life, constituting a serious burden on the individual and society.[3] However, there is a paucity of information and studies regarding the association between allergies and mental health problems here in the Philippines.

Given this observed link between allergies and mental health conditions and the additional stresses brought about by the COVID-19 pandemic, the researcher sought to identify the psychological impact of the pandemic on the mental health of people with allergies here in the Philippines.

STATEMENT OF THE PROBLEM

Are patients with respiratory allergies at risk for depression and post-traumatic stress disorder during the COVID-19 pandemic?

OBJECTIVES

General Objective

To determine the risk of depression and PTSD with respiratory allergies among adult Filipino patients during the COVID-19 pandemic.

Specific Objectives

1. To describe the sociodemographic characteristics of adult patients with respiratory allergic diseases as follows:
    a. Age
    b. Sex
    c. Marital status
    d. Educational attainment
    e. Employment Status
    f. Average monthly household income
    g. Household size
2. To describe the clinical characteristics of patients as follows:
    a. Type of allergic disease
        i. Allergic rhinitis
        ii. Asthma
        iii. both
    b. Severity of symptoms
        i. Allergic rhinitis: mild intermittent, mild persistent, moderate to severe intermittent, moderate to severe persistent
        ii. Asthma: controlled, partly controlled, uncontrolled
3. To determine the prevalence of depression among patients using the Patient Health Questionnaire (PHQ-9).
4. To determine the prevalence of post-traumatic stress disorder among patients using the Impact of Event Scale-Revised (IES-R).
5. To determine the association of demographic characteristics with depression and PTSD among patients with respiratory allergic diseases.
6. To determine the association of type of respiratory allergy, severity, and level of control with the presence of depression and PTSD.

METHODOLOGY

Research Method
Cross-sectional study (analytic)

Subjects
Adult patients with and without respiratory allergies seen in a tertiary hospital were included in the study.

Subjects with respiratory allergies

Inclusion Criteria
This study included adult patients (aged >19 years old) seen at the Allergy, Asthma, and Immunology Unit of Fe del Mundo Medical Center (FDMMC) from January to May 2022, *both newly and previously diagnosed with respiratory allergies such as allergic rhinitis and/or asthma.*

Exclusion Criteria
1. Patients with chronic medical conditions such as:
    a. stroke
    b. heart disease
    c. chronic pain like arthritis
    d. thyroid disease
    e. cancer
    f. other psychiatric disorders
2. Patients with incomplete responses to the survey were excluded from this study.

Subjects without respiratory allergies

Inclusion Criteria
This study included adult patients (aged >19 years old) seen at other clinics at FDMMC with no allergic rhinitis and asthma, as indicated in their responses to the patient data form.

Exclusion Criteria
Exclusion criteria are the same as that for patients with respiratory allergies.

Sampling Method and Sample Size Computation
A purposive sampling method was conducted based on the objectives of the study. The sample size computation for binary logistic regression analysis was carried out using GPower version 3.1.9.4. According to the study of Gonzalez-Diaz et al., the risk of depression among patients with allergic diseases was 1.65, with an R2-value of 0.04.[4] A null proportion of 20.00% will be utilized. With these parameters and a minimum power of 80% at a significance level of 5% (two-tailed), a minimum sample size of 164 respondents was necessary. This was divided into 82 subjects with respiratory allergies and 82 subjects without allergies.

Data Instruments
Patient data form was used to gather information on the demographic characteristics of participants, such as age, sex, educational attainment, employment status, household size, and average monthly household income, as well as their clinical characteristics (presence of respiratory allergies- asthma and/or allergic rhinitis), level of control and severity, as well as the presence of comorbid illnesses, were also included in the form.

The PHQ-9 and IES-R were used to assess depression and post-traumatic stress disorder, respectively.

