
Evidence Brief: Mental Health Outcomes of Adults Hospitalized for COVID-19

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WHAT'S NEW

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Search current as of March 2021

This update revises findings from our report published in March 2021. The review includes studies from an updated search and now focuses on the 17 studies (2 prospective cohort, 2 retrospective cohort, and 13 cross-sectional) that provide the best available evidence. We conclude that while many patients experience MH symptoms such as depression, anxiety, and insomnia during and in the 3 months following hospitalization for COVID-19, patients infrequently receive a new MH disorder diagnosis in the 6 months following hospitalization. However, some patients – such as women and those with more severe COVID-19 – may be at higher risk of poor MH outcomes.



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PREFACE

The VA Evidence Synthesis Program (ESP) was established in 2007 to provide timely and accurate syntheses of targeted healthcare topics of importance to clinicians, managers, and policymakers as they work to improve the health and healthcare of Veterans. These reports help:

- Develop clinical policies informed by evidence;
- Implement effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- Set the direction for future research to address gaps in clinical knowledge.

The program comprises three ESP Centers across the US and a Coordinating Center located in Portland, Oregon. Center Directors are VA clinicians and recognized leaders in the field of evidence synthesis with close ties to the AHRQ Evidence-based Practice Center Program and Cochrane Collaboration. The Coordinating Center was created to manage program operations, ensure methodological consistency and quality of products, and interface with stakeholders. To ensure responsiveness to the needs of decision-makers, the program is governed by a Steering Committee composed of health system leadership and researchers. The program solicits nominations for review topics several times a year via the [program website](#).

Comments on this evidence report are welcome and can be sent to Nicole Floyd, Deputy Director, ESP Coordinating Center at Nicole.Floyd@va.gov.

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TABLE OF CONTENTS

Preface.....	i
Executive Summary	1
Key Findings.....	1
Evidence Brief	7
Introduction.....	7
Purpose.....	7
Background.....	7
Scope.....	8
Key Questions and Eligibility Criteria.....	8
Methods.....	11
Searches and Study Selection	11
Quality Assessment and Data Extraction.....	11
Strength of Evidence Assessment.....	11
Synthesis of Data	11
Living Review.....	12
Results.....	13
Literature Flow.....	15
Key Question 1: Among adults who have been hospitalized for COVID-19, what is the prevalence of MH disorders during or after hospitalization?	16
Key Question 2: How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis?	17
Key Question 2A: How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis compared to those with outpatient COVID-19?	18
Key Question 2B: How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis compared to adults hospitalized for other causes?.....	19
Key Question 2C: Does the probability of developing new MH symptoms or diagnosis during or after hospitalization for COVID-19 vary by patient characteristics (<i>eg</i> , age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?	19
Key Question 3: How often do adults with preexisting MH conditions who have been hospitalized for COVID-19 experience exacerbation of MH symptoms?.....	22
Key Question 3A: How often do adults with preexisting MH conditions who have been hospitalized for COVID-19 experience exacerbation of MH symptoms compared to those with outpatient COVID-19?.....	22

Key Question 3B: How often do adults with preexisting MH conditions who have been hospitalized for COVID-19 experience exacerbation of MH symptoms compared to adults hospitalized for other causes?.....	23
Key Question 3C: Does the probability of exacerbating MH symptoms during or after hospitalization for COVID-19 vary by patient characteristics (<i>eg</i> , age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?	23
Key Question 4: How often and what kinds of MH care do adults access during or after hospitalization for COVID-19?.....	23
Key Question 4A: Does the type or extent of MH care used by adults during or after COVID-19 hospitalization differ compared to before hospitalization?.....	23
Key Question 4B: Does the type or extent of MH care utilization differ for adults hospitalized for COVID-19 compared to adults receiving outpatient treatment for COVID-19?.....	23
Key Question 4C: Does the type or extent of MH care utilization differ for adults hospitalized for COVID-19 compared to adults hospitalized for other causes?.....	24
Key Question 4D: Does the type or extent of MH care utilization during or after hospitalization for COVID-19 vary by patient characteristics (<i>eg</i> , age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?	24
Key Question 5: What are the MH care resource needs among adults who have been hospitalized for COVID-19?.....	24
Summary and Discussion.....	25
Limitations	26
Gaps and Future Research	26
Evolving Nature of COVID-19 and Mental Health.....	28
Conclusions.....	29
Acknowledgments.....	30
References.....	31

TABLES AND FIGURES

Table 1. Overview of the Best Available Evidence Addressing Each Key Question.....	3
Table 2. Key Questions and Eligibility Criteria.....	9
Figure 1: Literature Flowchart.....	15
Table 3. Prevalence of MH Disorders in Patients Hospitalized for COVID-19	17
Table 4. Prevalence of MH Disorders Among Patients Hospitalized for COVID-19 by Patient Characteristics, COVID-19 Disease Severity, and Level of Care	21

EXECUTIVE SUMMARY

Key Findings

- Seventeen studies (2 prospective cohort, 2 retrospective cohort, and 13 cross-sectional) that enrolled ≥ 200 participants provide the best available evidence on mental health (MH) outcomes among patients who have been hospitalized for COVID-19.
- Many patients may experience MH symptoms during and in the 3 months following hospitalization for COVID-19. Specifically, 30-39% of patients may experience anxiety symptoms, 24-40% insomnia symptoms, 20-26% obsessive-compulsive symptoms, and 10-15% PTSD symptoms. Estimates of depression symptom prevalence are more variable across studies (9-66%) due to differences in how symptoms were measured and reported (5 fair-quality cross-sectional studies, and 1 fair-quality prospective cohort study).
- The incidence of receiving a new MH disorder diagnosis in the 6 months after hospitalization for COVID-19 is probably low. Five percent of patients are likely to be diagnosed with a new mood disorder, 7% anxiety disorder, 3% insomnia, and 2% substance use disorder that was not diagnosed before the COVID-19 hospitalization (1 good-quality retrospective cohort study).
- Hospitalized COVID-19 patients are likely to have an elevated risk of receiving a new MH disorder diagnosis 6 months after COVID-19 diagnosis compared to outpatients with COVID-19 (1 good-quality retrospective cohort study). It is unknown whether the observed increased risk is due to hospitalization for COVID-19 specifically or hospitalization generally.
- The incidence of receiving a new psychotic disorder diagnosis in the 6 months following hospitalization for COVID-19 is probably very low (around 1%) (1 good-quality retrospective cohort study).

Background

The ESP Coordinating Center (ESP CC) is responding to a request from VA Central Office for an evidence brief on mental health (MH) outcomes of adults who have been hospitalized for COVID-19. Findings from this evidence brief will be used to inform national VA planning efforts to support Veterans who have been hospitalized for COVID-19 after they have been discharged from the hospital.

Methods

To identify studies, we searched MEDLINE, the WHO COVID-19 database, PsycINFO, and CINAHL from Dec 2019 to March 2021. We used prespecified criteria for study selection, data abstraction, and rating internal validity and strength of the evidence. See our PROSPERO protocol for our full methods (Registration # CRD42020199557).

In March 2020, the World Health Organization (WHO) declared the outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes coronavirus disease 2019 (COVID-19), a pandemic. Although most people with COVID-19 experience no symptoms or mild fever, cough, shortness of breath, or fatigue, approximately 1 in 7 experience severe symptoms requiring hospitalization. In-hospital mortality for patients with COVID-19 is around 17%. Many hospitalized patients experience life-threatening complications such as bacterial pneumonia, sepsis, acute respiratory distress syndrome, and multi-organ failure. As a result of the stress of being hospitalized for a serious, highly transmissible illness during a pandemic,

experts warn that patients hospitalized with COVID-19 are at high risk of developing mental health symptoms and psychiatric disorders such as major depression, panic or other anxiety disorders, or post-traumatic stress disorder (PTSD), or of experiencing exacerbations of existing disorders. Veterans who receive care at the VA have high rates of comorbid medical disorders (16% report having 5 or more medical conditions) and high rates of preexisting mental health diagnoses (including depression [13.5%], PTSD [9.3%], substance use disorders [8.3%], anxiety disorders [4.8%], and serious mental illness [3.7%]) and may be at particularly high risk of developing new mental health symptoms or disorders, or of experiencing exacerbations of existing mental health symptoms or disorders.

In June 2020, the Department of Veterans Affairs (VA) Central Office requested that the VA Evidence Synthesis Program (ESP) produce 3 rapid evidence reviews on post-acute care needs for adults who have had COVID-19. The first 2 reviews focused on major organ damage and rehabilitation needs, respectively. This is the third review in the series and focuses on the mental health needs of adults who have been hospitalized with COVID-19. The purpose of this review is to compare the prevalence of mental health disorders among adults who have been hospitalized for COVID-19 to relevant comparison groups, assess whether mental health disorder prevalence varies by patient and disease characteristics, and ascertain patients' mental health care utilization and resource needs. Findings from this evidence brief will be used to inform national VA planning efforts to support Veterans after hospital discharge for COVID-19.

We included cross-sectional and cohort studies that examined the prevalence of mental health disorders and clinical features, such as insomnia, among adults during or after hospitalization for COVID-19. Among 4,866 potentially relevant citations, we included 50 articles. Of these, 19 articles representing 17 studies (2 prospective cohort, 2 retrospective cohort, and 13 cross-sectional) enrolled ≥ 200 participants and provide the best available evidence. The remaining 31 included samples of fewer than 200 people and therefore are less likely to present reproducible results. Findings are summarized in **Table 1**.

Table 1. Overview of the Best Available Evidence Addressing Each Key Question

Rapid Evidence Review Question	Results & supporting evidence
<p>KQ1) Among adults who have been hospitalized for COVID-19, what is the prevalence of MH disorders during or after hospitalization?</p>	<p>In 1 fair-quality cross-sectional study, the prevalence of MH symptoms <i>during hospitalization</i> was:</p> <ul style="list-style-type: none"> • Depression symptoms: 42.0% • Anxiety symptoms: 34.9% <p>In 5 fair-quality studies, the prevalence of MH symptoms <i>in the 3 months following hospitalization</i> was:</p> <ul style="list-style-type: none"> • Depression symptoms: 9-65.7% (1 prospective cohort, 3 cross-sectional) • Anxiety symptoms: 30-39% (1 prospective cohort) • Insomnia symptoms: 24-39.6% (1 prospective cohort) • Obsessive compulsive symptoms: 19.6-26% (1 prospective cohort) • PTSD symptoms: 9.5-15.4% (1 prospective cohort, 1 cross-sectional)
<p>KQ2) How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis?</p>	<p>In 1 good-quality retrospective cohort study, the incidence of receiving a new MH disorder diagnosis <i>in the 6 months following hospitalization</i> was:</p> <ul style="list-style-type: none"> • Anxiety disorder: 6.9% • Mood disorder: 4.5% • Substance use disorder: 2.1% • Insomnia: 3.1% • Psychotic disorder: 0.9%
<p>KQ2a) How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis compared to those with COVID-19 treated only in outpatient settings?</p>	<p>In 1 good-quality retrospective cohort study, hospitalized patients were at higher risk of receiving the following new MH disorder diagnoses compared to non-hospitalized patients:</p> <ul style="list-style-type: none"> • Anxiety disorder: HR 1.49 [1.34–1.65] • Mood disorder: HR 1.53 [1.33–1.75] • Substance use disorder: HR 1.68 [1.40–2.01] • Insomnia: HR 1.49 [1.28–1.74] • Psychotic disorder: HR 2.77 [1.99–3.85]
<p>KQ2b) How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis compared to adults hospitalized for other causes?</p>	<p>No evidence.</p>

