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Scoping Review of COVID-19 Infection and the Post Diagnosis of Anxiety

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ABSTRACT

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by

Zenobia E. Roberts-Harley

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INTRODUCTION: During the COVID-19 pandemic, numerous news and media outlets reported an increase in mental health dilemmas. Studies varied from anxiety caused due to fear of catching the virus to if contracted, how did the virus psychologically affect the person. These reports examined different areas of the population, especially healthcare workers, first responders, teachers, and persons with comorbidities. The purpose of this scoping review is to describe the research conducted on the relationship between testing positive for COVID-19 and subsequent diagnosis of anxiety.

METHODS: The study design utilized for this research was a scoping review. The literature search was conducted in PubMed. Eligible studies included adults ages 18 and over, who tested positive for COVID-19 by a medical professional, who were diagnosed with anxiety less than a year after testing positive for COVID-19, and were part of the general population (not classified to any subcategory, such as healthcare workers). This scoping review displayed or listed the characteristics, similarities, and/or differences in the studies containing the eligibility criteria.

RESULTS: A total of 455 articles were identified in PubMed. After screening of titles and abstract followed by full-text screening, 12 full-text published articles were used in the scoping review. Seven of the studies utilized prospective cohorts as study designs. Half of the studies utilized some type of regression analyses. In many of the studies, males tend to be the higher percentage of gender type. Most of the of the studies occurred in China, while only two were conducted in the United States. 11 of 12 of the studies reported the incidence of anxiety among study participants.

CONCLUSION: In the general population, more investigation and studies on COVID-19 by psychologists, epidemiologists, and statisticians, will need to be evaluated on anxiety. After the patient develops COVID-19, evaluations for anxiety are essential, in order to thrive against the overburdened healthcare agencies and establish a healthy population of productive citizens in the workforce and contributing some other positive skill in society. Future research includes parallel screening measurements and time durations from a participant testing positive for COVID-19 until being surveyed for anxiety.

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Author's Statement

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TABLE OF CONTENTS

List of Tables

List of Figures

Chapter I – Introduction

1.1 Background

Since the beginning of the pandemic, more professional athletes, actors, celebrities, politicians, and professionals felt comfortable elaborating on their mental health status and its impactful nature on their lives. The addition of COVID-19 opened the door for public health funds and donors from private corporations, to drastically increase media coverage emphasizing the importance of maintaining mental health stability. According to an article from Reuters Institute, " The COVID-19 pandemic has led to a significant increase in mental health news coverage, indicating a growing public interest in the topic. A comparative analysis of global English-language media before and after the pandemic showed that the number of stories with mental health-related themes more than doubled in this period (Goswami, 2023)." On a daily basis, more and more social media platforms are being encouraged to eliminate the stigma surrounding mental health.

According to Weiner et al. (2022), before the COVID-19 pandemic struck, only about 11% of the U.S. adult population reported suffering from anxiety and depression. At the height of the pandemic, more than 40% of adults reported feeling these symptoms compared to the current weighted average of 33% (Weiner et al., 2022). Even though more persons are recognizing the value of their mental health, the current shortage of physicians, especially psychiatrists limit the feasibility of receiving timely and immediate care (Weiner et al., 2022). Psychiatry cross-training and collaborating with Primary Care Providers (PCP) and other specialized medical services/clinicians may be the short-term modification to caring for patients

(Weiner et al., 2022). However, the model of collaborating medical professionals may become a permanent solution to serving clientele in the ongoing mental health epidemic.

Even though PCP's received cross-training to tackle the shortage of psychiatrists and psychologists, more funds need to be allocated for mental health. Less than a year ago, a report published by the Pan American Health Organization (PAHO) urged leaders and decision makers to place mental health on the top of political agendas (Pan American Health Organization, 2023). According to the article, factors pre-dating the COVID-19 pandemic included only 3% of the countries' health budgets being applied for mental health; in addition, the chronic shortage of mental health professionals continued to reduce accessibility of affordable psychological care (Pan American Health Organization, 2023).

Another source identified mental health research that stated 41% of adults experienced high levels of psychological distress at some point during the pandemic (Gramlich, 2023). Women were 48% more likely than men (32%) to experience high levels of anxiety and depression; in regard to ages, non-gender specific, 58% of 18-29 years, 44% of 30-49 years, 41% of 50-64 years, and 27% of 60+ years, were the age ranges reported in the survey (Gramlich, 2023). In the same study from Gramlich, racial demography of patients with psychological distress included: White 38%, Black 42%, Hispanic 46%, and Asian 42% as the races categorized (Gramlich, 2023). This study was conducted in the United States.

Due to the rise and the continued demonstration of various reports of those negatively suffering from mental health statistics, again prioritizing care nationally across the Americas tends to be the goal (Pan American Health Organization, 2023). Integrating mental health into all policies, adopting a gender transformative approach (eliminating stereotypes of gender

norms and relationships) to mental health, improving the resources available to increase financing, and promoting and protecting mental health across the life course, tends to be part of the new agenda for mental health (Pan American Health Organization, 2023). Apparently, many factors inhibit the implementation of excellent care, even though acknowledgement of improving mental health data and research exists.

1.2 Objective of the Study

Due to the ongoing studies of COVID-19, and the non-selective effects on mental health, the aim of this scoping review is to identify and describe the research focused on the association between COVID-19 infection and subsequent diagnosis of anxiety. What are characteristics of the studies in the general population that are measuring the risk of anxiety after an identified positive COVID-19 infection in patients?