Patient Health Questionnaire-9 (PHQ-9) was developed by Dr. Robert J. Spitzer, Dr. Janet B.W. Williams, Dr. Kurt Kroenke, and colleagues from Columbia University in 1999 with a grant from Pfizer. It is a self-administered diagnostic screening instrument, which consists of 9 questions that focus on the diagnostic criteria of the DSM-IV for major depressive disorder (MDD). PHQ-9 as a screening tool for depression has been validated among Filipinos.[5] Items are scored from "0" (not at all") to "3" (nearly every day). The total sum of the responses suggests varying levels of depression. Scores range from 0-27. PHQ-9 scores are interpreted as follows: 0-4 (minimal depression), 5-9 (mild depression), 10-14 (moderate depression), 15-19 (moderately severe depression), and 20-27 (severe depression

The Impact of Event Scale-Revised (IES-R) was developed in 1997 by Daniel S. Weiss and Charles R. Marmar. The questionnaire comprises 22 items to measure the subjective response to a specific traumatic event in the older adult population, especially in intrusion, avoidance, and hyperarousal response sets. IES-R has been well validated in the European and Asian populations for determining the extent of psychological impact after exposure to a traumatic event within one week of exposure.[6] (Items are rated on a 5-point scale ranging from 0 ("not at all") to 4 ("extremely"). The total IES-R score is the sum of the means of the scores in the intrusion, avoidance and hyperarousal subsets. The score can range anywhere from 0-88. A score of 24-32 means that PTSD is of clinical concern; a score of 33-38 implies a probable diagnosis of PTSD, and a score of 39 and above is high enough to suppress the immune system's functioning.[7]

Data Collection Procedures
For the subjects with respiratory allergies, both new and old patients who were personally seen by the researcher at the Allergy Unit and diagnosed with allergic rhinitis and/or asthma were included. The concierge of FDMMC Outpatient Clinic Services (OCS) sent survey links to patients who were scheduled for teleconsult other than those at the Allergy Unit. Those with no allergic rhinitis and/or asthma, as indicated in their responses to the Patient Data Form,

were included in the study and classified as patients with no respiratory allergies. The survey, which included PHQ-9 and IES-R, was then sent to the participants via Google Forms.

Ethical Considerations

This study was conducted in accordance with international and national guidelines on research of human participants such as the Declaration of Helsinki, Good Clinical Practice, and the National Ethical Guidelines for Health and Health-Related Research 2017.

Data Analysis

Statistical analyses were conducted using STATA Statistical Software, Version 13, College Station, TX: StataCorp LP. A p-value of 0.05 was considered statistically significant. Descriptive statistics included mean and standard deviation for continuous-level data, median and interquartile range for ordinal data, and frequency and proportion for nominal data. The prevalence of depression and post-traumatic stress disorder (PTSD) was estimated using the chi-square test exact binomial.[8] Comparative analyses between cases and controls involved the Chi-Square Test of Homogeneity or Fisher's Exact Test, if the required expected frequency of 5 per cell is not met, for nominal data; Mann-Whitney U Test for ordinal data; or independent t-test for continuous-level data.[8] The relative risk or risk ratio (RR) of depression and post-traumatic stress disorder (PTSD) among subjects was estimated using Log-Binomial Regression.[8] Similarly, the influence of demographic characteristics on the risk of depression and post-traumatic stress disorder (PTSD) among the subjects was estimated using binomial regression.[8] Crude relative risks (cRR) were initially estimated. Afterward, significant confounders were screened, analyzed, and controlled using a 10% change-in-estimate criterion to estimate the adjusted relative risk or risk ratio (aRR).

RESULTS

Demographic Characteristics

Table 1 showed that most of the participants were between the ages of 31 and 40 (56.40%), female (70.93%), single (50.00%), had tertiary-level education (69.19%), employed (86.05%), had a monthly average income between PhP 21,914 and PhP 43,828 (37.21%), and had 3 – 5 occupants in their household (65.70%).

Comparative analyses showed that the age, sex, marital status, employment status, household size, and comorbidities were not statistically different (p >0.05). However, the proportion of participants with a post-graduate education was significantly higher among those with allergies (33.70% vs. 18.75%; p = 0.025) than those without. In addition, those with a monthly average income of PhP 10,957 to PhP 21,914 (22.50% vs. 9.78%) were significantly higher among those without allergies. In comparison, the proportion of participants with an average monthly income of PhP 43,828 to PhP 76,669 (25.00% vs. 12.50%) was significantly higher among those with respiratory allergies.

Type of Respiratory Allergy, the Severity of Allergic Rhinitis, and the Level of Control of Asthma among Respondents with Respiratory Allergies

Table 2 showed that 40.12% of the participants had allergic rhinitis, 3.49% had asthma, and 9.88% had both. Among those with allergic rhinitis, the majority (33.72%) had mild intermittent allergic rhinitis, while only 1.74% had moderate to severe persistent allergic rhinitis. Regarding asthma, results showed that 9.30% had controlled asthma, and 4.07% had partly controlled asthma.