Rapid Evidence Review Question	Results & supporting evidence
KQ2c) Does the probability of developing new MH symptoms or diagnosis during or after hospitalization for COVID-19 vary by patient characteristics (eg, age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?	Evidence from 4 fair-quality cross-sectional studies (1 prospective cohort & 3 cross-sectional) of patients with low or unclear rates of preexisting MH disorders indicate female sex and more severe COVID-19 are the 2 characteristics most consistently associated with worse MH outcomes. There were mixed findings on other pt, disease, and treatment characteristics such as older age, shorter duration of hospitalization and receipt of specific treatment such as ventilation and corticosteroids , with some studies showing an association between these characteristics and worse MH outcomes, and others showing no association or an association with better MH outcomes.
KQ3) How often do adults with preexisting MH conditions who have been hospitalized for COVID-19 experience exacerbation of MH symptoms?	In 1 fair-quality prospective cohort study, the prevalence of MH symptoms in the 3 months following hospitalization for COVID-19 among those with a MH history were: <ul style="list-style-type: none"> • Depression symptoms: 26% • PTSD symptoms: 27% • Anxiety symptoms: 50% • Obsessive-compulsive symptoms: 39% • Insomnia symptoms: 33%
KQ3a) How often do adults with preexisting MH conditions who have been hospitalized for COVID-19 experience exacerbation of MH symptoms compared to those with COVID-19 treated only in outpatient settings?	No evidence.
KQ3b) How often do adults with preexisting MH conditions who have been hospitalized for COVID-19 experience exacerbation of MH symptoms compared to adults hospitalized for other causes?	No evidence.
KQ3c) Does the probability of exacerbating MH symptoms during or after hospitalization for COVID-19 vary by patient characteristics (eg, age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?	No evidence.
KQ4) How often and what kinds of MH care do adults access during or after hospitalization for COVID-19?	One fair-quality prospective cohort study of 892 hospitalized pts found that 89 (10%) required psychiatric consultation. Of note, 23 out of 89 (25%) pts had a prior neuropsychiatric diagnosis. Another fair-quality retrospective cohort study of 339 hospitalized COVID-19 pts reported that 3 out of 19 (16%) readmitted pts had a psychiatric illness as their reason for readmission; however psychiatric diagnoses were present upon initial admission for 2 out of 3 (67%) of these pts.

Rapid Evidence Review Question	Results & supporting evidence
KQ4a) Does the type or extent of MH care used by adults during or after COVID-19 hospitalization differ compared to before hospitalization?	No evidence.
KQ4b) Does the type or extent of MH care utilization differ for adults hospitalized for COVID-19 compared to adults receiving outpatient treatment for COVID-19?	No evidence.
KQ4c) Does the type or extent of MH care utilization differ for adults hospitalized for COVID-19 compared to adults hospitalized for other causes?	No evidence.
KQ4d) Does the type or extent of MH care utilization during or after hospitalization for COVID-19 vary by patient characteristics (eg, age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?	In the fair-quality prospective study of 892 hospitalized patients, the 89 pts who required psychiatric consultation were more likely to require oxygen therapy, consequent ICU transfer, and mechanical ventilation. Pts requiring MH consultation were more likely to have presence of chronic medical disease and/or prior neuropsychiatric diagnosis.
KQ5) What are the MH care resource needs among adults who have been hospitalized for COVID-19?	59% of hospitalized pts report at least some need for psychological guidance in rehabilitation (1 poor-quality cross-sectional study)

Abbreviations: GAD = Generalized Anxiety Disorder; HR= Hazard Ratio; MDD = Major Depressive Disorder; MH = Mental health; Pt = Patient

The primary limitation of the methods used for this rapid review is that a single reviewer rated studies for inclusion, assessed quality, and abstracted data with second reviewer verification, rather than standard dual independent assessment. This process may have resulted in missing eligible studies or data. This risk was reduced by establishing explicit inclusion criteria for studies, developing and using a piloted data abstraction tool, and creating a key to rate each study according to Joanna Briggs Institute quality criteria.

There were several important limitations of the included primary studies. Only 2 analyses of 1 study were good quality. The other 16 studies were either fair or poor quality, commonly due to limited measurement or reporting of participants' preexisting MH disorders, comorbidities, and COVID-19 severity.

Future research should examine 3 primary gaps:

- Compare patients who have been hospitalized for COVID-19 to relevant control groups.
- Report and account for potential confounders, particularly preexisting mental health disorders, medications, and medical comorbidities.
- Determine the mental health care utilization and resource/treatment needs of patients after discharge for COVID-19.

As of March 2021, we identified 2 prospective cohort, 2 retrospective cohort, and 13 cross-sectional studies that provide the best available evidence on MH outcomes among people hospitalized for COVID-19. Evidence from primarily fair-quality studies suggests that many patients experience MH symptoms such as depression, anxiety, and insomnia during and in the 3 months following hospitalization for COVID-19. However, patients infrequently receive a new MH disorder diagnosis in the 6 months following hospitalization. Some patients – such as women and those with more severe COVID-19 – may be at higher risk of poor MH outcomes. Future research should compare patients hospitalized for COVID-19 to those hospitalized for other reasons and evaluate mental health treatment utilization and resource needs following hospitalization.

EVIDENCE BRIEF

INTRODUCTION

PURPOSE

The ESP Coordinating Center (ESP CC) is responding to a request from VA Central Office for an evidence brief on mental health outcomes of adults who have been hospitalized for COVID-19. Findings from this evidence brief will be used to inform national VA planning efforts to support Veterans after hospital discharge for COVID-19.

BACKGROUND

In March 2020, the World Health Organization (WHO) declared the outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus which causes coronavirus disease 2019 (COVID-19), a pandemic.¹ As of June 2021, over 175 million people have been confirmed to have had COVID-19 and over 3 million have died worldwide.² Although most people with COVID-19 experience no symptoms or mild fever, cough, shortness of breath, or fatigue, approximately 1 in 7 experience severe symptoms that require hospitalization.³ Life-threatening complications of COVID-19 include bacterial pneumonia, sepsis, acute respiratory distress syndrome, and multi-organ failure.³ Those who are over 65 years old with underlying medical conditions (including but not limited to hypertension, obesity, chronic lung disease, diabetes, and cardiovascular disease) are at higher risk of hospitalization and death.⁴ Among those hospitalized for COVID-19, 32% have been admitted to the intensive care unit (ICU), 19% required mechanical ventilation, and 17% have died in the hospital.⁵

Addressing complications of COVID-19 may require invasive procedures, including the administration of sedation and/or paralytic agents and intensive intravascular monitoring. These interventions interfere with a patient's ability to respond to and understand their providers, environment, and treatment. Dexamethasone (a steroid), which is a treatment for people hospitalized with COVID-19, is commonly associated with MH side effects such as anxiety and psychosis.⁶ In addition, the ICU setting is stressful due to frequent alarms, flashing lights, and providers moving in and out of rooms donning personal protective equipment that can prevent patients from seeing and recognizing faces.⁷ This environmental stress is likely compounded for patients with COVID-19 by isolation from family, friends, and other support systems that results from restrictive hospital visitation policies employed to reduce the risk of COVID-19 transmission.⁸ Hospitalization and isolation requirements may also cause a significant disruption in work, resulting in significant financial hardship and distress. Those with COVID-19 may also worry about transmission to and burden on their loved ones or caregivers.

As a result of the stress of being hospitalized for a serious, highly transmissible illness during a pandemic, experts warn that patients who are hospitalized with COVID-19 are at particularly high risk of developing mental health symptoms or experiencing exacerbation or relapse of existing or past mental health disorders.⁹⁻¹¹ A systematic review evaluating outcomes after the 2002 SARS and 2012 MERS pandemics indicates many patients with serious infections experienced anxiety (35.7%) and insomnia (41.9%) during the acute phase of their illness and some developed post-traumatic stress disorder (PTSD) (32.2%), depression (14.9%), and anxiety disorders (14.8%) after recovery.¹² Additionally, research has shown patients hospitalized for

other illnesses often experience MH symptoms and report problems sleeping while hospitalized. For example, 50% of patients hospitalized for congestive heart failure report experiencing depression symptoms during hospitalization,¹³ and patients who are hospitalized for any illness report waking up more and having worse sleep quality in the hospital than at home.¹⁴ Additionally, research on ICU patients has indicated MH disorders that develop after a serious illness can be significant and long-lasting.⁷

The current social environment may also contribute to greater risk of mental health disorders for hospitalized patients with COVID-19. Recent studies on the effects of the COVID-19 pandemic show that general populations have a high prevalence of depression, anxiety, insomnia, and acute stress, and therefore those who have been hospitalized are likely to return to home or work environments that are more stressful or significantly changed from pre-pandemic environments.¹⁵⁻¹⁷ In addition to stress-related development or exacerbation of mental health disorders, research on previous epidemics with similar pathogens suggests possible biological pathways for increased prevalence of mental health disorders. For example, hospitalized patients with COVID-19 may experience neurologic symptoms such as stroke and encephalopathy during and after their hospitalization, which can impact both acute and chronic mental health.¹⁸

In June 2020, the Department of Veterans Affairs (VA) Central Office requested that the VA Evidence Synthesis Program (ESP) produce 3 rapid evidence reviews on post-acute care needs for adults who have had COVID-19. The first 2 reviews focus on major organ damage and rehabilitation needs, respectively. This is the third review in the series, focused on mental health needs of adults who have been hospitalized for COVID-19. In general, Veterans who receive care at the VA are older and have more comorbidities than adults in the general population (16% of Veterans at the VA report 5 or more conditions vs 3% of general population),¹⁹ putting them at higher risk for contracting COVID-19. Veterans who receive care at the VA also have a high prevalence of preexisting mental health disorders including depression (13.5%), PTSD (9.3%), substance use disorders (8.3%), anxiety disorders (4.8%), and serious mental illness (3.7%),²⁰ which could be exacerbated by a COVID-19 hospitalization. The purpose of this review is to evaluate the prevalence of mental health disorders and assess mental health care needs among adults hospitalized for COVID-19 to assist the VA in supporting this population of Veterans. The VA ESP published a report synthesizing studies that had been published as of October 2020²¹; this updated report synthesizes studies published as of March 2021.

SCOPE

This rapid review compares the prevalence of mental health disorders and clinical features among adults who have been hospitalized for COVID-19 to relevant comparison groups, assesses whether the prevalence of mental health disorders varies by patient and disease characteristics, and ascertains mental health care utilization and resource needs for adults following hospitalization for COVID-19.

KEY QUESTIONS AND ELIGIBILITY CRITERIA

Key Questions and eligibility criteria (population, intervention, comparator, outcome, and timing) appear in **Table 2**. We included cross-sectional and cohort studies and excluded case series and case reports. We included insomnia as an outcome of interest as it is often symptomatic of another underlying MH disorder.

