Evidence Brief: Employment, Education, and Continuing Care Outcomes Among Individuals Following COVID-19

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PREFACE

The VA Evidence Synthesis Program (ESP) was established in 2007 to provide timely and accurate syntheses of targeted health care topics of importance to clinicians, managers, and policymakers as they work to improve the health and health care 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 four 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. The Coordinating Center was created to manage program operations, ensure methodological consistency and quality of products, interface with stakeholders, and address urgent evidence needs. 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.

The present report was developed in response to a request from VA Health Services Research & Development. The scope was further developed with input from Operational Partners (below) and the ESP Coordinating Center review team.

ACKNOWLEDGMENTS

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Operational Partners

Operational partners are system-level stakeholders who help ensure relevance of the review topic to the VA, contribute to the development of and approve final project scope and timeframe for completion, provide feedback on the draft report, and provide consultation on strategies for dissemination of the report to the field and relevant groups.

David Atkins, MD, MPH
Director, Health Services Research and Development
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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 (see Appendix D in Supplemental Materials for disposition of comments). 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 works to balance, manage, or mitigate any potential nonfinancial conflicts of interest identified.

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Key Findings

- **Employment:** Return to work and inability to work due to illness 3-24 months following COVID-19 varied widely and were likely associated with disease severity (as assessed by need for hospitalization and/or ICU care), symptom persistence, and time from initial infection. Employment outcomes were worse for those hospitalized in the ICU compared to those non-ICU hospitalized; employment outcomes were best for patients who did not require hospitalization.
- **Education:** Information was insufficient to determine the effect of COVID-19 on post-secondary education.
- **Continuing Care Needs:** Studies focused on discharge disposition for adults hospitalized for COVID-19. Limited data suggested ICU survivors were more likely to be discharged to a skilled nursing facility or equivalent, and less likely to be discharged home, than non-ICU survivors. Results ranged widely, few studies had comparators, and most studies did not report medical reason for hospital admission or health complications during hospitalization, discharge health status or symptoms, or pre-COVID-19 care needs.

Limitations in the evidence and its current applicability include:

- To date, no studies have enrolled a representative sample of all individuals who have had COVID-19;
- No studies evaluated Veteran status or Veterans within the VHA;
- Most studies occurred prior to the Delta and Omicron variants, vaccine availability. or wide population immunity (*ie,* studies enrolled adults who had COVID-19 in 2020 and early 2021);
- Treatments are now available for hospitalized and at-risk non-hospitalized adults;
- Changes have occurred in public health recommendations and in employment and education policies and practices.

Background

The Evidence Synthesis Program Coordinating Center is responding to a request from David Atkins, MD, MPH, Director, VA Health Services Research and Development. Findings from this Evidence Brief will be used to guide future VA health care planning, policy, and research initiatives to improve the health and healthcare delivery for Veterans with a history of COVID-19.

Methods

To identify studies, we searched MEDLINE, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, and other sources up to May 2022. We used prespecified criteria for study selection, data abstraction, and rating internal validity and strength of the evidence. See the Methods section and our PROSPERO protocol for full details of our methodology.

As of October 2022, there have been over 624 million reported cases of COVID-19 worldwide, with over 97 million in the US and over 781,000 among US Veterans. The burden of COVID-19 remains unclear. Post-acute sequelae of SARS-CoV-2 infection (PASC) have been described. As of April 2022, 29% of VA patients who had been hospitalized with acute COVID-19 later received PASC-related care, compared with 11.5% of SARS-CoV-2-positive patients who had not been hospitalized.

This Evidence Brief focused on 3 main outcomes in adults with a history of COVID-19 occurring at least 3 months after infection or at hospital discharge: 1) employment; 2) education, and 3) care needs. Our interest was in long-term outcomes of COVID-19 regardless of whether individuals had persisting symptoms.

EVIDENCE BRIEF

INTRODUCTION

PURPOSE

The Evidence Synthesis Program (ESP) Center is responding to a request from David Atkins, MD, MPH, Director, VA Health Services Research and Development to review the literature on employment, education, and care related outcomes for adults with a history of SARS-CoV-2 infection (COVID-19). Findings from this Evidence Brief will be used to guide future VA health care planning, policy, and research initiatives to improve health and health care delivery for Veterans with a history of COVID-19, especially those having long-term sequelae (*ie,* Long COVID).