Depression among the Respondents

Table 3 showed that 68.60% of the participants had varying degrees of depression. Most of the participants had mild depression (37.21%), followed by moderate depression (16.28%) and moderately severe depression (9.30%). Only 5.81% of the participants had severe forms of depression.

Among those without respiratory allergies, 41.25% had mild depression, 12.50% had moderate depression, 11.25% had moderately severe depression, and 6.25% had severe depression. Among those with respiratory allergies, 33.70% had mild depression, and 19.57% had moderate depression. Comparative analyses of the PHQ-9 scores and depression severity among those with respiratory allergies and those without respiratory allergies indicated no significant difference (p >0.05). In a similar vein, comparisons of the mean PHQ-9 score (F = 0.49, p = 0.614) and the proportion of depression severity across the categories of respiratory allergies (allergic rhinitis, asthma, and both; χ^2 = 3.80, p = 0.923) indicated no statistically significant difference.

PTSD among the Respondents

Table 4 shows that 58.14% of the participants had varying levels of post-traumatic stress disorder (PTSD), and 41.86% did not have PTSD. Among those without respiratory allergies, 31.50% had high scores for PTSD, 2.50% had probable PTSD, 20% had PTSD as a clinical concern, and 46.25% did not have PTSD. Among those with respiratory allergies, 13.04% had PTSD as a clinical concern, 6.52% had probable PTSD, 42.39% had high score of PTSD, and 38.04% did not have PTSD. Comparative analyses of the IES-R scores and prevalence of PTSD among those with (allergic rhinitis, asthma, and both) and without respiratory allergies indicated no significant difference (p>0.05).

Table 1. Demographic characteristics of the respondents with and without respiratory allergies (N = 172)

Characteristics	Without allergies (n = 80)	With allergies (n = 92)	Total (N = 172)	Test statistic[a]	*p*-value (Two-tailed)
Age (f, %)				3.99	0.343
19 to 30 years old	26 (32.50%)	19 (20.65%)	45 (26.16%)		
31 to 40 years old	39 (48.75%)	58 (63.04%)	97 (56.40%)		
41 to 50 years old	12 (15.00%)	12 (13.04%)	24 (13.95%)		
51 to 60 years old	1 (1.25%)	1 (1.09%)	2 (1.16%)		
more than 60 years old	2 (2.50%)	2 (2.17%)	4 (2.33%)		
Sex (f, %)				0.85	0.356
Male	26 (32.50%)	24 (26.09%)	50 (29.07%)		
Female	54 (67.50%)	68 (73.91%)	122 (70.93%)		
Marital status (f, %)				4.23	0.348
Single	43 (53.75%)	43 (46.74%)	86 (50.00%)		
Married	30 (37.50%)	44 (47.83%)	74 (43.02%)		
Common law or live-in	6 (7.50%)	4 (4.35%)	10 (5.81%)		
Separated	0 (0.00%)	1 (1.09%)	1 (0.58%)		
Widow or widower	1 (1.25%)	0 (0.00%)	1 (0.58%)		
Educational attainment (f, %)				8.42*	0.025
Primary education	0 (0.00%)	1 (1.09%)	1 (0.58%)		
Secondary education	5 (6.25%)	1 (1.09%)	6 (3.49%)		
Tertiary education	60 (75.00%)	59 (64.13%)	119 (69.19%)		
Post-graduate education	15 (18.75%)	31 (33.70%)	46 (26.74%)		
Employment status (f, %)				4.29	0.174
Unemployed	9 (11.25%)	7 (7.61%)	16 (9.30%)		
Employed	65 (81.25%)	83 (90.22%)	148 (86.05%)		
Student	5 (6.25%)	1 (1.09%)	6 (3.49%)		
Retired	1 (1.25%)	1 (1.09%)	2 (1.16%)		
Average monthly income (f, %)				12.80*	0.041
Below PhP 10,957	12 (15.00%)	6 (6.52%)	18 (10.47%)		
PhP 10,957 to PhP 21,914	18 (22.50%)	9 (9.78%)	27 (15.70%)		
PhP 21,914 to PhP 43,828	29 (36.25%)	35 (38.04%)	64 (37.21%)		
PhP 43,828 to PhP 76,669	10 (12.50%)	23 (25.00%)	33 (19.19%)		
PhP 76,669 to PhP 131,484	7 (8.75%)	11 (11.96%)	18 (10.47%)		
PhP 131,484 to PhP 219,140	2 (2.50%)	6 (6.52%)	8 (4.65%)		
More than PhP 219,140	2 (2.50%)	2 (2.17%)	4 (2.33%)		
Household Size (f, %)				0.51	0.930
1 Occupant	2 (2.50%)	2 (2.17%)	4 (2.33%)		
2 Occupants	7 (8.75%)	11 (11.96%)	18 (10.47%)		
3 – 5 Occupants	53 (65.22%)	60 (65.22%)	113 (65.70%)		
≥6 Occupants	19 (22.50%)	19 (20.65%)	37 (21.51%)		