Table 2. Key Questions and Eligibility Criteria

Key Question	Population	Comparator	Outcomes	Timing
1) Among adults who have been hospitalized for COVID-19, what is the prevalence of MH disorders during or after hospitalization?	Adults who have been hospitalized for COVID-19	None	Prevalence of MH disorders, including both diagnoses and symptoms. Specific MH disorders of interest are mood disorders, anxiety disorders, trauma-related disorders, psychotic disorders, and substance use disorders; excluding cognitive disorders such as delirium and dementia	During or after hospitalization
2) How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis?	Adults without preexisting MH conditions who have been hospitalized for COVID-19	vs before hospitalization	New MH symptoms or a new MH diagnosis	During or after hospitalization
2a) How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis compared to those with COVID-19 treated only in outpatient settings?		vs adults without preexisting MH conditions who received outpatient treatment for COVID-19		
2b) How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis compared to adults hospitalized for other causes?		vs adults without preexisting MH conditions who have been hospitalized for other causes		
2c) Does the probability of developing new MH symptoms or diagnosis during or after hospitalization for COVID-19 vary by patient characteristics (eg, age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?		Subgroups vs each other		
3) How often do adults with preexisting MH conditions who have been hospitalized for COVID-19 experience exacerbation of MH symptoms?	Adults with preexisting MH conditions who have been	vs before hospitalization	Exacerbation of MH symptoms	During or after hospitalization
3a) How often do adults with preexisting MH conditions who have been hospitalized for COVID-19		vs adults with preexisting MH conditions who	Exacerbation of MH symptoms	

Key Question	Population	Comparator	Outcomes	Timing
experience exacerbation of MH symptoms compared to those with COVID-19 treated only in outpatient settings?	hospitalized for COVID-19	received outpatient treatment for COVID-19		
3b) How often do adults with preexisting MH conditions who have been hospitalized for COVID-19 experience exacerbation of MH symptoms compared to adults hospitalized for other causes?		vs adults with preexisting MH conditions who have been hospitalized for other causes		
3c) Does the probability of exacerbating MH symptoms during or after hospitalization for COVID-19 vary by patient characteristics (eg, age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?		Subgroups vs each other		
4) How often and what kinds of MH care do adults access during or after hospitalization for COVID-19?	Adults who have been hospitalized for COVID-19	None	MH care utilization (eg, health care appointments, prescriptions filled, etc)	During or after hospitalization
4a) Does the type or extent of MH care used by adults during or after COVID-19 hospitalization differ compared to before hospitalization?		vs before hospitalization		
4b) Does the type or extent of MH care utilization differ for adults hospitalized for COVID-19 compared to adults receiving outpatient treatment for COVID-19?		vs adults who received outpatient treatment for COVID-19		
4c) Does the type or extent of MH care utilization differ for adults hospitalized for COVID-19 compared to adults hospitalized for other causes?		vs adults who have been hospitalized for other causes		
4d) Does the type or extent of MH care utilization during or after hospitalization for COVID-19 vary by patient characteristics (eg, age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?		Subgroups vs each other		
5) What are the MH care resource needs among adults who have been hospitalized for COVID-19?	Adults who have been hospitalized for COVID-19	None	MH care resource needs identified by patients or caregivers	

Abbreviation: MH = mental health



METHODS

SEARCHES AND STUDY SELECTION

To identify articles relevant to the key questions, a research librarian searched Ovid MEDLINE, the WHO COVID-19 database, PsycINFO, and CINAHL, as well as systematic review databases using terms for *COVID-19*, *mental health*, and *hospitalization* from December 2019 to March 2021 (see Supplementary Materials for complete search strategies). Additional citations were identified from hand-searching reference lists and consultation with content experts. We limited the search to published and indexed articles involving human subjects available in the English language. Study selection was based on the eligibility criteria described above. Detailed information in inclusion/exclusion criteria are available in the Supplementary Materials. Titles, abstracts, and full-text articles were reviewed for inclusion by 1 investigator and verified another. All disagreements were resolved by consensus.

Using a best evidence approach,²² we made a post-hoc decision to only conduct quality assessment, data extraction, and strength of evidence assessments of studies that included ≥ 200 participants. Our rationale is that larger studies likely provide more reliable prevalence estimates. While the smaller literature base available for our prior reports necessitated relying on studies with smaller samples, the increase in published literature available for this update allowed for a focus on studies with larger sample sizes in this report.

QUALITY ASSESSMENT AND DATA EXTRACTION

We used predefined criteria to rate the internal validity of included studies of ≥ 200 participants. We used checklists from the Joanna Briggs Institute (JBI) to assess the internal validity of cross-sectional and cohort studies.²³ We extracted study-level data including study characteristics, population, comparator, and outcomes for studies of ≥ 200 participants. All data abstraction and internal validity ratings were first completed by 1 reviewer then verified by another. All disagreements were resolved by consensus.

STRENGTH OF EVIDENCE ASSESSMENT

We graded the strength of the evidence of studies ≥ 200 participants based on the AHRQ Methods Guide for Comparative Effectiveness Reviews.²⁴ Although this method is designed for intervention studies, we applied the concepts to the non-intervention studies, including risk of bias (includes study design and aggregate quality), consistency, directness, and precision of the evidence. Strength of evidence was graded for each key outcome measure and ratings ranged from high to insufficient, reflecting our confidence that the prevalence estimates reflect an unbiased and precise estimate of the true prevalence.

SYNTHESIS OF DATA

Because of the variety of outcomes and outcome measurements used by these studies, we synthesized data narratively.

LIVING REVIEW

This is the last update of a living review. We made the decision to retire the review as several of our conclusions are supported by moderate strength of evidence, and we do not expect new evidence to substantially change our conclusions.

The complete description of our full methods can be found on the PROSPERO international prospective register of systematic reviews (<http://www.crd.york.ac.uk/PROSPERO/>; registration number CRD42020199557).

RESULTS

The literature flow diagram (Figure 1) summarizes the results of the search and study selection processes. Among 4,866 potentially relevant citations, we included 50 articles. Nineteen of these articles (representing 2 prospective cohort,²⁵⁻²⁷ 2 retrospective cohort,²⁸⁻³⁰ and 13 cross-sectional³¹⁻⁴³ studies) enrolled ≥ 200 participants. These larger studies provide the best available evidence to answer our review questions, as they provide more reliable estimates of prevalence than smaller studies. Results from these 19 articles are described in detail in the “Results” and “Discussion” sections. Citations and limited data extraction of the 31 included articles^{31,44-73} that enrolled fewer than 200 participants are available in the Supplementary Materials. The Supplementary Materials also include detailed data abstraction and quality assessment for the 19 included and prioritized articles.

Of the 19 prioritized articles, 3 were conducted entirely or primarily in the United States,²⁸⁻³⁰ 6 in China,^{31-33,35,37,41} 2 in Italy,^{25,26} 2 in the UK,^{34,38} 2 in Turkey,^{27,40} 2 in Iran,^{39,42} 1 in Bangladesh,³⁹ and 1 in Norway.⁴³ Study size varied from 200 to 236,379 participants, although most included between 200 and 1,000 participants. Nine articles measured outcomes during hospitalization,^{27,28,31,33,35,37,40-42} 9 measured outcomes up to 3 months post-hospitalization,^{25,26,30,32,34,36,38,39,43} and 1 measured outcomes up to 6 months post-hospitalization.²⁹

Patient characteristics varied across articles. Overall, mean age varied from 35 to 60 years, and the percentage who were female ranged from 8% to 65%. Medical comorbidities were inconsistently reported across articles, but those that did report comorbidities reported high prevalence (eg, 5 studies reported that 29% to 59% of patients had a comorbidity, underlying illness, or chronic medical condition).^{27,32,37,41,43} Race/ethnicity was also inconsistently reported. Of the 2 studies²⁸⁻³⁰ that reported participants’ race/ethnicity, both were conducted in the United States. Two articles^{29,30} reported outcomes from 1 retrospective cohort study of participants with COVID-19 in the United States (N=62,354 in the first article;³⁰ N=236,379 in the second).²⁹ These articles reported a large percentage of cohort participants were Black (18.8% to 23.6% of participants in each article were Black, compared to 13.4% of US population that is Black).⁷⁴ The other study²⁸ examined a smaller cohort (N=339) of hospitalized patients with COVID-19 in Rhode Island and reported 37% were Hispanic and 16% were Black – both of which are roughly double the percentage of the general population of Rhode Island that are Hispanic and Black (16.3% and 8.5%, respectively).⁷⁵ The high proportion of Black and Hispanic patients hospitalized with COVID-19 included in these studies reflects the health inequities exposed in national trends of patients hospitalized with COVID-19.⁷⁶

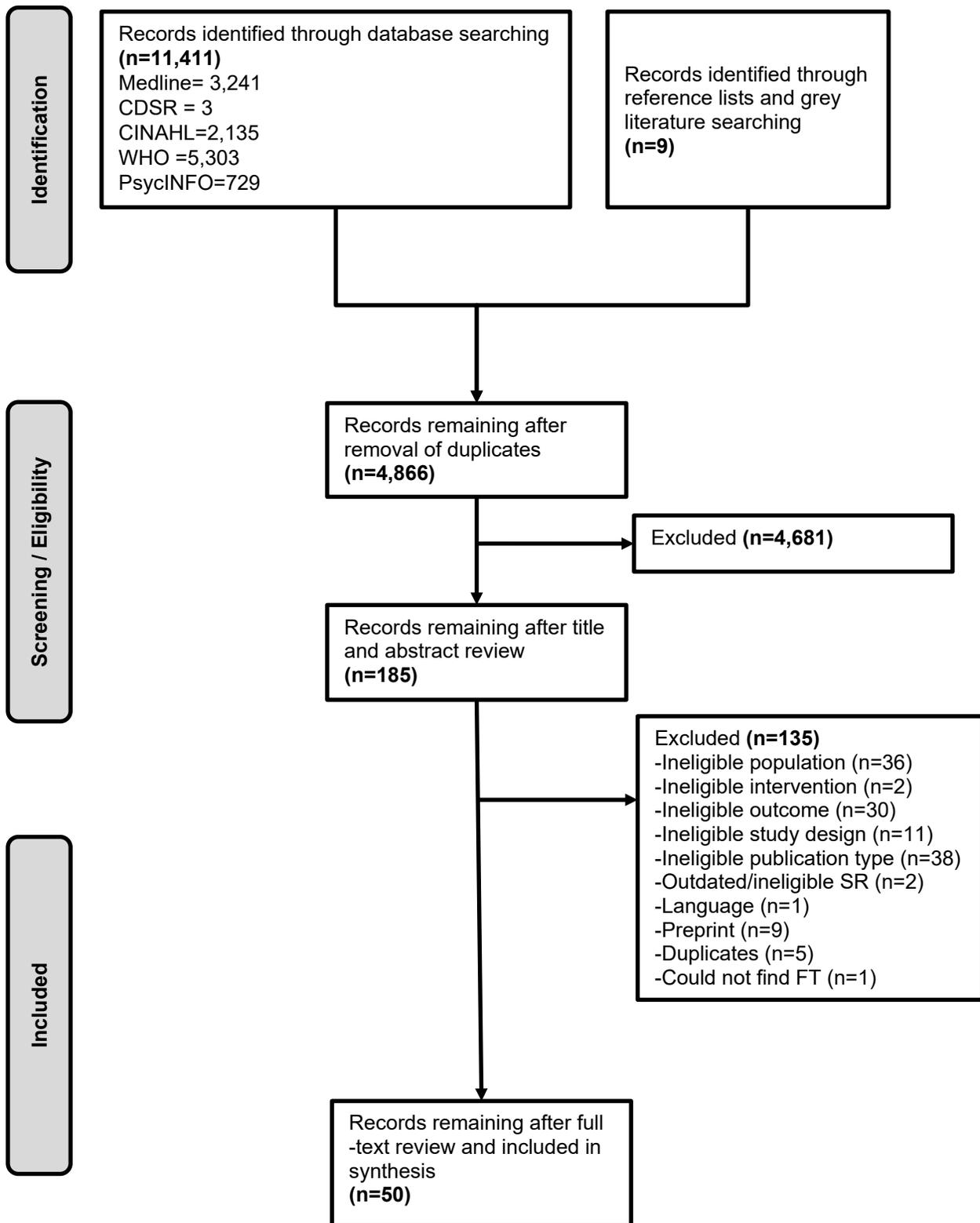
In terms of outcomes, most studies reported the prevalence of symptoms of MH disorders (including depression, anxiety, PTSD, obsessive-compulsive, and insomnia). A few studies reported the incidence of MH diagnoses (including mood disorders, anxiety disorders, psychotic disorders, substance use disorders, and insomnia). Additionally, a few studies reported on MH care utilization and resource needs, but data were limited.