BACKGROUND

As of October 2022, there have been over 624 million reported cases of COVID-19 worldwide, with over 97 million in the US and over 781,000 among US Veterans.

The burden of COVID-19 after initial infection remains unclear. Post-acute sequelae of SARS-CoV-2 infection (PASC; also known as Long COVID or Post-COVID-19 condition) have been described.[1-3] The Centers for Disease Control and Prevention (CDC) defines post-COVID conditions as new, returning, or ongoing health problems after an initial infection with SARS-CoV-2, including among individuals who may have been asymptomatic during the acute phase.[4] Symptoms may last for weeks, months, or longer, and can fluctuate over time.[5-7] Prevalence estimates of PASC vary widely, in part due to the variety of populations studied, methods used to acquire data, disease definitions, and outcomes assessed.[6,8] As of April 2022, 29% of VA patients who had been hospitalized with acute COVID-19 later received PASC-related care, compared with 11.5% of SARS-CoV-2-positive patients who had not been hospitalized.[9]

As a result of recovery from acute infection and/or persisting symptoms, some individuals may have difficulty completing daily activities including work or secondary education.[10] As such, as of July 2021, "Long COVID" can be considered a disability under the Americans with Disability Act.[11] Recovery from infection may also result in higher health care needs, including greater dependence on both formal and informal care partners.

On April 5, 2022, the Biden administration directed the Secretary of Health and Human Services to coordinate the first interagency National Research Action Plan on Long COVID.[12] Among the key findings of the initial report issued in August 2022 were:

- Persistent symptoms may affect quality of life, and patients experiencing severe fatigue or cognitive symptoms and impairment (*ie*, brain fog) may have trouble with schooling or employment and may require caregiving from a family member or professional.
- There is a lack of representative data to inform guidelines or policies related to educational outcomes, employment, and long-term disabilities.
- There are ongoing efforts among federal agencies and using national databases to track changes in education and employment over the pandemic period.

This Evidence Brief focused on 3 main outcomes in adults with a history of COVID-19 occurring at least 3 months after infection or at hospital discharge: 1) employment, 2) education, and 3) care needs. Our interest was in long-term outcomes of COVID-19 regardless of whether individuals had persisting symptoms. For this reason, and because of variability in the definition and diagnosis of Long COVID over time, we did not limit eligibility to studies among patients with Long COVID or similar diagnoses.

METHODS

PROTOCOL

A preregistered protocol for this review can be found on the PROSPERO international prospective register of systematic reviews (http://www.crd.york.ac.uk/PROSPERO/; registration number CRD42022337281).

KEY QUESTIONS

The following key questions (KQs) were the focus of this review:

KQ1a: What is the prevalence of adverse employment-related outcomes in adults with a history of COVID-19?

KQ1b: Do employment-related outcomes differ in adults with a history of COVID-19 compared to those with no COVID-19?

KQ2a: What is the prevalence of adverse post-secondary education-related outcomes in adults with a history of COVID-19? Do post-secondary education-related outcomes differ in adults with a history of COVID-19 compared to those with no COVID-19?

KQ2b: Do post-secondary education-related outcomes differ in adults with a history of COVID-19 compared to those with no COVID-19?

KQ3a: What is the prevalence of need for residential long-term care services, rehabilitation services, in-home services, or family caregiver services in adults with a history of COVID-19?

KQ3b: Does need for residential long-term care services, rehabilitation services, in-home services, or family caregiver services differ in adults with a history of COVID-19 compared to those with no COVID-19?

For each Key Question, we also examined whether outcomes varied according to:

1. Demographic characteristics: age, sex, race, marital status
2. Country of origin
3. Residency location: urban versus rural
4. Education: high school, college, trade school, post-college (KQ1 and KQ3 only)
5. Education program enrollment: trade school, 2-year college (private/public), 4-year college (private/public), graduate school. other (KQ2 only)
6. Job classification: professional, labor, farmer, hospitality, travel, healthcare, education, self-employed (KQ1 only)
7. Annual income relative to poverty guidelines[i]

[i] 2021 US Department of Health and Human Services Poverty Guidelines: 1 person: $12,880, 2 persons: $17,420, 4 persons: $26,500.