Chapter II - Review of the Literature

As discussed by Weiner et al. (2022), the number of people suffering from anxiety and depression increased during the pandemic. For example, one scoping review reviewed research on the psychological status of emergency care workers providing care to COVID-19 patients (Alanazi et al., 2022). The study focuses on the workers' mindsets including anxiety, depression, and coping skills of navigating the frontline of the pandemic. An abundance of systematic reviews, for healthcare workers analyzing the effects of COVID-19 on their mental health continue to emerge.

Vindegaard et al. (2020) reviews the research on the mental health consequences of the Covid-19 pandemic among current psychiatric patients. In this study, the eligibility criteria included persons with a previous COVID-19 infection, a prior diagnosis of a mental health illness before the pandemic, and studies where psychiatric symptoms were present in new patients diagnosed with a psychiatric illness (but the incidence of COVID-19 is unknown). The study separated the data collected from the healthcare workers and the general population, making two distinct population categories (Vindegaard et al., 2020).

Among the differing population categories, a high amount of Post-Traumatic Stress Disorder, increased levels of depression, worsening of psychiatric symptoms in patients with preexisting psychiatric disorders, and higher levels of psychiatric symptoms in healthcare workers were noted (Vindegaard et al., 2020). In the general public, a decrease in psychological well-being was observed, yet smaller sample sizes were recorded in this population. Therefore, well-conducted and larger scale studies are needed for further analysis and evaluation of

COVID-19 infection and psychiatric diagnoses in the general population, separate from skilled healthcare workers.

Another scoping review by Jain et al. (2023) investigated the psycho-social-cultural challenges and stigma in tackling the COVID-19 pandemic. The review focused on the differences of the general population who had not been infected by COVID-19 and on the COVID-19 patients and survivors (Jain et. al, 2023). From the study, those who survived COVID-19 felt stereotyped by those from the general population who had not been infected by the disease. The study criteria from the BOOLEAN logic and search engine included COVID-19, mental health, cultural issues, stigma, and mental health access. In the study,

> "the results showed…race/ethnicity were both associated with mental health, beyond the contributions of prior mental health…in comparison to other sociocultural groups, Black participants reported the worst mental health results when exposed to the virus and/or COVID-19-related discrimination (Jain et. al, 2023).

Overall, the literature reported higher levels of depression, anxiety, insomnia, and PTSD being contributed to stigmatization, and this led to a decreased quality of life in the COVID-19 survivors (Jain et. al, 2023). The general population who had not been infected with COVID-19 tended to have less of these psychiatric symptoms and a higher quality of life.

Many systematic reviews did not focus singularly on COVID-19 as a variable and on anxiety as an outcome. Instead they investigated other cultural/social or environmental associations and mental health results. An example of some variables reported from cultural/social associations were the pandemic effects of economic downturns, being an essential worker, school closures, and racial stereotypes. In addition, other factors from

environmental associations on mental health outcomes included quarantines, isolations, and financial burdens.

As described in the paragraph above, based on the existing literature, a single emphasis on the status of COVID-19 infection on anxiety is limited. Other associations and mental health outcomes from physiological and psychological effects of COVID-19 may be described. For instance, physiological identifications on mental health outcomes involved comorbidities, insomnia, amsonia, headaches, stroke, coma, and seizures. Moreover, psychological associations may be incorporated from the grief of the loss of a loved-one to the identification of societal failure (i.e., feeling one is not a good and protective parent) as an underlying issue.

Chapter III – Methods

3.1 Definition of Scoping Review

In order to answer the present study's main objective, a scoping review of the topic of COVID-19 infection and anxiety was conducted. A scoping review maps the literature and summarizes the evidence to identify knowledge gaps and the consistency or direction of the current studies. According to Peters et al. (2021), this type of review synthesizes broad ranging, available literature as the methodology is continuing to evolve and reviews are becoming increasingly rigorous. This methodology was chosen because it facilitated an efficient and focused review of the scope and nature of studies conducted that explored the relationship between being diagnosed with Covid and a later diagnosis of anxiety.

3.2 Search Strategy

An initial search to identify key search terms was developed in consultation with an expert librarian. The search strategy included text words contained in the title and index terms from the MeSH database for PubMed. The PubMed Search Builder contained the following script (("COVID-19"[Mesh]) AND "Adult"[Mesh]) AND "Anxiety Disorders"[Mesh]. The search was conducted on September 26, 2023, using the database PubMed. Due to time and resource constraints, the search was limited to published studies.

3.3 Eligibility Criteria

3.4 Inclusion Criteria

Studies eligible for the scoping review needed to include the following:

Participants:

- Adults at least 18 years old testing positive for Covid-19 by a medical professional who were from the general adult population

- Studies focused exclusively on medical personnel or adults hospitalized for conditions other than Covid-19 were excluded

Outcomes:

- A validated measure of anxiety or anxiety-disorder performed by a medical professional no more than one year after a Covid-19 positive test confirmed by a medical professional

Study Design:

- Any quantitative study design where the Covid-19 positive test was recorded by a medical professional prior to a screening for anxiety by a medical professional. Qualitative and narrative studies were excluded.

Language:

- Written in English

3.5 Exclusion Criteria

Studies that include specific adult populations (i.e., medical professionals, adolescents, children, psychiatric patients, persons with preexisting or chronic health conditions) will be excluded from the review. Studies that do not explicitly state that a positive COVID-19 and anxiety/anxiety disorder diagnosis were conducted by a medical professional will also be excluded. Additionally, if the longitudinal studies revealed more than a 12 month gap in

diagnosing anxiety after the individual has COVID-19, these studies will be excluded. Studies where the patients were only followed during the hospitalization stay of COVID-19 diagnosis and were not followed or contacted post hospitalization were excluded.