[a]Note: Comparative analyses were conducted using the Chi-square test of homogeneity or Fisher's Exact test, Mann-Whitney U Test, or independent t-test.

**Significant at 0.05, †Significant at 0.01*

Association of Demographic Characteristics and Depression among Participants with Respiratory Allergies

Table 5 indicates that sex, educational attainment, employment status, average monthly income, and household size did not significantly influence the odds of developing depression of any degree (p >0.05). Nevertheless, it can be noted that age and marital status were significantly associated with depression. Those who are 31 to 40 years old (OR = 0.06, p = 0.014) and 41 to 50 years old (OR = 0.01, p = 0.003) were 16.67 times and 100.00 times at lower risk of developing moderate depression compared to those who are 19 to 30 years old. In terms of marital status, results indicated that those who are married were ten times at lower odds of developing moderate depression (OR = 0.10, p = 0.002) compared to their single counterparts.

Association of the Demographic Characteristics and Post-traumatic Stress Disorder (PTSD) Status among the Respondents with Respiratory Allergies

Table 6 shows that those who were married (OR = 0.31, p = 0.012) were 3.23 times less likely to develop PTSD than their single counterparts.

Table 2. Descriptive statistics of the type of respiratory allergy, the severity of allergic rhinitis, and the level of control of asthma among respondents with respiratory allergies (N = 92)

Characteristics	Frequency (*f*)	Percentage (%)	95% CI (%)
Type of respiratory allergy			
Allergic rhinitis	69	40.12	32.99 to 47.69
Asthma	6	3.49	1.56 to 7.60
Both allergic rhinitis and asthma	17	9.88	6.20 to 15.39
Severity of allergic rhinitis			
Mild intermittent	58	33.72	26.99 to 41.18
Mild persistent	19	10.47	6.62 to 16.06
Moderate to severe intermittent	7	4.07	1.93 to 8.34
Moderate to severe persistent	3	1.74	0.56 to 5.32
Level of control of asthma			
Controlled	16	9.30	5.75 to 14.71
Partly controlled	7	4.07	1.94 to 8.35
Uncontrolled	1	0.58	0.08 to 4.08

Table 3. Descriptive statistics and comparative analyses of depression among the respondents with and without respiratory allergies (N = 172)

Characteristics	Without allergies (n = 80)	With allergies (n = 92)				Total (N = 172)	Test statistic[a]	*p*-value (Two-tailed)
		Allergic rhinitis (n=69)	Asthma (n=6)	Both allergic rhinitis and asthma (n = 17)	All with allergies (n = 92)			
PHQ-9 overall score (x̄, SD)	7.89 (6.20)	7.54 (6.34)	6.63 (5.01)	8.94 (6.62)	7.72 (6.29)	7.80 (6.23)	0.34	0.794
Depression severity (*f*, %)							6.59	0.900
No depression (scores <5)	23 (28.75%)	24 (34.78%)	3 (50.00%)	4 (23.53%)	31 (33.70%)	54 (31.40%)		
Mild depression (scores 5–9)	33 (41.25%)	22 (31.88%)	2 (33.33%)	7 (41.18%)	31 (33.70%)	64 (37.21%)		
Moderate depression (scores 10–14)	10 (12.50%)	14 (20.29%)	1 (16.67%)	3 (17.65%)	18 (19.57%)	28 (16.28%)		
Moderately severe depression (scores 15–19)	9 (11.25%)	6 (8.70%)	0 (0.00%)	1 (5.88%)	7 (7.61%)	16 (9.30%)		
Severe depression (scores ≥20)	5 (6.25%)	3 (4.35%)	0 (0.00%)	2 (11.76%)	5 (5.43%)	10 (5.81%)		