8. COVID-19 severity: hospitalized (ICU vs non-ICU), hospitalized versus non-hospitalized, symptomatic versus asymptomatic
9. COVID-19 treatments received: monoclonal antibodies, remdesivir, corticosteroids, other
10. Vaccination status: unvaccinated versus vaccinated versus boosted
11. Length of time after index data (*ie,* initial diagnosis, date of hospitalization or hospital discharge): 3 months (12 weeks), >3 to 6 months, >6 months
12. COVID-19 variant: Delta, Omicron, other
13. Comorbidities (pre-COVID-19)
14. Setting where patients were identified/recruited: Long COVID clinic, primary care clinic, community based, hospital, long-term care facility
15. Method of data collection: administrative database, in-person assessment, patient survey (including online survey)

ELIGIBILITY CRITERIA

The ESP included studies that met the following criteria:

***P**opulation:*	Adults ($N \geq 100$) with history of SARS-CoV-2 infection/COVID-19 (hospitalized or community based)
***I**ntervention:*	COVID-19 diagnosis (laboratory confirmed, clinician identified, or self-report); any severity
***C**omparator:*	None required
***O**utcomes:*	• *KQ1:* Days/weeks lost from work, decreased hours worked, % working "part time;" leaving workforce, unemployment, changing jobs, disability impacting ability to work • *KQ2:* Discontinue or delay educational enrollment, time to complete program of study, loss of internship opportunities, post-graduation job opportunities, unemployment post-graduation; post-graduation earnings, income below poverty level • *KQ3:* Receipt of residential long-term care services (*ie,* board and care homes, assisted living facilities, skilled nursing facility/nursing home); rehabilitation services, in-home services, family caregiver services; length of stay
***T**iming:*	• *KQ1 and KQ2*: Reporting outcomes ≥3 months following index event (typically initial diagnosis, hospital discharge, or 'recovery') as reported by study authors • *KQ3*: Any time following acute COVID-19 (*ie*, hospital discharge, discharge from rehabilitation, other follow-up)
***S**etting:*	Any
***S**tudy Design:*	Any

DATA SOURCES AND SEARCHES

With input from a research librarian, we searched Ovid MEDLINE, Ovid PsycINFO, CINAHL, and Embase, as well as ERIC and EconLit through May 26, 2022 (see Appendix A in Supplemental Materials for complete search strategies). We limited the search to indexed articles available in the English language. Additional citations were identified from hand-searching reference lists and consultation with content experts. Study selection was based on the eligibility criteria described above. We utilized the artificial intelligence (AI) function in DistillerSR to expedite the title and abstract review process. Distiller AI served as 1 independent reviewer. All studies deemed eligible at the abstract triage level were reviewed by 2 independent reviewers (*ie*, either 2 investigators or 1 investigator and Distiller AI). All studies deemed ineligible at the abstract triage level were reviewed independently by 1 reviewer (*ie,* either 1 investigator or Distiller AI). Full-text articles were reviewed by 1 investigator and checked by another. All disagreements were resolved by consensus or discussion with a third reviewer.

DATA ABSTRACTION AND ASSESSMENT

Study characteristics and outcomes of interest were abstracted from all included studies, and study authors were queried for missing information when necessary. We rated the internal validity (risk of bias) of each included study using the Newcastle Ottawa Scale[13] for cohort studies and the JBI Checklist for case series.[14] All data abstraction and internal validity ratings were first completed by 1 reviewer and then checked by another; disagreements were resolved by consensus or discussion with a third reviewer.