3.6 Screening Criteria

Identified articles were first screened using title and abstracts by the author using the program Rayyan (Ouzzani et al., 2016). In the title and abstract screening, eligible studies needed to include:

- A focus on persons who were diagnosed with COVID-19
- Adults aged 18 and over
- General adult population (excluding special populations such as healthcare workers)
- Diagnosis of anxiety or an anxiety disorder after being diagnosed with COVID-19

After examining the first set of screening questions, studies that did not meet these criteria were excluded from future selection and data extraction. Studies where the patients were only followed during the hospitalization stay of COVID-19 diagnosis and were not followed or contacted post hospitalization were excluded.

The full-text of the studies eligible after title and abstract screening was then examined by the author. During the full-text screening, eligible studies needed to include:

- Reliable measures for COVID-19 screening conducted by a medical professional
- Reliable measures for anxiety screening conducted by a medial professional
- Less than one year lapse to identify anxiety after COVID-19 infection

After examining the second set of screening questions, studies that did not meet these criteria were excluded from future selection and data extraction. More specifically, case reports of a one-person study were excluded. Studies which did not show reliable measures for COVID-19 or anxiety screening (i.e., social media surveys, robocalls, non-scientific randomization, and not having a physician diagnosis of COVID-19 and anxiety) were excluded. Outcomes focusing on solely physiological markers of COVID-19 infection, including inflammation, neurology, immune system variations, nocebo effects, or placebo effects were excluded. Studies which focused primarily or solely on comparing non-covid diagnoses of mental health to COVID-19 diagnoses of mental health were excluded.

3.7 Data Extraction

Data was extracted from papers included in the scoping review by the author. The data extracted included demographics of the participants (gender, race, age, location), study design (methods), percentages of anxiety, severity of anxiety symptoms, types of measurements for anxiety, modeling strategies, and the reliability of the measures. In addition, the year of the study data was incorporated along with a brief description summarizing why the study took place (Table 1).

Table 1. This provides the variables coded in the scoping review.

Study Characteristics	Description
Study Year	Dates of the data was collected for the study
Location	Country and urbanicity
Sample Size	Total persons assessed in the study
Age	Average age of the participants, age ranges

Gender	Percent of male and female participants
Race	Percent of participants from the following racial groups: White, Black, Hispanic, Asian, Other
Persons with Anxiety	Percent of persons who were diagnosed with anxiety after testing positive for COVID-19
Severity of Anxiety	Whether they symptoms were mild, moderate, severe, or in ICU
Measurement of Anxiety	Survey or technique employed to score and analyze the information on anxiety
Study Design	Study design used to collect and analyze the data (i.e., prospective or retrospective)
Duration of Study	Time elapsed from when participants tested positive with COVID-19 until the diagnosis of anxiety
Statistical Analysis of Study	Modeling strategy for association between COVID-19 and anxiety
Reliability	Reliability of the measure of anxiety
Objective of the study	Main research question for the study

Chapter IV - Results

The search yielded 455 studies. All 455 articles were uploaded into the Rayyan AI (rayyan.ai) for screening (Ouzzani et al., 2016). There was one study that was retracted, and thus it was deleted from the sample, resulting in 454 studies for title and abstract screening. 407 studies were excluded during title and abstract screening. The 47 remaining studies were downloaded from Rayyan and were transferred to Zotero for full-text screening.

Out of the 47 full-text articles screened, only 12 studies were eligible for inclusion in the scoping review. The 35 full-text studies were excluded for the following reasons: the wrong population (healthcare workers, teachers, children, adolescents, in-patient psychiatric wards, pre-existing or co-morbidity health conditions, diagnosed with a mental illness before COVID-19), wrong outcomes (did not report anxiety as a dependent variable), wrong study designs (case-control, case-reports, qualitative reviews, and systematic reviews), and wrong study duration (the data was collected before the COVID-19 pandemic or anxiety was only measured in the hospital when the patient was positive with the SARS illness, not post diagnosis or hospitalization).