[a]*Note: Comparative analyses were conducted using the Chi-Square Test of Homogeneity, Fisher's Exact Test, or independent t-test.*

**Significant at 0.05,* [†]*Significant at 0.01*

Table 4. Descriptive statistics and comparative analyses of Post-Traumatic Stress Disorder among the respondents with and without respiratory allergies (N = 172)

Characteristics	Without allergies (n = 80)	With allergies (n = 92)				Total (n = 172)	Test statistic[a]	*p*-value (Two-tailed)
		Allergic rhinitis (n = 69)	Asthma (n = 6)	Both allergic rhinitis and asthma (n = 17)	All with allergies (n = 92)			
IES-R scores (x̄, SD)								
Intrusion subscale	9.85 (7.22)	10.28 (7.28)	10.83 (9.00)	12.53 (7.86)	10.73 (7.46)	10.32 (7.34)	0.63	0.597
Avoidance subscale	10.49 (7.04)	11.23 (6.98)	9.67 (8.45)	14.71 (8.11)	11.77 (7.35)	11.17 (7.21)	1.71	0.167
Hyperarousal subscale	6.48 (4.93)	6.91 (5.48)	8.00 (6.66)	9.35 (6.35)	7.43 (5.73)	6.99 (5.38)	1.42	0.238
Overall scale score	26.81 (18.08)	28.42 (18.54)	28.50 (23.62)	36.59 (20.24)	29.93 (19.23)	28.48 (18.71)	1.28	0.282
Post-Traumatic Stress Disorder (PTSD; f, %)							13.91	0.163
Without PTSD (Scores <24)	37 (46.25%)	29 (42.03%)	3 (50.00%)	3 (17.65%)	35 (38.04%)	72 (41.86%)		
PTSD is clinical concern (Scores 24 to 32)	16 (20.00%)	9 (13.04%)	0 (0.00%)	3 (17.65%)	12 (13.04%)	28 (16.28%)		
Probable PTSD (Scores 33 to 36)	2 (2.50%)	3 (4.35%)	0 (0.00%)	3 (17.65%)	6 (6.52%)	8 (4.65%)		
High score for PTSD (Scores ≥37)	25 (31.50%)	28 (40.58%)	3 (50.00%)	8 (47.06%)	39 (42.39%)	64 (37.21 %)		

Table 5. Univariate multinomial logistic regression analyses of the association of demographic characteristics and depression severity among those with respiratory allergies (N = 92)

Predictors	Depression severity							
	Mild depression		Moderate depression		Moderately severe depression		Severe depression	
	OR	*p*-value	OR	*p*-value	OR	*p*-value	OR	*p*-value
Age								
19 to 30 years old	Referent	–	Referent	–	Referent	–	Referent	–
31 to 40 years old	0.16	0.114	0.06*	0.014	0.11	0.093	0.01*	0.003
41 to 50 years old	0.14	0.117	1.06	0.992	1.07	0.995	1.02	0.996
51 to 60 years old	1.03	0.998	1.08	1.000	1.01	1.000	1.04	1.000
more than 60 years old	1.03	0.997	1.02	0.997	1.01	1.000	1.04	1.000
Sex (Female)	2.63	0.098	1.64	0.440	3.79	0.243	1.03	0.989
Marital status								
Single	Referent	–	Referent	–	Referent	–	Referent	–
Married	0.61	0.363	0.10*	0.002	0.17	0.057	0.11	0.060
Common Law or Live-in	0.75	0.846	1.39	0.802	1.02	0.996	1.01	0.996
Separated	1.09	0.996	0.40	1.000	0.41	1.000	0.36	1.000
Educational attainment								
Primary education	Referent	–	Referent	–	Referent	–	Referent	–
Secondary education	1.00	1.000	1.04	1.000	1.00	1.000	1.04	1.000
Tertiary education	1.01	1.000	1.03	0.994	0.63	1.000	0.86	1.000
Post-Graduate Education	0.80	1.000	1.09	0.994	1.77	1.000	0.62	1.000
Employment status (employed)	0.54	0.446	0.80	0.808	1.33	0.815	3.36	0.230
Average monthly income								
Below PhP 10,957	Referent	–	Referent	–	Referent	–	Referent	–
PhP 10,957 to PhP 21,914	1.00	1.000	1.07	0.993	1.08	0.996	1.04	0.995
PhP 21,914 to PhP 43,828	7.50	0.093	1.06	0.993	1.03	0.996	1.50	0.756
PhP 43,828 to PhP 76,669	4.57	0.217	1.02	0.993	1.05	0.996	0.57	0.718
PhP 76,669 to PhP 131,484	3.00	0.417	1.06	0.993	1.09	0.996	1.02	0.994
PhP 131,484 to PhP 219,140	2.67	0.497	1.04	0.993	2.15	1.000	1.06	0.996
More than PhP 219,140	4.00	0.442	1.08	1.000	1.84	1.000	1.04	0.998
Household size								
1 Occupant	Referent	–	Referent	–	Referent	–	Referent	–
2 Occupants	1.67	0.748	1.09	0.996	1.02	1.000	2.14	1000
3 – 5 Occupants	0.83	0.900	1.04	0.996	1.03	0.998	1.02	0.998
≥6 Occupants	1.67	0.748	1.03	0.996	1.03	0.997	1.03	0.998