SYNTHESIS

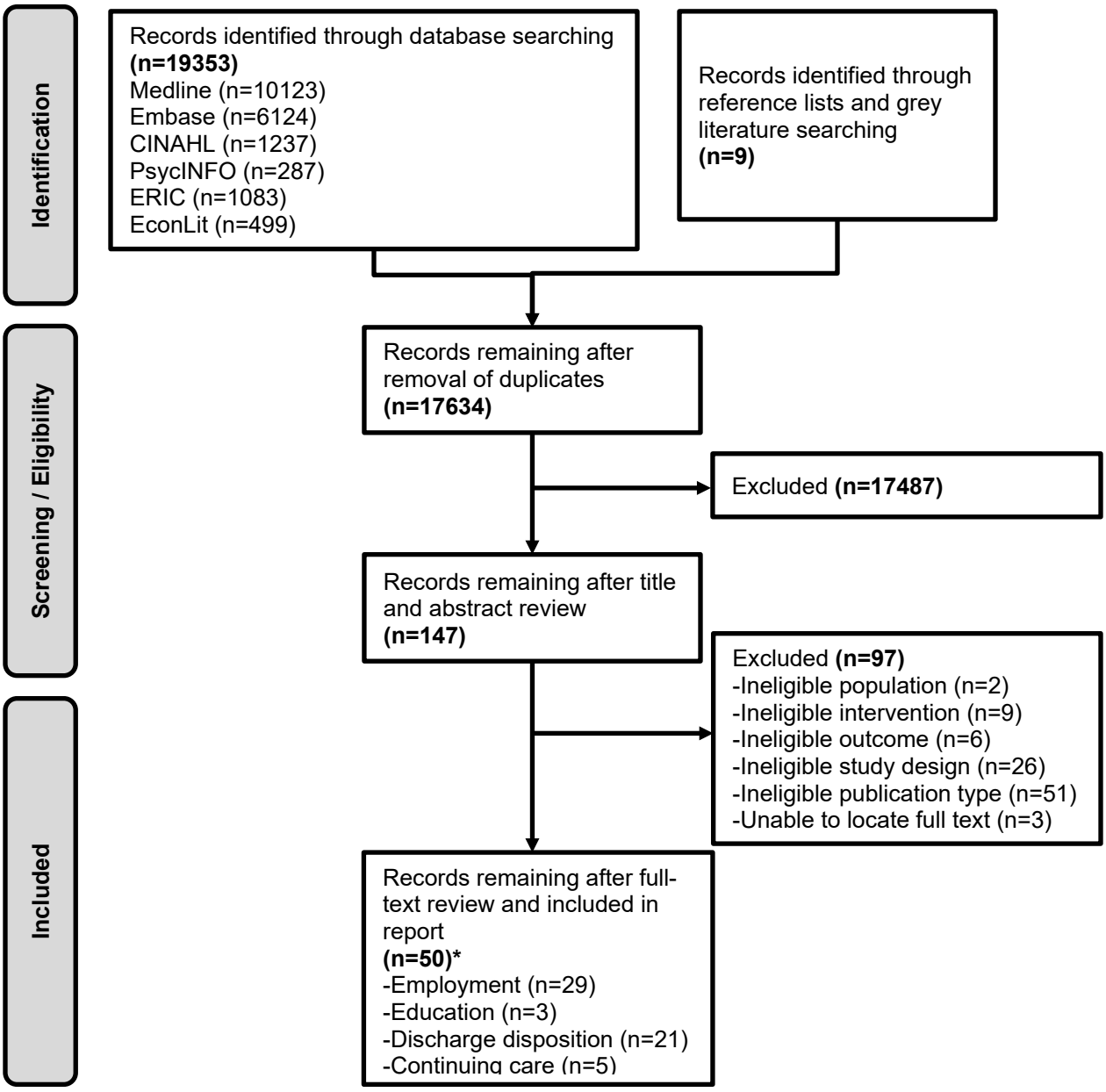
We organized findings by KQ. Several studies provided outcomes relevant to more than 1 KQ. Due to variability of study designs, populations, outcome definitions and measures used, and timing of outcome assessment post-COVID, meta-analysis was not conducted. Findings are narratively summarized.

RESULTS

LITERATURE FLOW

The literature flow diagram (Figure 1) summarizes the results of the study selection process (full list of excluded studies available in Appendix B in Supplemental Materials).

Figure 1. Literature Flowchart



Notes. *Outcome categories are not mutually exclusive.
Abbreviations. CINHAL=Cumulative Index to Nursing and Allied Health Literature database, ERIC=Education Resources Information Center.

LITERATURE OVERVIEW

Our search identified 19,353 potentially relevant articles. Following title and abstract review, 147 articles were eligible for full text review; 50 studies were included. Study characteristics for studies pertaining to KQs 1 and 2 are presented in Supplemental Materials, Appendix C, Table 1. Study characteristics for studies pertaining to KQ 3 are presented in Supplemental Materials, Appendix C, Table 2.

KQ1: EMPLOYMENT

KQ1a: What is the prevalence of adverse employment-related outcomes in adults with a history of COVID-19?

KQ1b: Do employment-related outcomes differ in adults with a history of COVID-19 compared to those with no COVID-19?

Twenty-nine studies reporting employment-related outcomes were eligible for inclusion. Study characteristics are presented in Supplemental Materials Appendix C, Table 1 and outcomes are presented in Supplemental Materials Appendix C, Table 2. Assessments of study quality are reported in Supplemental Materials Appendix C, Tables 5 and 6.