Figure 1. PRISMA

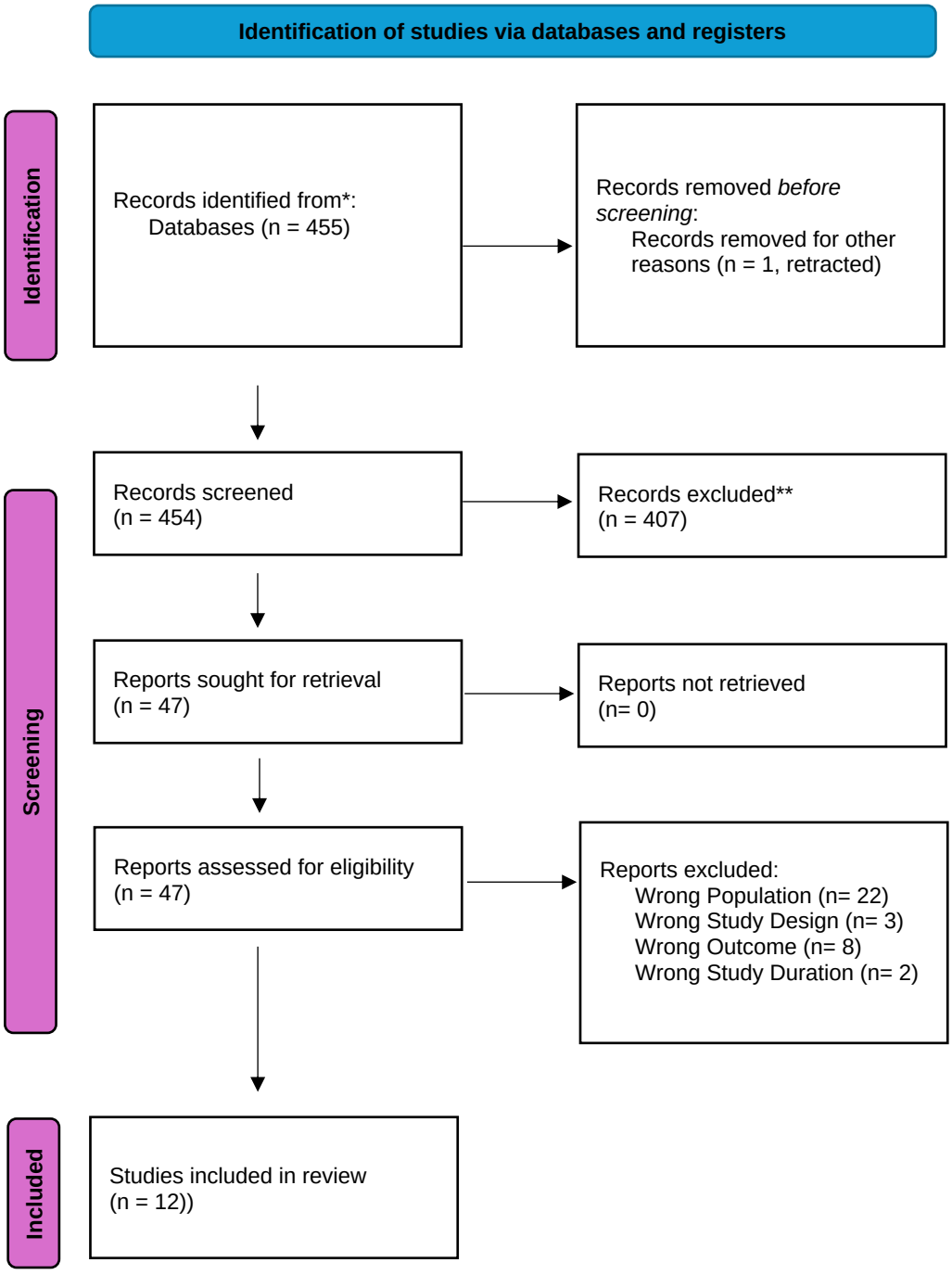


Table 2. This provides the country, study design, objectives, number of persons with anxiety and duration of each of the 12 eligible studies.

No.	References	Country	Study Design	Objectives	Persons with Anxiety	Duration of Study
1	Gasnier at al.	France	Retrospective Cohort	Highlights the importance of continuous tracking of neuropsychiatric symptoms and the impact of COVID-19 on patient quality of life.	20 (11.3%)	Month 4 - Month 6 after COVID-19 hospitalization
2	Mazza et al.	Italy	Prospective Cohort	A clinical interview and a battery of self-report questionnaires were for patients.	42%	One-month after COVID-19
3	Xiao et al.	China	Cross-Sectional Telephone Survey	To show the significant factors of probable anxiety.	7.50%	6-month follow-up after COVID-19 hospitalization
4	Parker et al.	USA - New York	Prospective Longitudinal Cohort	Among patients hospitalized with COVID-19 infection, is there is a high prevalence of anxiety and depression.	9%	Followed up by phone 2 weeks after being released from the hospital for COVID-19.
5	Leung et al.	China	Observational Cohort Prospective	Confluence with depressive and anxiety symptoms predicted	9.4% or 45.2%	One Year of Study, ranging from 47-570 days,

				impairment and associating factors.		321 being average days for the follow-up for anxiety.
6	Teixeira et al.	USA	Cross-Sectional Analysis	To examine if COVID-19 infection was directly associated with a diagnosis of new psychiatric disorders.	46.89%/9.4 %	One Year of Study
7	Kim et al.	Korea	Prospective Cohort	To highlight the importance of continuous tracking of neuropsychiatric symptoms and the impact of COVID-19 on patient quality of life.	12.90%	Six and 12 Months
8	Huarcaya et al.	Peru	Prospective Cohort	Factors in patients who survived COVID-19 and to assess the prevalence and severity of their depression and anxiety symptoms.	12.60%	3 months and 12 months
9	Wu et al.	China	Prospective Cohort	Examine COVID-19 survivors reporting moderate-to-severe symptoms of PTSD, anxiety, or depression.	14%	One-month after being released from the hospital with COVID-19

10	Zhu et al.	China	Retrospective Cohort	To estimate the prevalence of disability and anxiety in Covid-19 survivors at discharge from hospital.	29%	<2 weeks released from the hospital
11	Chieffo et al.	Italy	Prospective Cohort	Comparing anxiety symptoms with inpatient COVID-19 patients during and after discharge.	46.70%	4 months after hospitalization for COVID-19
12	Yang et al.	China	Descriptive Exploratory	To explore the relationship between psychosocial support related factors and the mental health of COVID-19 positive patients.	Not Applicable	Two weeks after they were hospitalized for COVID-19

Table 3. This provides the sample size, age, gender, race, anxiety measurement, and modeling strategies of each of the 12 eligible studies.