OR – Odds Ratio

[a]Note: The base outcome used for the analysis was the absence of depression or no depression.

**Significant at 0.05, [†]Significant at 0.01*

Association of Respiratory Allergy Type, Severity and Level of Control, and Depression among Participants with Respiratory Allergies

Table 7 showed that the type of respiratory allergies, the severity of allergic rhinitis, and the level of asthma control were not significantly associated with the severity of depression ($p > 0.05$)

Analysis of the Association of the Type, Severity and Control of Respiratory Allergies and Post-traumatic Stress Disorder (PTSD) Status among the Respondents with Respiratory Allergies

It can be noted in Table 8 that the type of respiratory allergies, the severity of allergic rhinitis, and the level of asthma control were not significantly associated with the development of PTSD ($p > 0.05$).

DISCUSSION

Socioeconomic status was the only demographic factor observed to be associated with the prevalence of respiratory allergies in this study. In epidemiological studies, the classification of SES usually includes income, occupation, occupational status, educational level, or a combination of these. In particular, allergic rhinitis and asthma were more frequently seen among those with higher educational attainment than those without allergies. In addition, those with a monthly average income of PhP 10,957 to PhP 21,914

Table 6. Univariate multinomial logistic regression analyses of the association of demographic characteristics and Post-Traumatic Stress Disorder (PTSD) status among those with respiratory allergies (N = 92)

Predictors	Post-Traumatic Stress Disorder Status (with possible PTSD)		
	Odds Ratio (OR)	SE	*p*-value (Two-tailed)
Age			
19 to 30 years old	Referent	–	–
31 to 40 years old	0.35	0.22	0.093
41 to 50 years old	0.27	0.21	0.101
51 to 60 years old	1.02	1.07	0.996
More than 60 years old	1.02	1.05	0.994
Sex (Female)	1.96	0.94	0.164
Marital status			
Single	Referent	–	–
Married	0.31	0.14	0.012
Common law or live-in	1.03	1.24	0.980
Separated	1.02	1.05	0.995
Widow or widower	1.00	–	1.000
Educational attainment			
Primary education	Referent	–	–
Secondary education	1.00	1.02	1.000
Tertiary education	1.04	0.01	0.994
Post-graduate education	1.03	0.01	0.994
Employment status (employed)	0.83	0.50	0.755
Average monthly income			
Below PhP 10,957	Referent	–	–
PhP 10,957 to PhP 21,914	0.80	0.21	0.833
PhP 21,914 to PhP 43,828	3.38	1.34	0.181
PhP 43,828 to PhP 76,669	1.30	0.29	0.775
PhP 76,669 to PhP 131,484	1.20	0.18	0.858
PhP 131,484 to PhP 219,140	1.00	0.00	1.000
More than PhP 219,140	1.00	0.00	1.000
Household Size			
1 Occupant	Referent	–	–
2 Occupants	1.04	0.01	0.992
3 – 5 Occupants	1.03	0.01	0.992
≥6 Occupants	1.09	0.01	0.992

**Significant at 0.05, †Significant at 0.01*

was significantly higher among those without allergies. In contrast, the proportion of participants with an average monthly income of PhP 43,828 to PhP 76,669 (25.00% vs. 12.50%) was significantly higher among those with allergies.