Overall, only 2 analyses^{30,77} of the same study were good quality, 11 studies were fair quality,^{25-28,32-34,36-38,40,43} and 5 studies were poor quality.^{31,35,39,41,42} Among fair-quality studies, common methodological limitations included limited measurement or reporting of participants’ preexisting MH disorders, comorbidities, and COVID-19 severity. Poor-quality studies had

additional limitations, including a lack of information on how COVID-19 was ascertained and use of unvalidated instruments to measure outcomes. Because we have extremely low confidence in the results of these poor-quality studies, we do not report results in the following sections except when they provide the only available data on a certain outcome.

LITERATURE FLOW

Figure 1: Literature Flowchart



KEY QUESTION 1: Among adults who have been hospitalized for COVID-19, what is the prevalence of MH disorders during or after hospitalization?

One fair-quality prospective cohort study with 2 associated publications (N=402 and N=226)^{25,26} and 5 fair-quality cross-sectional studies^{32,36,38,40,43} (N=281 to N=1,002) reported a high prevalence of MH symptoms among patients with COVID-19 during and in the 3 months following hospitalization (**Table 3**). One fair-quality prospective cohort study²⁵ also reported that changes in the severity of MH symptoms varied by disorder between 1-3 months of discharge, with some symptoms becoming less severe and others becoming more severe.

During hospitalization, approximately 4 out of 10 patients with COVID-19 experienced depression symptoms and 3 out of 10 experienced anxiety symptoms.⁴⁰ PTSD, obsessive-compulsive symptoms, psychosis, and insomnia were not assessed in studies of hospitalized patients. The prevalence of anxiety symptoms was similar in the 3-month period post discharge as during the hospitalization period.^{25,26,32} Studies also found approximately 1 out of 10 people hospitalized for COVID-19 experienced PTSD symptoms or met criteria for a PTSD diagnosis,^{25,26,32,43} 3 out of 10 experienced insomnia, and 2 out of 10 experienced obsessive compulsive symptoms within 3 months of leaving the hospital.^{25,26} The prevalence of depression was highly variable across studies conducted within 3 months of hospital discharge (9-66%).^{25,26,32,36,38} No studies in the post-discharge period assessed the prevalence of psychotic disorder.

Findings on the prevalence of mental health disorders were generally of similar magnitude across studies. However, this was not the case with depression, where prevalence estimates ranged from 9% to 66%. It is possible part of this variance is due the wide range of measures used across studies as well as differences in the choice of cut-off point for determining if someone has depression symptoms. The lowest prevalence estimate (9%) comes from a study²⁵ (N=226) that reported participants as having depression if they scored 8 or higher on the 13-item Beck Depression Inventory. The same study found the prevalence of depression was 28% when using a score of 50 or higher on the Zung Self-Rating Depression Scale. The highest prevalence estimate (65.7%) comes from a study³² (N=675) that reported that 19% of participants had moderate-severe symptoms and 46.7% had mild symptoms for a total of 65.7% with any depression symptoms.

While most studies reported prevalence of MH symptoms at 1 time point, 1 single-center, fair-quality prospective cohort study²⁵ reported changes across time. This study found that PTSD symptoms of COVID-19 survivors typically decreased post-discharge from the 1-month to the 3-month follow up (IES-R: $F = 21.29$, $p = 0.001$; PCL-5: $F = 9.07$, $p = 0.003$). These patients also generally experienced a decrease in anxiety symptoms (STAI-state: $F = 11.28$, $p = 0.001$) and insomnia symptoms (WHIIRS: $F = 9.36$, $p = 0.003$). However, there was no overall change in depression symptoms (measured using ZSDS), and patients' obsessive compulsive symptoms tended to worsen from the 1-month to 3-month follow-up appointments ($F = 4.84$, $p = 0.030$).²⁵

Overall, we have low confidence in these findings, as most are only supported by 1-3 studies (*ie*, had low precision), and findings on the prevalence of depression symptoms varied between studies (*ie*, were inconsistent).

Table 3. Prevalence of MH Disorders in Patients Hospitalized for COVID-19

	During hospitalization	0-3 months post-discharge	3+ months post-discharge
Depression or mood disorder	42.0% depression symptoms ⁴⁰	9-65.7% depression symptoms ^{25,26,32,36,38} 19% moderate-severe depression symptoms ³²	No data from prioritized studies
Anxiety	34.9% anxiety symptoms ⁴⁰	30-39.0% anxiety symptoms ^{25,26} 10.4% moderate-severe anxiety symptoms ³²	No data from prioritized studies
PTSD	No data from prioritized studies	9.5-15.4% PTSD symptoms ^{25,26,43} 12.4% PTSD diagnosis ³²	No data from prioritized studies
Obsessive-compulsive	No data from prioritized studies	19.6-26% obsessive compulsive ^{25,26} symptoms	No data from prioritized studies
Sleep disorders	No data from prioritized studies	24-39.6% insomnia symptoms ^{25,26}	No data from prioritized studies

Abbreviations: GAD=Generalized Anxiety Disorder; PTSD=Post-traumatic Stress Disorder

Prioritized studies were those that included ≥ 200 participants and were either fair or good quality. The table does not include studies of <200 pts. The following studies also do not appear in the table, as they were poor quality: Chen 2021, Li 2020, Moradian 2020, Moayed 2021, Wang 2020 & Zhang 2020. Ma 2020 also does not appear in the table, as the study only reported data for those with severe COVID-19.

KEY QUESTION 2: How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis?

A good-quality, retrospective cohort study²⁹ of over 230,000 people from the TriNetX Analytics Network found that approximately 4.5% of hospitalized patients were diagnosed with a mood disorder for the first time within 6 months of their COVID-19 diagnosis. Within the same time period, an estimated 6.9% of hospitalized COVID-19 survivors were diagnosed with an anxiety disorder for the first time, 3.1% were diagnosed with insomnia for the first time, 2.1% were diagnosed with a substance use disorder for the first time, and 0.9% were diagnosed with a psychotic disorder for the first time. Strengths of this study include its large sample size, long follow-up time (6 months), and the fact that it was designed to detect incidence of new MH disorder diagnoses. However, authors provided limited information on the hospitals that comprise the TriNetX database, making it difficult to gauge generalizability to other hospital settings.

A fair-quality, prospective cohort study²⁵ (N=226) reported the prevalence of MH symptoms 3 months after COVID-19 hospitalization among patients without a MH history. The prevalence of MH symptoms were as follows:

- Depression symptoms: 5% (BDI-13 ≥ 8) to 23% (ZSDS ≥ 50)

- PTSD symptoms (PCL-5 ≥ 33): 6%
- Anxiety symptoms (STAI-Y state ≥ 40): 21%
- Insomnia symptoms (WHIIRS ≥ 9): 22%
- Obsessive compulsive symptoms (OCI ≥ 21) 18%.

Overall, we have moderate confidence in estimates of the incidence of receiving a first MH disorder diagnoses within 6 months of being hospitalized for COVID-19, as these estimates are based on a large, good-quality cohort study. We have low confidence in the estimates of MH symptom prevalence among those without a MH history, as the study supporting this finding only included 226 participants (*ie*, had low precision).

KEY QUESTION 2A: How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis compared to those with outpatient COVID-19?

One good-quality retrospective cohort study²⁹ of the TriNetX Analytics Network found that patients who had been hospitalized with COVID-19 were at higher risk of being diagnosed with a mood disorder (HR 1.53 [1.33–1.75]), anxiety disorder (HR 1.49 [1.34–1.65]), psychotic disorder (HR 2.77 [1.99–3.85]), substance use disorder (HR 1.68 [1.40–2.01]) and insomnia (HR 1.49 [1.28–1.74]) for the first time compared to outpatients with COVID-19. This analysis and a previously conducted analysis on a smaller cohort of patients from the same dataset found that hospitalized patients have a 40% increased risk of being diagnosed with a new psychiatric disorder within 3 months and 55% increased risk of being diagnosed with a new mood, anxiety or psychotic disorder within 6 months compared to outpatients.^{29,30} Strengths of both analyses include their large sample sizes, long follow-up time (between 3-6 months), and the fact that they were designed to detect incidence of new MH disorders. However, as noted previously, there was limited information about the hospitals that comprise the TriNetX database.

One fair-quality prospective cohort study²⁶ and 3 fair-quality cross-sectional studies^{34,36,43} provide indirect evidence on the development of new MH *symptoms* by reporting the comparative prevalence of MH symptoms among hospitalized patients versus outpatients with COVID-19. All of the studies looked at populations with unclear prevalence of preexisting MH disorders. One cross-sectional study (N=1,002) found a higher prevalence of depression symptoms among hospitalized patients compared to outpatients with COVID-19 (63% vs 44% on PHQ 9; $p < .001$).³⁶ A second cross-sectional study (N=13,049) found hospitalized patients with respiratory symptoms had more PTSD symptoms than outpatients without respiratory symptoms. A third cross-sectional study (N=583) similarly found higher PCL-5 scores among hospitalized patients than outpatients (mean 12.4 vs 9.7; $p = .042$)⁴³ but noted PTSD diagnoses (as indicated by DSM-5 criteria) were similar between groups (9.5% vs 7%). By contrast, the prospective cohort study²⁶ (N=402) found that hospitalization did not have an independent effect on MH symptoms measured a mean of 1 month after discharge. Of note, participants in this study were recruited after presenting to the Emergency Department (300 were subsequently

admitted to the hospital while the other 102 were managed at home), so the outpatient group likely had more severe symptoms than most outpatients with COVID-19.