No.	References	Sample Size	Age	Gender Female/Male	Race	Anxiety Measurement	Modeling Strategy
1	Gasnier et al.	177	57.5	38.40, 61.60	Not Reported	MINI - Mini-International Neuropsychiatric Interview	Multivariate Logistic Regression
2	Mazza et al.	402	57.8	34.10, 65.90	Not Reported	Impact of Events Scale-Revised and State-Trait Anxiety Inventory	General Linear Model
3	Xiao et al.	199	42.7	53.30, 46.70	Not Reported	Generalized Anxiety Disorder (GAD-7) Scale, Post-Traumatic Growth Inventory	Univariate and multivariate linear regression analyses
4	Parker et al.	58	59	36.20, 63.80	White 19%, Black 41%, Hispanic 29%, Asian 1.70%, Other 14%	HADS = Hospital Anxiety and Depression Scale	1-way ANOVA
5	Leung et al.	248	48.9	54.00, 46.00	Not Reported	Chinese GAD7	Latent Profile Analysis
6	Teixeira et al.	418,450	Not Report-ed	54.25, 45.75	White 67.74%, Black 11.56%, Hispanic 17.62%, Asian 3.08%	General Anxiety Disorder-7 (GAD7), Patient Health Questionnaire 9-item scale (PHQ9), Patient Health Questionnaire 15 (PHQ15)	Logistic Regression

7	Kim et al.	170	51	60.00, 40.00	Not Reported	General Anxiety Disorder-7 (GAD7)	Fisher's Exact Test or Chi-square Tests, Student's T-Test or the Mann-Whitney U-Test
8	Huarcaya et al.	119	Not Report-Ed		Not Reported	Generalized Anxiety Disorder-7 (GAD-7)	Poisson Regression
9	Wu et al.	199	Not Report-ed	51.80, 48.20	Not Reported	Generalized Anxiety Disorder-7 (GAD-7)	MANOVA
10	Zhu et al.	401	49	49.00, 51.00	Not Reported	Zung's Self-Reported Anxiety Scale	ZIP Regression = Logistic and Poisson Regression
11	Chieffo et al.	34	54	44.10, 55.90	Not Reported	Symptom Checklist 90-R	T-tests and McNemar Test
12	Yang et al.	35	57	40.00, 60.00	Not Reported	General Anxiety Disorder-7 (GAD7)	Linear Regression

4.1 Years and Locations of Studies

Of the 12 eligible studies, nine of them collected data during the first year of the pandemic, 2020. Two of the studies happened during continuous years, 2020 – 2021 and 2021 – 2022 respectively, while one occurred only in year 2021. Locations for the studies differed in continents and countries worldwide. Six of the studies took place in Asia, five in China and one in Korea. Europe accounted for three of the studies, two in Italy and one in France. North and South America accounted for the last three studies, two in the United States (one in New York) and one in Peru (Table 2 and Table 4). The most recent study was conducted in China and published in 2023, with the year of the data collection being in 2022. Urbanicity, rural, and peri-urban locations for the studies were not reported directly in the studies (Table 4).

Table 4. This provides the location and years of the studies.

References	Location	Study Year of Data
Gasnier et al.	France	2020
Mazza et al.	Italy	2020
Xiao et al.	China	2021
Parker et al.	USA - New York	2020
Leung et al.	China	2021 – 2022
Teixeira et al.	USA	2020
Kim et al.	Korea	2020
Huarcaya et al.	Peru	2020

Wu et al.	China	2020 – 2021
Zhu et al.	China	2020
Chieffo et al.	Italy	2020
Yang et al.	China	2020

4.2 Study Designs

Study designs for the data stretched across a few categories, with prospective cohort studies leading the way. Seven of the studies used a prospective cohort design, including one longitudinal and one observational cohort, ranging from anxiety measurements given <2 weeks, one-month, three-months, four-months, six-months, and one-year post hospitalization with COVID-19 (Table 2). In the prospective cohort studies, data on COVID-19 was logged and then anxiety measurements were collected at a later moment in time. In some of the studies, especially the longitudinal and observational cohort studies, the information was collected more than once and compared to the data collected earlier in the study.

Two of the study designs opposite of the prospective cohort were retrospective in strategy (Table 2). The dependent variables included the outcome of anxiety, and the independent variables examined prior exposures, including COVID-19. In review, the data of anxiety was collected first and then assessors traced or went backwards in time to learn of the COVID-19 diagnosis.

Three study designs differ from the prospective and retrospective cohorts in their analyses. These consists of cross-sectional and descriptive exploratory investigations. One cross-sectional study occurring in the USA, employed nationwide administrative data on new

psychiatric diagnoses over 2018, 2019, and 2020, and COVID-19 infections, in order to configure analysis (only 2020 was included in these results). The other one in China, included a review of clinical records of COVID-19 experiences and severity of symptoms, including a telephone survey to gather more psychosocial factors (i.e., self-stigma and social support) to complete the study.

As mentioned above, the descriptive exploratory investigation happened in China. Examination of patients with COVID-19 and psychiatric symptoms, such as anxiety, were included with psychosocial risk factors, in order to see symptom improvement. This may be classified as an exploratory study because there was no specific outcome charted, yet this study falls closely into the ranks of a cross-sectional analysis.