Our study findings align with previous studies relating asthma and other allergies as a disease of the middle and upper classes. The hygiene hypothesis was the probable explanation for higher prevalence rates in more affluent countries, which states that maternal exposure to microorganisms during pregnancy and early childhood exposure would protect against sensitization to allergens later in life. Similar findings were also reported in an earlier study by Li et al., in 2011, wherein a higher prevalence of allergies was related to higher individual-level socioeconomic status (SES) represented by parental education and household income per capita.[9] In another study by Chong and Chew in 2018, a higher AR susceptibility was found among people with more computer usage, higher education, higher stress levels, and less sleeping time.[10] Authors hypothesized that those who obtained higher education and enjoyed a higher income usually work in jobs featuring more indoor than outdoor activity, thus increasing the odds of developing AR.[11] This hypothesis is congruent with the observation of Hancox et al., that SES interacts with specific environmental factors to have different effects on asthma prevalence in different populations, such that, for example, less affluent people may have greater exposure to cockroaches and, therefore may have asthma because of cockroach allergy. House dust mites are more significant in other populations, and exposure may be greater in higher SES homes. Another explanation for the role of SES in allergies may be that physician diagnosis and treatment of asthma may differ

Table 7. Univariate multinomial logistic regression analyses of the association of respiratory allergy type, severity, and level of control and depression severity among those with respiratory allergies (N = 92)

Predictors	Depression severity							
	Mild depression		Moderate depression		Moderately severe depression		Severe depression	
	OR	*p*-value	OR	*p*-value	OR	*p*-value	OR	*p*-value
Respiratory allergies								
Allergic rhinitis	Referent	–	Referent	–	Referent	–	Referent	–
Asthma	0.73	0.740	0.57	0.642	1.01	0.990	1.02	0.992
Both allergic rhinitis and asthma	1.91	0.351	1.29	0.763	1.00	1.000	4.00	0.191
Severity of allergic rhinitis								
Mild intermittent	Referent	–	Referent	–	Referent	–	Referent	–
Mild persistent	1.50	0.707	1.50	0.765	1.06	0.995	1.04	0.996
Moderate to severe intermittent	1.50	0.765	1.50	0.810	1.08	0.995	1.04	0.995
Moderate to severe persistent	1.02	0.996	1.04	0.996	1.02	0.994	1.04	0.999
Level of control of asthma								
Uncontrolled	Referent	–	Referent	–	Referent	–	Referent	–
Partly controlled	1.00	1.000	3.47	0.326	1.05	0.996	1.05	0.996
Controlled	0.75	0.723	0.43	0.473	1.04	0.992	1.04	0.993

OR – Odds Ratio

Table 8. Univariate multinomial logistic regression analyses of the association of respiratory allergy type, severity, and level of control, and Post-Traumatic Stress Disorder (PTSD) status among those with respiratory allergies (N = 92)

Predictors	Post-Traumatic Stress Disorder (PTSD) status (with possible PTSD)		
	Odds Ratio (OR)	SE	*p*-value (Two-tailed)
Respiratory allergies			
Allergic rhinitis	Referent	–	–
Asthma	0.73	0.62	0.706
Both allergic rhinitis and asthma	3.38	2.31	0.074
Severity of allergic rhinitis			
Mild intermittent	Referent	–	–
Mild persistent	1.25	1.18	0.813
Moderate to severe intermittent	2.50	2.92	0.433
Moderate to severe persistent	1.00	1.00	1.000
Level of control of asthma			
Uncontrolled	Referent	–	–
Partly controlled	0.58	0.60	0.596
Controlled	0.58	0.43	0.464

between economic groups, with an increase in prevalence in those with better access to care or an increase in disease severity due to inadequate treatment seen in lower economic strata.[12]

Previous cross-sectional studies have shown a consistent link between asthma, depression, and anxiety. Studies among patients with allergic rhinitis also show an increase in the frequency of depression and an increase in posttraumatic stress disorder due to the COVID-19 lockdown.[13] It is thought that the additional psychosocial stresses brought about by the lockdown could worsen these conditions. However, our study did not produce the same results. Table 3 showed that the presence of respiratory allergies did not significantly influence the odds of developing depression of any degree. Also, the type of respiratory allergy, asthma level of control, and allergic rhinitis severity were not significantly associated with the development of depression.