Overall, we have moderate confidence hospitalized patients are at increased risk of being diagnosed with a new psychiatric disorder, including mood, anxiety, psychotic, substance use disorders, as well as insomnia as this finding is supported by a large, good-quality, retrospective cohort study. We have low confidence hospitalized patients have higher rates of MH *symptoms*, as the prevalence of preexisting MH disorders (*ie*, indirect) was unclear in studies examining symptoms and sample sizes were considerably smaller (*ie*, low precision).

KEY QUESTION 2B: How often do adults without preexisting MH conditions who have been hospitalized for COVID-19 develop new MH symptoms or a new MH diagnosis compared to adults hospitalized for other causes?

We identified no evidence addressing this question.

KEY QUESTION 2C: Does the probability of developing new MH symptoms or diagnosis during or after hospitalization for COVID-19 vary by patient characteristics (eg, age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?

Four studies (1 prospective cohort²⁵ and 3 cross-sectional)^{37,40,43} examined the association between patient characteristics, COVID-19 disease severity, level of care and MH symptoms among populations with either low or unclear prevalence of preexisting MH conditions (**Table 4**).

In terms of patient characteristics, female sex was associated with worse depression and anxiety symptoms during hospitalization and worse depression, anxiety, obsessive-compulsive, and insomnia symptoms post-discharge.^{25,37,40} Findings were mixed with respect to post-discharge PTSD symptoms. Female sex was associated with worse PTSD symptoms in 1 prospective cohort study,²⁵ but there was no such association in a cross-sectional study.⁴³ Older age was associated with worse depression symptoms during hospitalization,^{37,40} but not with PTSD symptoms post-discharge.⁴³ There was no association between number of comorbidities and PTSD symptoms post-discharge.⁴³ No studies reported on the association between race/ethnicity and MH disorder diagnoses or symptoms.

In terms of COVID-19 disease characteristics, COVID-19 severity was associated with worse anxiety, PTSD, and depression symptoms post-discharge.³² In terms of level of care, longer duration of hospitalization was associated with less severe depression, PTSD, obsessive-compulsive, and insomnia symptoms post-discharge in a prospective cohort study.²⁵ However, duration of hospitalization was not associated with depression or anxiety symptoms during hospitalization in a cross-sectional study.³⁷ Receipt of ICU care was associated with depression symptoms post-discharge.³² Receipt of ventilation, however, was not associated with depression, anxiety, or PTSD symptoms post-discharge.³² Receipt of corticosteroids was associated with higher risk of anxiety symptoms and lower risk of PTSD symptoms post-discharge.³² Overall, we

have low confidence in these findings, as each association was only examined in 1-3 studies (*ie*, had low precision), and many findings were inconsistent across studies.

Table 4. Prevalence of MH Disorders Among Patients Hospitalized for COVID-19 by Patient Characteristics, COVID-19 Disease Severity, and Level of Care

	Sex	Age	Comorbidities	COVID-19 disease severity	Level and type of care
Depression	1 DH and 1 PD study found females had worse depression symptoms. ^{25,37}	1 DH study found being over 50 years old was associated depression symptoms. ⁴⁰ 1 DH study found age was associated with depression symptoms. ^{25,37}	No data from prioritized studies	1 PD study found COVID-19 severity was associated with depression symptoms ³²	1 PD study found receipt of ventilation not associated with depression symptoms, but receipt of ICU care was associated with depression symptoms. ³² 1 PD study found duration of hospitalization associated with better depression symptoms while 1 DH study found no association. ³⁷
Anxiety	2 DH & 1 PD study found female sex was associated with anxiety symptoms. ^{25,37,40}	No data from prioritized studies	No data from prioritized studies	1 PD study found COVID-19 severity was associated with anxiety symptoms ³²	1 PD study found receipt of ventilation not correlated with anxiety symptoms, but receipt of corticosteroids was associated with anxiety symptoms. ³² 1 DH study found duration of hospitalization was not associated with anxiety symptoms. ³⁷
PTSD	1 PD study found females had worse PTSD symptoms. ²⁵ 1 PD study found no association between female sex and PTSD symptoms. ⁴³	1 PD study found no association between age and PTSD symptoms. ⁴³	1 PD study found no association between number of comorbidities and PTSD symptoms. ⁴³	1 PD study found COVID-19 severity was associated with PTSD symptoms ³²	1 PD study found receipt of ventilation not correlated with PTSD symptoms, but receipt of corticosteroids was associated with lower risk of PTSD symptoms. ³² 1 PD study found duration of hospitalization associated with better PTSD symptoms. ²⁵
Obsessive-compulsive	1 PD study found females had worse obsessive-compulsive symptoms. ²⁵	No data from prioritized studies	No data from prioritized studies	No data from prioritized studies	1 PD study found duration of hospitalization associated with better obsessive-compulsive symptoms. ²⁵
Sleep disorders	1 PD study found females had worse insomnia symptoms. ²⁵	No data from prioritized studies	No data from prioritized studies	No data from prioritized studies	1 PD study found duration of hospitalization associated with better insomnia symptoms. ²⁵

Abbreviations: DH=During hospitalization; PD=Post-discharge; PTSD=Post-traumatic Stress Disorder. Prioritized studies were those that included ≥ 200 participants and were either fair or good quality. The table does not include studies of < 200 ppts. Excluded Chen 2021 & Wang 2021 from table as they were poor quality.



KEY QUESTION 3: How often do adults with preexisting MH conditions who have been hospitalized for COVID-19 experience exacerbation of MH symptoms?

A fair-quality prospective cohort study²⁵ (N=226) reported the prevalence of MH symptoms 3 months after COVID-19 hospitalization among patients *with a MH history* were as follows:

- Depression symptoms: 26% (BDI-13 ≥ 8) to 40% (ZDS ≥ 50)
- PTSD symptoms (PCL-5 ≥ 33): 27%
- Anxiety symptoms (STAI-Y state ≥ 40): 50%
- Obsessive compulsive symptoms (OCI ≥ 21): 39%
- Insomnia symptoms (WHIIRS ≥ 9): 33%

A good-quality retrospective cohort study²⁹ of the TriNetX Analytics Network (N=236,379) and a cross-sectional study provide additional, indirect evidence to address this question. In the retrospective cohort study,²⁹ the incidence of receiving any mental health disorder diagnosis in the 6 months following a COVID-19 diagnosis were as follows for hospitalized patients: 14.7% for mood disorder, 16.4% for anxiety disorder, 2.9% for psychotic disorder, 8.6% for substance use disorder, and 6% for insomnia disorder. Because the incidence of receiving *any* mental health disorder diagnosis was consistently higher than the incidence of receiving a *first* mental health disorder diagnosis (14.7% vs 4.5% for mood disorder, 16.4 vs 6.9% for anxiety disorder, 2.9% vs 0.9% for psychotic disorder; 8.6% vs 2.1% for substance use disorder, and 6% vs 3.1% for insomnia disorder), we can deduce that at least some of the patients who received a mental health diagnosis during the 6-month time period were experiencing an exacerbation of a pre-existing, diagnosed MH condition.

In the cross-sectional study²⁶ (N=402), authors found that psychiatric history had a significant effect on current self-reported MH symptoms ($p < .0001$). Specifically, patients with a previous psychiatric history (*ie*, diagnosis of MDD, GAD, panic attack disorder, bipolar disorder, social phobia, eating disorder, or other MH disorder) had worse symptoms of anxiety, depression, PTSD, insomnia, and obsessive-compulsive disorder an average of 32 days after discharge than those without a previous psychiatric history. Of note, in this study only 300 participants were hospitalized with COVID-19, with the other 102 participants managed at home. The study does not stratify results by hospitalization status.

Overall, we have low confidence in these findings, as only a single, relatively small study²⁵ directly reported the prevalence of MH symptoms among those with a MH history.

KEY QUESTION 3A: How often do adults with preexisting MH conditions who have been hospitalized for COVID-19 experience exacerbation of MH symptoms compared to those with outpatient COVID-19?

We identified no evidence addressing this question.

KEY QUESTION 3B: How often do adults with preexisting MH conditions who have been hospitalized for COVID-19 experience exacerbation of MH symptoms compared to adults hospitalized for other causes?

We identified no evidence addressing this question.

KEY QUESTION 3C: Does the probability of exacerbating MH symptoms during or after hospitalization for COVID-19 vary by patient characteristics (eg, age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?

We identified no evidence addressing this question.

KEY QUESTION 4: How often and what kinds of MH care do adults access during or after hospitalization for COVID-19?

One fair-quality cross-sectional study²⁷ reported that 89 out of 892 hospitalized COVID-19 patients (10%) required psychiatric consultation during hospitalization. The most common reasons for psychiatric consultation in these 89 patients were psychomotor agitation/restlessness (25.8%), impairment of sleep (23.6%), evaluation of prior psychiatric treatment (16.7%), anxiety/fear (14.6%), and suicidal ideation (9%). Delirium was the most common diagnosis made (38.2%), followed by adjustment disorder (27.0%), depressive disorder (19.1%), and anxiety disorder (11.2%). Of note, 23 out of the 89 patients (25%) who had a psychiatric consultation had a prior neuropsychiatric diagnosis. This study is limited by excluding patients in ICU settings.

Another fair-quality cross-sectional study²⁸ of 339 hospitalized COVID-19 patients examined the reasons for readmission of 19 patients who were readmitted. Authors reported that 3 out of 19 (16%) readmitted patients had a psychiatric illness as their reason for readmission; 2 of those patients had psychiatric illness of initial presentation. Therefore, COVID-19 is unlikely to be the etiology for these psychiatric symptoms.

Evidence is insufficient to draw conclusions on MH care utilization during or after hospitalization for COVID-19, due to the limited available data.

KEY QUESTION 4A: Does the type or extent of MH care used by adults during or after COVID-19 hospitalization differ compared to before hospitalization?

We identified no evidence addressing this question.

KEY QUESTION 4B: Does the type or extent of MH care utilization differ for adults hospitalized for COVID-19 compared to adults receiving outpatient treatment for COVID-19?

We identified no evidence addressing this question.

KEY QUESTION 4C: Does the type or extent of MH care utilization differ for adults hospitalized for COVID-19 compared to adults hospitalized for other causes?

We identified no evidence addressing this question.

KEY QUESTION 4D: Does the type or extent of MH care utilization during or after hospitalization for COVID-19 vary by patient characteristics (eg, age, sex, race/ethnicity, comorbidities), COVID-19 disease severity, or level of care?

One fair-quality study²⁷ of 891 hospitalized COVID-19 patients examined outcomes among those who received psychiatric consultations. Patients requiring MH consultation were more likely to require oxygen therapy, consequent ICU transfer, and mechanical ventilation. Patients requiring MH consultation were more likely to have presence of chronic medical disease and/or prior neuropsychiatric diagnosis. We identified no evidence regarding age, sex, or race/ethnicity and mental health utilization. Evidence is insufficient to draw conclusions on type or extent of MH care utilization by patient characteristics during or after hospitalization for COVID-19, due to the limited available data.

KEY QUESTION 5: What are the MH care resource needs among adults who have been hospitalized for COVID-19?

There is limited available evidence on MH resource needs among people hospitalized for COVID-19. A poor-quality study⁷⁸ found 59% of hospitalized patients reported at least some need for psychological guidance in rehabilitation; however, the study does not provide any additional information on what is meant by “guidance.” Evidence is therefore insufficient to draw conclusions on MH care resource needs based on the paucity of available data.