In this scoping review, primary data included information collected directly from the researchers to be evaluated. All of the cohort studies and the one exploratory study involved researchers talking, questioning, or surveying the patients of their COVID-19 and anxiety symptoms.. Out of the 12 studies, 11 were conducted using this method. On the other hand, the other study in this scoping review utilized administrative data or secondary research. During this type of research, investigators learned of patient information through data records and insurance claims. A cross-sectional analysis was the study design and millions of records were examined with pre-determined codes to look for COVID-19 and anxiety associations. The sample size derived from over 10,000,000 entries was 418,450. In actuality, this was less than 4% of the total administrative sample.

In this scoping review, most of the research sample sizes were adequate for statistical measurements, yet two of the studies fell below 50 participants. These two studies may not

have provided enough information to have compute an accurate statistical measurement: Chieffo et al., (2020). (Table 3).

4.3 Demographics

Nine of the 12 studies conveyed the mean age group, while only six of the Studies showed the age ranges. The mean ages in the studies were in the forties and fifties (Table 3). Age ranges varied from 18 - 87, from those reported. In totality, the ages spanned rom 18 – 87 years. As reported, the ages fluctuated from young adult hood to old age.

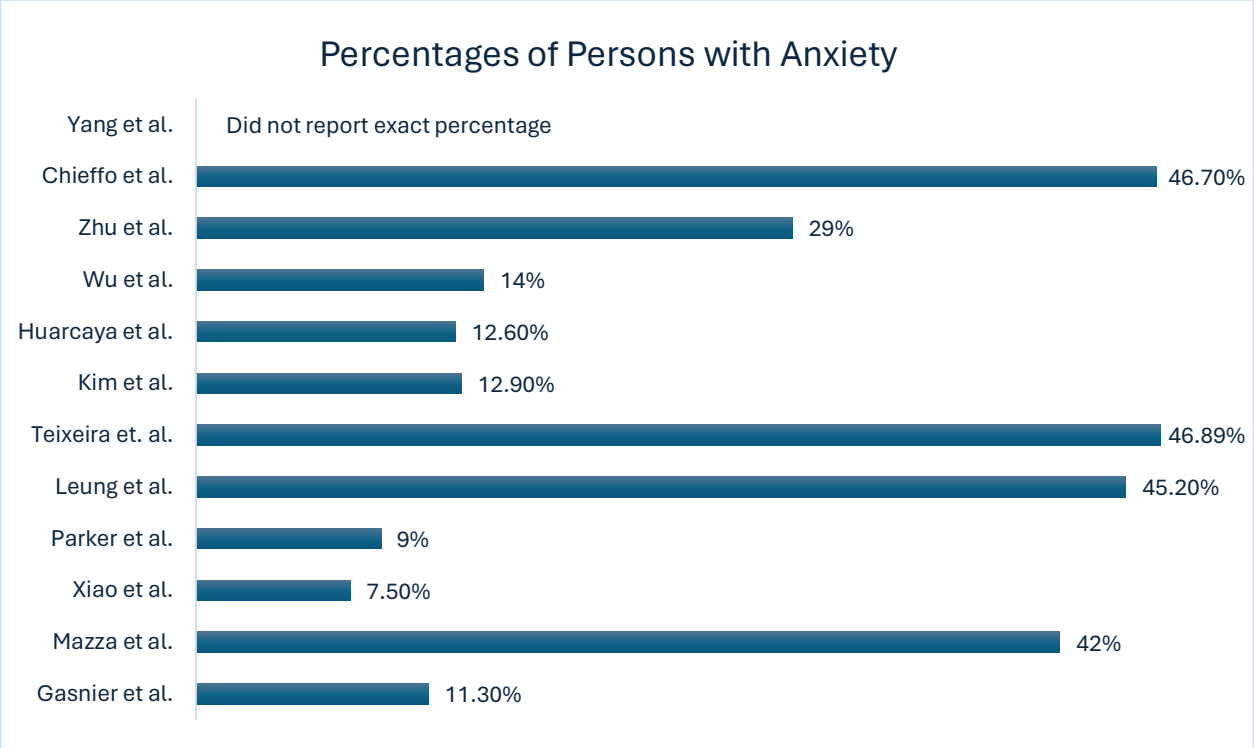
Of the 12 studies, 11 of them reported the percentage of males and females (Table 3). One study from Peru did not include any sex or gender data. In this scoping review, ranges for males spread from 40.00% - 65.90%. Female ranges spread from 34.10% - 60.00% (Table 3). When the proportions of patients from each gender was averaged across the 11 studies conveyed, more males 53.17% were examined for the association of anxiety after testing positive for COVID-19, than females 46.83%.

Only two of the studies reported the racial groups of the participants (Table 3). Both of these studies occurred within the United States. Of the two studies that reported the data on race, one collected primary data in New York and included the following racial groups: White 19%, Black 41%, Hispanic 29%, Asian 1.70%, and Other 14%. The other study contained quantitative data from administrative sources in a larger sample from the United States. These numbers include 67.74% White, 11.56% Black, 17.62% Hispanic, and 3.08% Asian (Table 3).

Out of the 12 studies, 11 of them included the percentages of participants diagnosed with anxiety following diagnosis and/or hospitalization of COVID-19. The only study that did not

detail any separate percentages or information on anxiety was the exploratory study on 35 participants in China, which included anxiety as a positive outcome from COVID-19 (Yang et al., 2020). (Table 1 and Figure 2).

Figure 2. This provides the percentages of persons with anxiety.