Of note, however, is the significant association of age and marital status among those with respiratory allergies with depression among all the demographic variables studied. Those who are 31 to 40 years old and 41 to 50 years old were 16.67 times and 100.00 times at lower risk of developing moderate depression compared to those who are 19 to 30 years old. In terms of marital status, results indicated that those who are married were ten times at lower odds

of developing moderate depression compared to their single counterparts.

Identifying subsets of people who are more at risk for the pandemic's psychological effects is paramount among healthcare practitioners. The CDC reported a massive increase of 25% in the global prevalence of anxiety and depression during the first year of the pandemic. The stress that resulted from social isolation and the limitations on people's ability to work and seek support were among the reasons for this increase. Stressors that contribute to anxiety and depression have also been identified as loneliness, fear of infection, pain and death for oneself and loved ones, grief following a bereavement, and financial concerns.[14] But this was during the early phase of the pandemic. The author hypothesizes that the timing of this research could have affected the responses to PHQ-9 and IES-R. The survey links were sent from January to May 2022, when the COVID-19 situation in the Philippines had already improved; fewer restrictions and lockdowns had been lifted, people were gradually returning to work, and improved outcomes patients due to the vaccination rollout. At this point, the respondents may better perceive their condition and the world. Studies based on a longitudinal population demonstrate that anxiety and depression symptoms were noticeable but frequently fleeting, peaking during lockdowns and then returning to pre-pandemic levels following.[15] The same observation was seen in a study by Pedersen et al., who used a longitudinal or time-trend series of mental health landscapes during COVID-19. The research revealed better results during the reopening stages and worse mental health indicators during the rigorous lockdown periods.[16]

Young people tend to be more vulnerable and have a higher risk of having mental health problems, as observed in many recent studies. The current drastic limitations and social changes may have a more significant impact on the younger generation since their psychological resilience and established social base may be inadequate for the situation.[17] This population segment tends to obtain more information about such issues from social media, frequently infused with fake news and rumors.[18] This age group, 19-30 years old, also includes students; hence, frequent suspensions during the pandemic may have inflicted feelings of loneliness, boredom, uncertainty, and stress.

A recent study that explored the association between marital status and well-being by Serapinas and Narbekovas showed that married people had lower scores on anxiety and depression and higher scores on romantic love. This is because marriage usually occurs in the later stages of young adulthood when individuals start to have more independence and financial freedom and have already established experiences both about love and relationships.[19] The intimacy and emotional support from a good marriage lead to better emotional and physical health. This may be regarded as true, especially if faced with challenges such as the COVID-19 19-pandemic. However, caution should be made in making a generalization/or conclusion that being married per se is a protective factor for depression, and that is consistent in all life stages. There are age-related differences in the effects of marital status and depressive symptoms, and thus serve to have moderating effects. These observations have been documented in some studies.[20]

The study has several limitations. First, the study utilized a small, single-center population, which may have implications for the generalizability of the results. Small study populations are considered nonrepresentative samples of the population. Hence, a larger sample size is recommended to scrutinize better the link between respiratory allergies and mental health conditions. The use of an online questionnaire also poses several limitations. It could increase the probability of underrepresentation and selection bias in this study. Those with more access to technology and adept at it are more inclined to participate in the study. Second, an objective mental health assessment may not be attained via self-reporting done through an online survey. As pointed out earlier, mental health status varies during different phases of pandemics; hence, the use of cross-sectional study design may be insufficient. Longitudinal or cohort studies are therefore recommended.

CONCLUSIONS

Patients with respiratory allergies did not have an increased risk of depression and post-traumatic stress disorder in this particular population. The PHQ-9 AND IES-R scores among those with respiratory allergies and those without were shown to have no significant difference. Demographic factors found to be associated with depression were age and marital status, while for PTSD, it was only marital status. The type of respiratory allergy, control, and severity were not associated with depression and PTSD of any degree.

The study provided insight into the relationship of socioeconomic status with the risk of developing allergies. A longer study design and a larger number of patients in a multicenter trial should be considered for a more thorough examination of the psychological effects of the pandemic on patients' mental health. If possible, screening should be done by a qualified specialist for more objective data on symptoms of depression and post-traumatic stress disorder. Assessment and surveillance of mental health status should always be included in routine visits, particularly among the younger population because of their increased risk.

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All authors certified fulfillment of ICMJE authorship criteria.

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