SUMMARY AND DISCUSSION

We conducted a rapid evidence review to determine the prevalence of MH disorders among adults hospitalized for COVID-19, to compare this to the prevalence of MH disorders in relevant comparison groups, and to determine MH care utilization and resource needs post-hospitalization for patients with COVID-19. Although a few systematic reviews have examined the prevalence of MH disorders during the COVID-19 pandemic, they have either focused on the general population,⁷⁹ or evaluated patients with COVID-19 together with SARS and MERS patients.¹² To our knowledge, this is the first evidence review on the prevalence of mental health disorders *specifically* among patients who have been hospitalized for COVID-19. This is the last update of the review, adding literature published in the 8 months after the initial review. In this update, we prioritized evidence from 19 articles²⁵⁻⁴³ that reported data from 17 studies of ≥ 200 participants.

The best available evidence from these 17 studies indicates there may be a high prevalence of MH symptoms during and in the 3 months after hospitalization for COVID-19 (approximately 40% of patients may experience depression symptoms, 30% anxiety symptoms, 20% insomnia symptoms, 20% obsessive-compulsive symptoms, and 10% PTSD symptoms). However, the incidence of receiving a new MH disorder diagnosis in the 6 months after hospitalization is probably much lower than the reported symptom rate (range of 2-7% of patients were diagnosed with substance use, insomnia, anxiety, or mood disorder for the first time). These data suggest that while some patients may experience mental health symptoms after hospitalization for COVID-19, most do not go on to develop a new mental health disorder. As with any serious medical condition, clinicians should provide patients who were recently hospitalized for COVID-19 with general MH resources (*eg*, stress management strategies; local MH contact information in case of new, persistent, or worsening MH symptoms). Additionally, hospitalization for COVID-19 may represent a point of contact for patients who do not frequently utilize healthcare services; this provides clinicians with a unique opportunity to screen these patients for mental health disorders.

Hospitalized COVID-19 patients are probably at a slightly elevated risk of receiving a first MH disorder diagnosis 6 months after COVID-19 diagnosis compared to outpatients with COVID-19. Because we did not find studies comparing hospitalized COVID-19 patients to patients hospitalized for other reasons, we do not know if this increased risk is due to hospitalization for COVID-19 specifically or hospitalization generally. Furthermore, although there have been case reports^{80,81} of psychotic episodes following COVID-19 diagnosis, the incidence of receiving a new psychotic disorder diagnosis in the 6 months following hospitalization for COVID-19 is likely extremely low (around 1%).²⁹ It is noteworthy, however, that the risk is higher in hospitalized patients than outpatients (HR 2.77 [1.99–3.85]). Overall, clinicians should be aware that hospitalized patients may be at slightly elevated risk of developing new MH disorders than outpatients with COVID-19, and that some patients may develop a psychotic disorder after hospitalization for COVID-19. However, psychosis is extremely rare.

Finally, we found that female sex and COVID-19 severity are the 2 patient and disease characteristics most consistently associated with worse MH outcomes. Given women are more likely to report and seek help for MH symptoms than men,⁸² this could be the result of sex-related reporting biases, rather than a true difference in symptoms. COVID-19 severity was associated with worse anxiety, PTSD, and depression symptoms post-discharge. Studies had mixed findings on other patient, disease, and treatment characteristics such as older age, duration

of hospitalization and receipt of specific treatment such as ventilation and corticosteroids, with some studies showing an association with MH outcomes and others showing no association.

LIMITATIONS

There were limitations to both our rapid review methods and limitations of our included studies.

Rapid Review Limitations

The primary limitation of our rapid review methods is that we had a single reviewer assess articles for inclusion, abstract data, and assess study quality, with second reviewer verification. This could have resulted in missing eligible studies or data, although we attempted to reduce this risk by establishing explicit inclusion criteria for studies, developing and using a piloted data abstraction tool, and developing a key for determining whether a study met each of JBI's quality criteria.

A second limitation of our rapid review methods is that we focused our synthesis on the 19 prioritized articles of ≥ 200 participants that provided the best available evidence, rather than all 50 articles. As a result, we do not include an exhaustive account of all outcomes reported by all studies. For example, 2 studies^{54,72} (N=33 and N=109) reported low rates of suicidal ideation in hospitalized patients with COVID-19 (3/33 or 9% in 1 study⁵⁴ and 3/109 or 3% in the other⁷²), which is an outcome not measured in larger studies. However, given the small sample sizes of these 2 studies and low base rates of suicidal ideation among hospitalized patients, larger studies are needed for reliable estimates of suicidal ideation prevalence. This is an area in need of future research.

Primary Study Limitations

There were several important limitations of our 19 prioritized articles. As described in the "Results" section, only 2 analyses^{29,30} of 1 study were high quality. The other 16 studies were fair or poor quality, with common methodological limitations including not reporting or accounting for the prevalence of preexisting MH disorders in analyses, limited information on other medical comorbidities that could be confounders, and limited information on the severity of COVID-19 and how COVID-19 was ascertained among participants.

GAPS AND FUTURE RESEARCH

For the most part, new studies addressed the gaps in evidence described in the March 2021 report. However, a few important knowledge gaps remain.

- Researchers should compare patients who have been hospitalized for COVID-19 to relevant control groups. More comparative studies are needed as these can help to determine the extent to which outcomes are driven by the COVID-19 illness itself or by other factors such as the experience of hospitalization, severity of COVID-19 symptoms, level of care needed such as ICU versus non-ICU, and other factors.
- Researchers should report and account for potential confounders, particularly preexisting mental health disorders, medications, and medical comorbidities. As discussed in the "Limitations" section, few studies reported whether participants had preexisting mental health disorders. This is problematic because the prevalence of *post-hospitalization* mental

health disorders is likely influenced by the prevalence of *pre-hospitalization* mental health disorders. For cross-sectional studies, researchers should at minimum report the proportion of participants with specific preexisting mental health disorders. For comparative cross-sectional studies or longitudinal studies, researchers should report the proportion of participants with specific preexisting mental health disorders *for each comparison group*. Ideally, researchers would account for preexisting mental health disorders in prevalence estimates (eg, by separately reporting the proportion of participants with mental health disorders among those who had preexisting disorders and the proportion of participants with new-onset mental health disorders, and by estimating adjusted prevalence or risk ratios). Similarly, researchers should also report patients' preexisting medications and medical comorbidities. Finally, wherever possible, researchers should also report on patients' social determinants of health (such as homelessness and social support), as these factors are likely to be associated with the pre-hospitalization prevalence of mental health disorders.

- Researchers should assess the mental health care utilization and resource needs of patients after their discharge for COVID-19. While we identified 3 studies that provide some information about the MH care needs of COVID-19 patients during or after hospitalization, the studies were relatively small, 1 was low quality, and most importantly, they provided limited information about patient MH care preferences or needs. While new MH diagnoses are rare after hospitalization for COVID-19, it remains unclear whether traditional methods of diagnosing and treating mental health disorders are sufficient for these patients, or if additional or novel assessments, treatment strategies, or resources should be provided.

Given the absence of evidence on patients' post-hospitalization needs and preferences, continuing to rely on existing, standard procedures to assess patients' mental and physical health needs after hospitalization is likely appropriate. For those with new anxiety or depression symptoms, the WHO recommends providing support strategies including mental health first aid, stress management, and brief psychological interventions based on cognitive behavioral therapy (CBT) as first-line therapy and benzodiazepines as second-line therapy for those with severe distress.⁸³ If anxiety and depression symptoms persist, patients should consult with mental health professionals for further evaluation and treatment. While the American Psychological Association and American Psychiatric Association do not provide clinical practice guidelines on caring for patients with COVID-19 specifically, they provide guidance on caring for patients with mental health disorders generally^{84,85} as well as high-level guidance for identifying signs of COVID-19-related mental health issues and providing mental health care remotely.^{86,87}

Going forward, developing mental health screening tools tailored to the specific needs of patients who have been hospitalized for COVID-19 may be warranted. Screening items could include assessment of mental health symptoms related to hospitalization as well as other concerns stemming from the COVID-19 pandemic that could impact mental health (eg, loss of employment, separation from loved ones, anxiety about possible reinfection, etc).

EVOLVING NATURE OF COVID-19 AND MENTAL HEALTH

In the year since we first searched for evidence on this topic, the nature of the COVID-19 pandemic has changed. In late 2020 and early 2021, the FDA authorized 3 vaccines for emergency use in the United States.⁸⁸ The subsequent increase in the number of people vaccinated against COVID-19 has corresponded with a decline in the number of new, daily COVID-19 cases in the United States (from 290,000 on Jan 6, 2021 to 8,000 on Jun 20, 2021).^{89,90} The rate of new COVID-19 hospitalizations per 100,000 people per day in the United States has also declined tremendously (from 4.85 on Jan 6, 2021 to 0.56 on Jun 20, 2021).⁹¹ Additionally, there are now a variety of FDA-authorized treatments available for patients hospitalized for COVID-19, including tocilizumab and remdesivir.⁹²

Although there has been much progress to contain the SARS-CoV-2 virus this past year, numerous variants have emerged, some of which may be associated with more serious illness.⁹³ Currently, the spread of the Delta variant has corresponded to increases in COVID-19 cases and hospitalizations in the United States.⁹⁴ As a result, it will be important for researchers to continue to evaluate mental health outcomes among those hospitalized for COVID-19, especially in places with high rates of hospitalizations.

Due to the different ways the pandemic is evolving, factors such as vaccination, treatment, variants, and policy changes could influence MH outcomes for patients hospitalized for COVID-19. For example, many healthcare systems are allowing patients hospitalized for COVID-19 to have visitors if the visitors are vaccinated.⁹⁵ Being able to see family and friends has the potential to reduce depression, anxiety, and PTSD symptoms among hospitalized COVID-19 patients. Additionally, the knowledge that treatments are available may also help reduce stress and anxiety among patients hospitalized for COVID-19. Regardless of the way COVID-19 evolves, assessing the impact of COVID-19 hospitalization on MH outcomes will continue to be important.

CONCLUSIONS

We identified a total of 2 prospective cohort, 2 retrospective cohort, and 13 cross-sectional studies that provide the best available evidence on MH outcomes during and after hospitalization for COVID-19 through March 2021. Evidence from primarily fair-quality studies suggests that many patients experience MH symptoms such as depression, anxiety, and insomnia during and in the 3 months following hospitalization for COVID-19. However, patients infrequently receive a new MH disorder diagnosis in the 6 months following hospitalization. Some patients (such as women and those with more severe COVID-19) may be at higher risk of poor MH outcomes. Future research should compare patients hospitalized for COVID-19 to those hospitalized for other reasons and evaluate mental health treatment utilization and resource needs following hospitalization.

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In designing the study questions and methodology at the outset of this report, the ESP consulted several technical and content experts. Broad expertise and perspectives were sought. Divergent and conflicting opinions are common and perceived as healthy scientific discourse that results in a thoughtful, relevant systematic review. Therefore, in the end, study questions, design, methodologic approaches, and/or conclusions do not necessarily represent the views of individual technical and content experts.