4.4 Measurements and Statistical Analyses

Numerous measurements for anxiety were utilized in the studies. Six studies used General Anxiety Disorder-7 (GAD7) and one similar to the GAD-7 in China titled the Chinese GAD7 (Table 2). The GAD-7 represents a Generalized Anxiety Disorder measurement from a 7-item scale, based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). The

seven items are scored from zero to three and assess the severity of anxiety by asking questions about nervousness, worrying, relaxing, restlessness, irritability, and fearfulness.

Other instruments used in the studies included Zung's Self-Reported Anxiety Scale and State-Trait Anxiety Inventory. These assessments monitor anxiety in a person's personality, response to stressful situations, feelings of tension, and apprehensive thoughts. Similar to the GAD-7, these instruments rate the severity of anxiety. Measurements applied such as the Symptom Checklist 90-R MINI (International Neuropsychiatric Interview), and the HADS, Hospital Anxiety and Depression Scale (Table 3) include more of a systematic psychological approach where other disorders may also be identified.

Modeling strategies varied in the included studies. The most consistent method was regression. Six of the 12 studies involved regression: one Multivariate Logistic, one Multivariate Linear, one Logistic, one Linear, one Poisson, and one Zero Inflated Poisson (a combination of Logistic and Poisson distribution data) (Table 3). Implementation of regression exhibited the relationship between the dependent variable, anxiety, and the independent variable of COVID-19.. More specifically, linear regression was used to analyze the predictors (COVID-19) of the outcome anxiety. Whereas, logistic regression was used to estimate the probability of a diagnosis of anxiety.

In addition to regression, two studies utilized ANOVA: a one-way ANOVA and a MANOVA (Table 3). The analysis of variance compared three or more means of groups to identify a significant difference from one another. In the MANOVA, the means evaluated were anxiety, depression, and post-traumatic stress. This may include the means of those infected with COVID-19 and then reported anxiety, those not infected by COVID-19 and reported

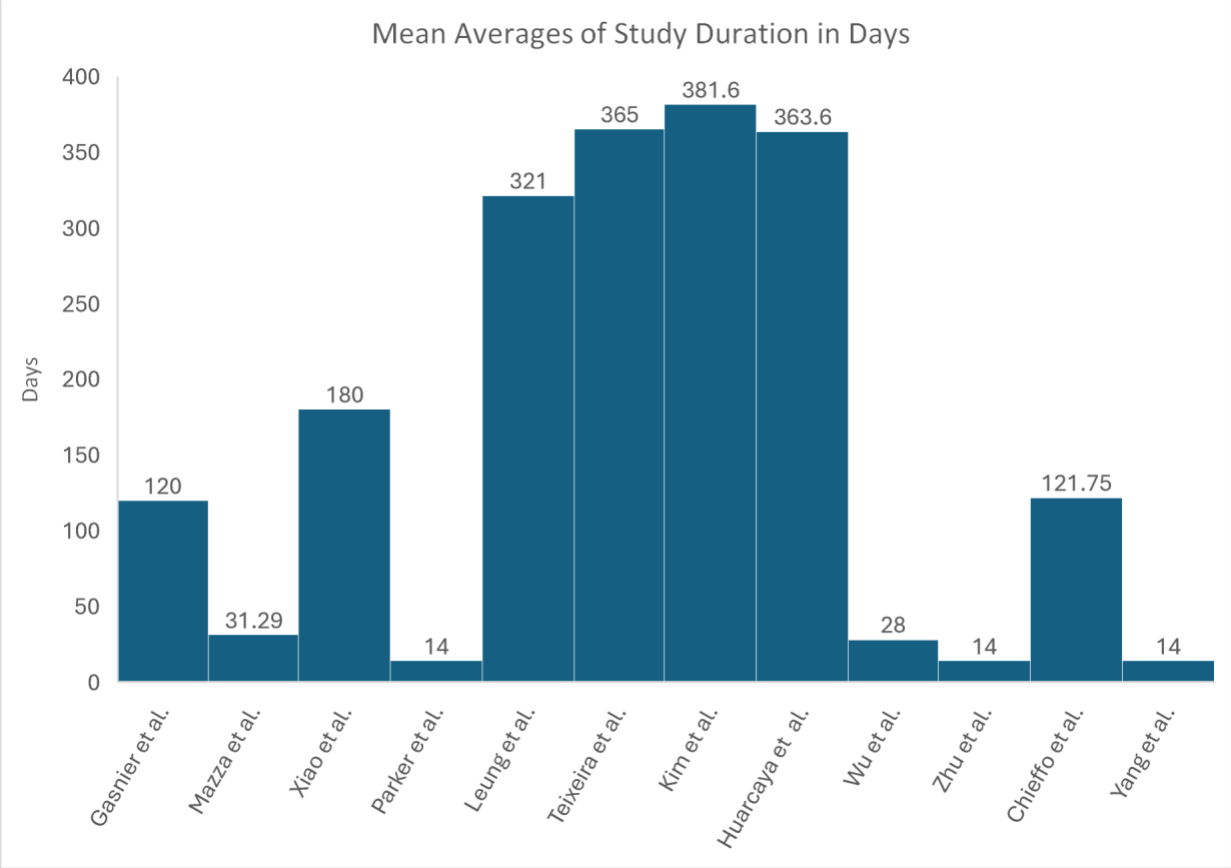
anxiety, and those where the status of COVID-19 infection was not known. Other analyses contained General Linear Models, McNemar Tests, Chi-square Tests and Whitney U-Tests, and Latent Profile Analysis (Table 3). Latent profile analysis shows subgroups within a population based on observed variables. This allowed for probabilistic modeling and statistical inference on how to use the information on an association between anxiety and COVID-19.