We organized studies based on their potential to provide the most representative estimates of outcomes for the overall population of COVID-19 survivors. We ranked these from most to least representative as follows: 1) general population including both hospitalized and/or non-hospitalized individuals; 2) populations attending post-COVID clinics; and 3) respondents to online or social media surveys. Eighteen studies recruited patients from a general population (*ie,* hospital survivors, public health records, COVID-19 registries).[15-32] Four studies enrolled patients who attended a post-COVID clinic or were identified on a post-hospital follow-up call as having residual symptoms.[33-36] The remaining 7 studies included patients who completed an online survey distributed via social media, news media, or targeted announcements to COVID survivor/Long COVID groups.[37-43]

There were 3 cohort studies providing a comparison of patients with COVID-19 to those without COVID-19[16,28] or a hospitalized influenza group.[22] The remainder were case series with no comparator group. Overall, the cohort studies were of moderate quality, having selected exposed and non-exposed cohorts from the same community and using valid measures of exposure. However, 2 of the 3 studies assessed outcomes via self-report, follow-up durations were short, and response rates were low to moderate.

We did not formally rate quality of the case series. Many of the studies enrolled participants based on self-report of COVID-19. It was often unclear if consecutive cases were enrolled, and many studies reported substantial loss to follow-up. Most outcome assessments were also self-reported with an assortment of study-created questions (often not provided).

Studies of Patients Recruited Broadly from the General Population (Table 1)

Overview of Studies

Of 18 studies of general populations, 4 were from the US,[17,24,27,29] 10 were from Europe or the UK,[15,18-20,22,23,25,28,30,32] and 4 were from Asia/South Pacific.[16,21,26,31] Among the 18 studies were

the 3 cohort studies; the remainder were case series. Enrollments ranged from 113 to 152,880 with 9 enrolling more than 1,000.[16,18,19,21-23,25,28,31] All studies reported age with mean or medians ranging from 42 to 69 years, and all reported sex with the proportion of male participants ranging from 18% to 77%. Race/ethnicity was inconsistently reported. Follow-up time post-acute COVID-19 ranged from 3 months[15,16,32] to 24 months,[31] although follow-up was 6 months or less in all but 4 studies. One study included only non-hospitalized patients[32] and 1 did not report the proportion hospitalized[16]; in the remaining 16 studies, between 4% and 100% were hospitalized. Of the 9 studies enrolling only hospitalized patients, 5 enrolled only patients treated in an intensive care unit (ICU).[15,20,26,27,30] In 8 studies, more than 50% reported persistent symptoms suggesting Long COVID.[15,17,19,23,25,26,31,32] Three studies reported fewer than 50% of enrolled participants reported or had persistent symptoms[24,28,30] and the remainder did not report on symptoms.

Studies of Patients Admitted to ICUs

Studies limited to ICU patients were small, single institution, and lacked a comparator group.

Return to Work if Working Before COVID-19 (Figure 2)

One study from Spain reported that 32% of those patients working pre-COVID-19 infection were working at 3 months follow-up.[15] Two studies, 1 from Sweden and 1 from the US, reported 50% to 59% of patients were working at 5 to 6 months post-hospitalization.[20,27] A study from Italy reported 64% had returned to work at 6 months and 86% had returned to work at 12 months, although this study did not report pre-infection employment status.[30]

Unable to Return to Work Due to Illness (Figure 3)

Two studies reported unable to work due to illness, with 68% unable to work at 3 months in the study from Spain[15] and 11% unable to work at 6 months in a study from Australia.[26] The study from Italy reported that 31%, 29%, and 14% had not returned to work at 3, 6, and 12 months, respectively; the reason for not returning was not reported.[30]

Other Outcomes

One study reported no significant difference in financial distress before and 6 months after COVID-19.[26] A study from the US reported that 80% were employed at the same level as before COVID-19 and the median time to return to work was 6 weeks.[27] A third study reported 2%, 7%, and 0% reporting reduced effectiveness at work at 3, 6, and 12 months, respectively.[30]

Table 1. Employment Outcomes from Studies of Patients Recruited Broadly (*k* = 18)