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Operational Partners

Operational partners are system-level stakeholders who have requested the report to inform decision-making. They recommend Technical Expert Panel (TEP) participants; assure VA relevance; help develop and approve final project scope and timeframe for completion; provide feedback on draft report; and provide consultation on strategies for dissemination of the report to field and relevant groups.

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Peer Reviewers

The Coordinating Center sought input from external peer reviewers to review the draft report and provide feedback on the objectives, scope, methods used, perception of bias, and omitted evidence. Peer reviewers must disclose any relevant financial or non-financial conflicts of interest. Because of their unique clinical or content expertise, individuals with potential conflicts may be retained. The Coordinating Center and the ESP Center work to balance, manage, or mitigate any potential nonfinancial conflicts of interest identified.

REFERENCES

1. World Health Organization. Timeline of WHO's response to COVID-19. <https://www.who.int/news-room/detail/29-06-2020-covidtimeline>. Published 2020. Updated July 30, 2020. Accessed September 16, 2020.
2. Johns Hopkins University. COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE). <https://coronavirus.jhu.edu/map.html>. Published 2020. Accessed March 29, 2021.
3. Centers for Disease Control and Prevention. Interim Clinical Guidance for Management of Patients with Confirmed Coronavirus Disease (COVID-19). Coronavirus Disease 2019 (COVID-19) Web site. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html>. Updated September 10, 2020. Accessed February 18, 2021.
4. Centers for Disease Control and Prevention. Hospitalization Rates and Characteristics of Patients Hospitalized with Laboratory-Confirmed Coronavirus Disease 2019 - COVID-NET, 14 State, March 1-30, 2020. <https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e3.htm>. Published 2020. Updated April 17, 2020. Accessed September 16, 2020.
5. Kim L, Garg S, O'Halloran A, et al. Risk Factors for Intensive Care Unit Admission and In-hospital Mortality among Hospitalized Adults Identified through the U.S. Coronavirus Disease 2019 (COVID-19)-Associated Hospitalization Surveillance Network (COVID-NET). *Clinical Infectious Diseases*. 2020.
6. Warrington TP, Bostwick JM. Psychiatric adverse effects of corticosteroids. Paper presented at: Mayo Clinic Proceedings 2006.
7. Tingey JL, Bentley JA, Hosey MM. COVID-19: Understanding and mitigating trauma in ICU survivors. *Psychological Trauma: Theory, Research, Practice, and Policy*. 2020;12(S1):S100-S104.
8. Montauk TR, Kuhl EA. COVID-related family separation and trauma in the intensive care unit. *Psychological Trauma: Theory, Research, Practice, and Policy*. 2020;12(S1):S96-S97.
9. Huff C. Delirium, PTSD, brain fog: The aftermath of surviving COVID-19. American Psychological Association. Monitor on Psychology Web site. <http://www.apa.org/monitor/2020/09/aftermath-covid-19>. Published 2020. Accessed September 16, 2020.
10. de Girolamo G, Cerveri G, Clerici M, et al. Mental Health in the Coronavirus Disease 2019 Emergency—The Italian Response. *JAMA Psychiatry*. 2020;77(9):974-976.
11. Kahl KG, Correll CU. Management of Patients With Severe Mental Illness During the Coronavirus Disease 2019 Pandemic. *JAMA Psychiatry*. 2020;77(9):977-978.
12. Rogers JP, Chesney E, Oliver D, et al. Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the COVID-19 pandemic. *The Lancet Psychiatry*. 2020;7(7):611-627.
13. Freedland KE, Rich MW, Skala JA, Carney RM, Dávila-Román VG, Jaffe AS. Prevalence of depression in hospitalized patients with congestive heart failure. *Psychosom Med*. 2003;65(1):119-128.
14. Wesselius HM, van den Ende ES, Alsmas J, et al. Quality and Quantity of Sleep and Factors Associated With Sleep Disturbance in Hospitalized Patients. *JAMA Internal Medicine*. 2018;178(9):1201-1208.

15. Shi L, Lu Z-A, Que J-Y, et al. Prevalence of and Risk Factors Associated With Mental Health Symptoms Among the General Population in China During the Coronavirus Disease 2019 Pandemic. *JAMA Network Open*. 2020;3(7):e2014053-e2014053.
16. Qiu J, Shen B, Zhao M, Wang Z, Xie B, Xu Y. A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *General Psychiatry*. 2020;33(2):e100213.
17. Ettman CK, Abdalla SM, Cohen GH, Sampson L, Vivier PM, Galea S. Prevalence of Depression Symptoms in US Adults Before and During the COVID-19 Pandemic. *JAMA Network Open*. 2020;3(9):e2019686-e2019686.
18. Varatharaj A, Thomas N, Ellul MA, et al. Neurological and neuropsychiatric complications of COVID-19 in 153 patients: a UK-wide surveillance study. *The Lancet Psychiatry*.
19. Agha Z, Lofgren RP, VanRuiswyk JV, Layde PM. Are Patients at Veterans Affairs Medical Centers Sicker?: A Comparative Analysis of Health Status and Medical Resource Use. *Archives of Internal Medicine*. 2000;160(21):3252-3257.
20. Trivedi RB, Post EP, Sun H, et al. Prevalence, Comorbidity, and Prognosis of Mental Health Among US Veterans. *American Journal of Public Health*. 2015;105(12):2564-2569.
21. O'Neil A, Nicholls SJ, Redfern J, Brown A, Hare DL, O'Neil A. Mental Health and Psychosocial Challenges in the COVID-19 Pandemic: Food for Thought for Cardiovascular Health Care Professionals. *Heart, Lung & Circulation*. 2020;29(7):960-963.
22. Treadwell JR, Singh S, Talati R, McPheeters ML, Reston JT. A framework for "best evidence" approaches in systematic reviews. <https://www.ncbi.nlm.nih.gov/books/NBK56653/>. Published 2011. Accessed 2021.
23. Joanna Briggs Institute. Critical Appraisal Tools. <https://joannabriggs.org/critical-appraisal-tools>. Accessed September 16, 2020.
24. Berkman ND, Lohr KN, Ansari M, et al. *Grading the Strength of a Body of Evidence When Assessing Health Care Interventions for the Effective Health Care Program of the Agency for Healthcare Research and Quality: An Update Methods Guide for Effectiveness and Comparative Effectiveness Reviews*. Rockville MD2013.
25. Gennaro MM, Mariagrazia P, De Lorenzo R, et al. Persistent psychopathology and neurocognitive impairment in COVID-19 survivors: effect of inflammatory biomarkers at three-month follow-up. *Brain, Behavior, & Immunity*. 2021;24:24.
26. Mazza MG, De Lorenzo R, Conte C, et al. Anxiety and depression in COVID-19 survivors: Role of inflammatory and clinical predictors. *Brain, Behavior, & Immunity*. 2020;30:30.
27. Turan S, Poyraz BC, Aksoy Poyraz C, et al. Characteristics and outcomes of COVID-19 inpatients who underwent psychiatric consultations. *Asian Journal of Psychiatry*. 2021;57:102563.
28. Atalla E, Kalligeros M, Giampaolo G, Mylona EK, Shehadeh F, Mylonakis E. Readmissions among Patients with COVID-19. *International Journal of Clinical Practice*. 2020:e13700.
29. Taquet M, Geddes JR, Husain M, Luciano S, Harrison PJ. 6-month neurological and psychiatric outcomes in 236 379 survivors of COVID-19: a retrospective cohort study using electronic health records. *The Lancet Psychiatry*. 2021;8(5):416-427.

30. Taquet M, Luciano S, Geddes JR, Harrison PJ. Bidirectional associations between COVID-19 and psychiatric disorder: retrospective cohort studies of 62 354 COVID-19 cases in the USA. *The Lancet Psychiatry*. 2020.
31. Li X, Tian J, Xu Q. The Associated Factors of Anxiety and Depressive Symptoms in COVID-19 Patients Hospitalized in Wuhan, China. *Psychiatric Quarterly*. 2020;23:23.
32. Liu D, Baumeister RF, Veilleux JC, et al. Risk factors associated with mental illness in hospital discharged patients infected with COVID-19 in Wuhan, China. *Psychiatry Research*. 2020;292:113297.
33. Ma Y-F, Li W, Deng H-B, et al. Prevalence of depression and its association with quality of life in clinically stable patients with COVID-19. *Journal of Affective Disorders*. 2020;275:145-148.
34. Chamberlain SR, Grant JE, Trender W, Hellyer P, Hampshire A. Post-traumatic stress disorder symptoms in COVID-19 survivors: online population survey. *BJPsych Open*. 2021;7(2):e47.
35. Chen Y, Huang X, Zhang C, et al. Prevalence and predictors of posttraumatic stress disorder, depression and anxiety among hospitalized patients with coronavirus disease 2019 in China. *BMC Psychiatry*. 2021;21(1):80.
36. Islam MS, Ferdous MZ, Islam US, Mosaddek ASM, Potenza MN, Pardhan S. Treatment, Persistent Symptoms, and Depression in People Infected with COVID-19 in Bangladesh. *International Journal of Environmental Research & Public Health [Electronic Resource]*. 2021;18(4):05.
37. Jiang Z, Zhu P, Wang L, et al. Psychological distress and sleep quality of COVID-19 patients in Wuhan, a lockdown city as the epicenter of COVID-19. *Journal of Psychiatric Research*. 2020;27:27.
38. Mandal S, Barnett J, Brill SE, et al. 'Long-COVID': a cross-sectional study of persisting symptoms, biomarker and imaging abnormalities following hospitalisation for COVID-19. *Thorax*. 2020;10:10.
39. Moradian ST, Parandeh A, Khalili R, Karimi L. Delayed Symptoms in Patients Recovered from COVID-19. *Iranian Journal of Public Health*. 2020;49(11):2120-2127.
40. Sahan E, Unal SM, Kirpinar I. Can we predict who will be more anxious and depressed in the COVID-19 ward? *Journal of Psychosomatic Research*. 2021;140:110302.
41. Wang M, Hu C, Zhao Q, et al. Acute psychological impact on COVID-19 patients in Hubei: a multicenter observational study. *Transl Psychiatry*. 2021;11(1):133-133.
42. Moayed MS, Vahedian-Azimi A, Mirmomeni G, et al. Depression, Anxiety, and Stress Among Patients with COVID-19: A Cross-Sectional Study. *Advances in Experimental Medicine & Biology*. 2021;1321:229-236.
43. Einvik G, Dammen T, Ghanima W, Heir T, Stavem K. Prevalence and Risk Factors for Post-Traumatic Stress in Hospitalized and Non-Hospitalized COVID-19 Patients. *International Journal of Environmental Research & Public Health [Electronic Resource]*. 2021;18(4):20.
44. Akinci T, Melek Basar H. Relationship between sleep quality and the psychological status of patients hospitalised with COVID-19. *Sleep Medicine*. 2021;80:167-170.
45. Cai X, Hu X, Ekumi IO, et al. Psychological Distress and Its Correlates Among COVID-19 Survivors During Early Convalescence Across Age Groups. *American Journal of Geriatric Psychiatry*. 2020;28(10):1030-1039.
46. Chang MC, Park D. Incidence of Post-Traumatic Stress Disorder After Coronavirus Disease. *Healthcare*. 2020;8(4):30.