4.5 Duration of the Studies and Reliability Measurements

As mentioned earlier in the Study Design Section of the Results, the durations for the studies differed from weeks to months (Table 2). Nine of the study designs employed one testing increment from the participant testing positive for COVID-19 to the diagnosis of anxiety, while three of the studies had two testing measurements for anxiety (Table 2). Investigators utilized more than one testing increment to determine if anxiety was increasing or decreasing in participants, possibly determining a trajectory. The durations in the studies ranged from post two weeks testing positive for COVID-19 or COVID-19 inpatient hospitalization to one year after an initial diagnosis (Table 2). During the time periods, researchers tested anxiety at different time points. Means and/or days mentioned in the studies were computed and placed into a figure to visualize the time-points of calculations (Figure 3).

Below in the figure, Kim et al. (2022) study meets the eligibility criteria of diagnosing anxiety in less than a year after testing positive for COVID-19 (Figure 3). This particular study used two increments of data collection, six months and twelve months: six months mean days of duration were 193 (Kim et al., 2022).

Figure 3. This provides the mean averages of study durations in days from participants testing positive for COVID-19 to the screening of anxiety symptoms.



(*Authors Gasnier et al. , Kim et al., and Huarcaya et al. used two anxiety measurement increments, 4 and 6 months, 6 and 12 months, and 3 and 12 months, respectively. For the purposes of this Figure, only the latter measurement or mean days were incorporated) - Pareto Line represents the frequency of occurrence of the data.

Measurements for the studies evaluated two different types of test reliability. The kinds of reliability investigated were either test-retest, internal consistency, or both. Per the shorter duration periods of 14 days, two of the researchers utilized, test-retest reliability with confidence intervals of 95% and 99%. One used both a confidence interval of 99% and an

internal consistency of 92%, with linear regression as the modeling strategy (Table 3 and Figure 2). The internal consistency was assessed using Cronbach Alpha, a scale of reliability to indicate whether responses are consistent between items (Table 5). Application of Cronbach Alpha is commonly implemented in a survey/questionnaire for these reasons.

A few of the studies with longer durations, utilized more Cronbach Alpha for reliability measurements than test-rest (Table 5). The studies with 121.75, 180, and 321 day durations from testing positive with COVID-19 to the surveying of anxiety, showed more examinations of the internal reliability (Table 5). However, the studies do not display one preference of reliability over another. In this scoping review, the regression studies displayed more test-rest reliability or both test-retest reliability and internal consistency over the other statistical instruments applied (Table 3 and Table 5).

Table 5. This provides the duration in days, testing instrument, and reliability of the measurements.

Author	Duration	Testing Instrument, Reliability Measurement
Yang et al.	14	Linear Regression, 99% CI, Cronbach Alpha 0.92
Zhu et al.	14	Zero Inflated Poisson Regression, 95% CI
Parker et al.	14	ANOVA, 95% CI
Wu et al.	28	MANOVA, Cronbach Alpha 0.94
Mazza et al.	31.29	General Linear Model, 99% CI
Gasnier et al.	120	Logistic Regression, Not Reported

Chieffo et al.	121.75	T-tests & McNemar Test, 95% CI
Xiao et al.	180	Linear Regression, Cronbach Alpha 0.88
Leung et al.	321	Latent Profile Analysis, Cronbach Alpha 0.91
Huarcaya et al.	363.6	Poisson Regression, 83% CI, Cronbach Alpha 0.92
Teixeira et al.	365	Logistic Regression, 98% CI
Kim et al.	381.6	Mann-Whitney U-Test, Not Reported

Chapter V - Discussion

Due to COVID-19 being a newer strand of the SARS-VIRUS 2, there is limited previous research on the illness in conjunction with anxiety. Many of the scientifically reviewed published articles focus on the effect of the SARS-VIRUS 2 on the psychological mindset of the population, but sampling the population for psychiatric changes after testing positive for the COVID-19 virus moves past the scope or is not a priority at this time for the medical community.

Other demographic data from the sample populations such as urbanicity and race, were not reported for majority of the studies. Urbanicity categorizes whether the participants received COVID-19 in a rural, city, or suburban environment and where treatment for anxiety resides. Race was only included in the two studies from the United States. Thus, we know little about whether particular groups of patients may be more susceptible to anxiety following covid.

Time constraints and durations of the studies from testing positive for COVID-19 to surveying or screening of anxiety caused fluctuating anxiety results. The wide-ranging durations of the studies from 2 weeks after COVID-19 hospitalization release to one year after testing positive, may observe other environmental variables in between the diagnoses that contributed to the anxiety. Yet, all of the studies displayed and/or discussed reliability from the statistical measurements applied to assess anxiety results.

5.1 Limitations

The limitations of this Scoping Review consist of only one database searched, only published studies included, only one person who screened and coded the studies, and there was no meta-analysis conducted.

5.2 Conclusion

The COVID-19 era requires continuous research and investigation to bring about effective and applicable change. From the data collected, the studies showed an association between participants testing positive for COVID-19 and then being diagnosed with anxiety. All of the studies displayed a mental health outcome of anxiety, even with the varying study designs and statistical measurements. The characteristics listed cannot completely rule out other independent variables that maybe associated with anxiety, yet those variables were not examined for in this scoping review. In the general population, COVID-19 and anxiety require more research for preventive measures and appropriate timely treatment for both diagnoses.

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