47. De Lorenzo R, Conte C, Lanzani C, et al. Residual clinical damage after COVID-19: A retrospective and prospective observational cohort study. *PLoS One*. 2020;15(10):e0239570-e0239570.
48. Dorman-Ilan S, Hertz-Palmor N, Brand-Gothelf A, et al. Anxiety and Depression Symptoms in COVID-19 Isolated Patients and in Their Relatives. *Frontiers in psychiatry Frontiers Research Foundation*. 2020;11:581598.
49. Fang C, Xiao-Dong W, Kan-Kai Z, et al. Investigation of the psychological status of suspected patients during the Coronavirus disease 2019 epidemic. *Medicine*. 2020;99(38):1-6.
50. Hao F, Tam W, Hu X, et al. A quantitative and qualitative study on the neuropsychiatric sequelae of acutely ill COVID-19 inpatients in isolation facilities. *Transl Psychiatry Psychiatry*. 2020;10(1):355.
51. Horn M, Wathélet M, Fovet T, et al. Is COVID-19 Associated With Posttraumatic Stress Disorder? *Journal of Clinical Psychiatry*. 2020;82(1):08.
52. Hu Y, Chen Y, Zheng Y, et al. Factors related to mental health of inpatients with COVID-19 in Wuhan, China. *Brain, Behavior, & Immunity*. 2020;15:15.
53. Kandeger A, Aydin M, Altinbas K, et al. Evaluation of the relationship between perceived social support, coping strategies, anxiety, and depression symptoms among hospitalized COVID-19 patients. *International Journal of Psychiatry in Medicine*. 2020:91217420982085.
54. Kim JW, Stewart R, Kang SJ, Jung SI, Kim SW, Kim JM. Telephone based Interventions for Psychological Problems in Hospital Isolated Patients with COVID-19. *Clinical Psychopharmacology & Neuroscience*. 2020;18(4):616-620.
55. Kong X, Kong F, Zheng K, et al. Effect of Psychological-Behavioral Intervention on the Depression and Anxiety of COVID-19 Patients. *Frontiers in psychiatry Frontiers Research Foundation*. 2020;11:586355.
56. Mendez R, Balanza-Martinez V, Luperdi SC, et al. Short-term Neuropsychiatric Outcomes and Quality of Life in COVID-19 Survivors.
57. Nie X-D, Wang Q, Wang M-N, et al. Anxiety and depression and its correlates in patients with coronavirus disease 2019 in Wuhan. *International Journal of Psychiatry in Clinical Practice*. 2020:1-6.
58. Parker C, Shalev D, Hsu I, et al. Depression, Anxiety, and Acute Stress Disorder Among Patients Hospitalized With Coronavirus Disease 2019: A Prospective Cohort Study. *Psychosomatics*. 2020;10:10.
59. Raman B, Cassar MP, Tunnicliffe EM, et al. Medium-term effects of SARS-CoV-2 infection on multiple vital organs, exercise capacity, cognition, quality of life and mental health, post-hospital discharge. *EClinicalMedicine*. 2021;31:100683.
60. Rass V, Beer R, Josef Schiefecker A, et al. Neurological outcome and quality of life three months after COVID-19: a prospective observational cohort study. *European Journal of Neurology*. 2021;07:07.
61. Suarez-Robles M, Iguaran-Bermudez MDR, Garcia-Klepizg JL, Lorenzo-Villalba N, Mendez-Bailon M. Ninety days post-hospitalization evaluation of residual COVID-19 symptoms through a phone call check list. *The Pan African medical journal*. 2020;37:289.
62. Sykes DL, Holdsworth L, Jawad N, Gunasekera P, Morice AH, Crooks MG. Post-COVID-19 Symptom Burden: What is Long-COVID and How Should We Manage It? *Lung*. 2021;11:11.

63. Tomasoni D, Bai F, Castoldi R, et al. Anxiety and depression symptoms after virological clearance of COVID-19: A cross-sectional study in Milan, Italy. *Journal of Medical Virology*. 2020;25:25.
64. van den Borst B, Peters JB, Brink M, et al. Comprehensive health assessment three months after recovery from acute COVID-19. *Clinical Infectious Diseases*. 2020;21:21.
65. van der Sar-van der Brugge S, Talman S, Boonman-de Winter L, et al. Pulmonary function and health-related quality of life after COVID-19 pneumonia. *Respiratory Medicine*. 2021;176:106272.
66. Xu F, Wang X, Yang Y, et al. Depression and insomnia in COVID-19 survivors: a cross-sectional survey from Chinese rehabilitation centers in Anhui province. *Sleep Medicine*. 2021;08:08.
67. Yuan B, Li W, Liu H, et al. Correlation between immune response and self-reported depression during convalescence from COVID-19. *Brain, Behavior, & Immunity*. 2020;25:25.
68. Zandifar A, Badrfam R, Yazdani S, et al. Prevalence and severity of depression, anxiety, stress and perceived stress in hospitalized patients with COVID-19. *Journal of Diabetes & Metabolic Disorders*. 2020:1-8.
69. Zhang J, Xu D, Xie B, et al. Poor-sleep is associated with slow recovery from lymphopenia and an increased need for ICU care in hospitalized patients with COVID-19: A retrospective cohort study. *Brain, Behavior, & Immunity*. 2020;88:50-58.
70. Matalon N, Dorman-Ilan S, Hasson-Ohayon I, et al. Trajectories of post-traumatic stress symptoms, anxiety, and depression in hospitalized COVID-19 patients: A one-month follow-up. *Journal of Psychosomatic Research*. 2021;143:110399.
71. Park HY, Jung J, Park HY, et al. Psychological Consequences of Survivors of COVID-19 Pneumonia 1 Month after Discharge. *Journal of Korean Medical Science*. 2020;35(47):e409.
72. Putri DU, Tsai YS, Chen JH, et al. Psychological distress assessment among patients with suspected and confirmed COVID-19: A cohort study. *Journal of the Formosan Medical Association*. 2021;26:26.
73. Zarghami A, Farjam M, Fakhraei B, Hashemzadeh K, Yazdanpanah MH. A Report of the Telepsychiatric Evaluation of SARS-CoV-2 Patients. *Telemedicine Journal & E Health*. 2020;11:11.
74. United States Census Bureau.
. Quick Facts Web site. <https://www.census.gov/quickfacts/fact/table/US/PST045219>. Published 2020. Accessed February 2, 2021.
75. Rhode Island. U.S. Census Bureau. <https://www.census.gov/quickfacts/RI>. Published 2020. Accessed January 25, 2021.
76. COVID-19 Hospitalization and Death by Race/Ethnicity. Centers for Disease Control and Prevention. <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html#footnote02>. Published 2020. Updated November 30, 2020. Accessed February 2, 2021.
77. Taquet M, Luciano S, Geddes JR, Harrison PJ. Bidirectional associations between COVID-19 and psychiatric disorder: retrospective cohort studies of 62 354 COVID-19 cases in the USA. *The Lancet Psychiatry*. 2021;8(2):130-140.
78. Li Z, Zheng C, Duan C, et al. Rehabilitation needs of the first cohort of post-acute COVID-19 patients in Hubei, China. *European journal of physical & rehabilitation medicine*. 2020;56(3):339-344.

79. Vindegaard N, Benros ME. COVID-19 pandemic and mental health consequences: Systematic review of the current evidence. *Brain Behav Immun*. 2020.
80. Parra A, Juanes A, Losada CP, et al. Psychotic symptoms in COVID-19 patients. A retrospective descriptive study. *Psychiatry research*. 2020;291:113254-113254.
81. Belluck P. Small Number of Covid Patients Develop Severe Psychotic Symptoms. The New York Times. <https://www.nytimes.com/2020/12/28/health/covid-psychosis-mental.html>. Published 2020. Updated December 28, 2020. Accessed February 2, 2021.
82. World Health Organization. Gender disparities and mental health: The Facts. World Health Organization. Mental Health and Substance Use Web site. <https://www.who.int/teams/mental-health-and-substance-use/gender-and-women-s-mental-health>. Published 2021. Accessed June 15, 2021.
83. World Health Organization. Clinical management of COVID-19. [https://www.who.int/publications/i/item/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-\(ncov\)-infection-is-suspected](https://www.who.int/publications/i/item/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-(ncov)-infection-is-suspected). Published 2020. Updated May 27 2020. Accessed September 16, 2020.
84. American Psychological Association. Clinical Practice Guideline for the Treatment of Depression Across Three Age Cohorts. <https://www.apa.org/depression-guideline>. Accessed September 16, 2020.
85. American Psychological Association. Clinical Practice Guideline for the Treatment of Posttraumatic Stress Disorder (PTSD). <https://www.apa.org/ptsd-guideline>. Updated March 2017. Accessed September 16, 2020.
86. American Psychiatric Association. Practice Guidance for COVID-19. <https://www.psychiatry.org/psychiatrists/covid-19-coronavirus/practice-guidance-for-covid-19>. Published 2020. Updated August 26, 2020. Accessed September 16, 2020.
87. American Psychological Association. APA COVID-19 Information and Resources. American Psychological Association. <https://www.apa.org/topics/covid-19>. Accessed September 16, 2020.
88. COVID-19 Vaccines. U.S. Food and Drug Administration. <https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/covid-19-vaccines>. Published 2021. Updated July 13, 2021. Accessed July 15, 2021.
89. Vaccination and Case Trends of COVID-19 in the United States. Centers for Disease Control and Prevention. COVID Data Tracker Web site. <https://covid.cdc.gov/covid-data-tracker/#vaccinations-cases-trends>. Published 2021. Updated July 15, 2021. Accessed 2021, July 16, 2021.
90. Trends in Number of COVID-19 Cases and Deaths in the United States Reported to CDC, by State/Territory. Center for Disease Control and Prevention. COVID Data Tracker Web site. https://covid.cdc.gov/covid-data-tracker/#trends_dailytrendscases. Published 2021. Updated July 15, 2021. Accessed July 16, 2021.
91. New Admissions of Patient with Confirmed COVID-19 per 100,000 population by Age Group, United States. Centers for Disease Control. <https://covid.cdc.gov/covid-data-tracker/#new-hospital-admissions>. Published 2021. Updated July 14, 2021. Accessed July 16, 2021.
92. Treatments for COVID-19. <https://www.health.harvard.edu/diseases-and-conditions/treatments-for-covid-19>. Published 2021. Updated July 12, 2021. Accessed July 16, 2021.

93. SARS-CoV-2 Variant Classifications and Definitions. Centers for Disease Control and Prevention. <https://www.cdc.gov/coronavirus/2019-ncov/variants/variant-info.html>. Published 2021. Updated July 13, 2021. Accessed July 16, 2021.
94. Mendez R. Hospitalizations rising again as delta variant spreads among the unvaccinated, doctors say. <https://www.cnbc.com/2021/07/13/hospitalizations-rising-again-as-delta-variant-spreads-among-the-unvaccinated-doctors-say-.html>. Published 2021. Updated July 13, 2021. Accessed July 16, 2021.
95. Carbajal E. Spectrum Health's new policy: COVID-19 patients can have visitors. <https://www.beckershospitalreview.com/patient-experience/spectrum-health-s-new-policy-covid-19-patients-can-have-visitors.html>. Published 2021. Updated June 17, 2021. Accessed July 17, 2021.