Author, Year Country Number Enrolled (All with History of COVID-19 Unless Noted) Proportion of Enrolled Hospitalized/Proportion of Enrolled in ICU	Time of Assessment Number Working Pre-COVID	Returned to Work if Working Pre-COVID-19	Unable to Work Due to Illness	Employed Post-COVID-19 (Pre-COVID Employment Unknown)	Unemployed Post-COVID-19 (Reason Not Provided)	Other Outcomes
100% ICU						
Nanwani-Nanwani, 2022[15] Spain N=186 100%/100%	3 months N=101	32% (32/101)	68% (69/101)		Prior to and post COVID-19 4% (7/180)	Prior to and post COVID-19 Retired: 32% (57/180) Housekeeper: 8% (15/180)
Schandl, 2021[20] Sweden N=113 100%/100%	5 months N=46	50% (23/46)[a]				
Hodgson, 2021[26] Australia N=115 100%/100%	6 months N=unclear		11% (13/114) Note: unclear if all patients were working pre-COVID			Financial distress[b] Baseline: 1 (IQR 1-4) 6 months: 1 (IQR 1-5) Median difference = 0.00, 95% CI [-1.07, 1.07], *p*=.999

Author, Year **Country** **Number Enrolled (All with History of COVID-19 Unless Noted)** **Proportion of Enrolled Hospitalized/Proportion of Enrolled in ICU**	**Time of Assessment** **Number Working Pre-COVID**	**Returned to Work if Working Pre-COVID-19**	**Unable to Work Due to Illness**	**Employed Post-COVID-19 (Pre-COVID Employment Unknown)**	**Unemployed Post-COVID-19 (Reason Not Provided)**	**Other Outcomes**
Neville, 2022[27] USA N=132 100%/100%	6 months N=68 (Respondents working before becoming ill)	59% (40/68)				Employed at prior level: 80% (32/40) Time before returning to work (median, weeks): 6 (IQR 3.5, 13.0)
Latronico, 2022[30] Italy N=114 100%/100%	3, 6, and 12 months N=unclear			Full employment 3 mo: 64% (63/98) 6 mo: 64% (49/77) 12 mo: 86% (44/51)	No return to work 3 mo: 31% (30/98) 6 mo: 29% (22/77) 12 mo: 14% (7/51)	Reduced effectiveness at work 3 mo: 2% (2/98) 6 mo: 7% (5/77) 12 mo: 0% (0/51)
0.3% to 29% ICU						
Ghosn, 2021[25] France N=1137 100%/29%	6 months N=429	71% (304/429)			29% (125/429)	
Frontera, 2021[24] USA N=382	6 months N=154	Total: 53% (81/154)				

Author, Year **Country** **Number Enrolled (All with History of COVID-19 Unless Noted)** **Proportion of Enrolled Hospitalized/Proportion of Enrolled in ICU**	**Time of Assessment** **Number Working Pre-COVID**	**Returned to Work if Working Pre-COVID-19**	**Unable to Work Due to Illness**	**Employed Post-COVID-19 (Pre-COVID Employment Unknown)**	**Unemployed Post-COVID-19 (Reason Not Provided)**	**Other Outcomes**
100%/25% Neurological Complications Group; 29% Control Group		Neurological complications group: 41% (30/74) Control group: 64% (51/80) *p*=.004				
Evans, 2021[23] UK N=1077 100%/27%	6 months N=641		Total: 18% (113/641) WHO class 3-4[c]: 15/133 (11%) WHO class 5: 24/203 (12%) WHO class 6: 20/109 (18%) WHO class 7-9: 54/196 (28%)			Occupation change due to health after COVID Total: 19% (124/641) WHO class 3-4[c]: 19/133 (14%) WHO class 5: 19/203 (9%) WHO class 6: 18/109 (17%) WHO class 7-9: 68/196 (35%)
Jacobson, 2021[17] USA N=118 (22 hospitalized, 96 not hospitalized) 19%/9%	4 months N=NR			Total: 68% (80/117) Hospitalized: 73% (16/22) Non-hospitalized: 67% (64/95)		Missed work due to health Total: 12% (9/78) Hospitalized: 13% (2/15) Non-hospitalized: 11% (7/63)

Author, Year **Country** **Number Enrolled (All with History of COVID-19 Unless Noted)** **Proportion of Enrolled Hospitalized/Proportion of Enrolled in ICU**	**Time of Assessment** **Number Working Pre-COVID**	**Returned to Work if Working Pre-COVID-19**	**Unable to Work Due to Illness**	**Employed Post-COVID-19 (Pre-COVID Employment Unknown)**	**Unemployed Post-COVID-19 (Reason Not Provided)**	**Other Outcomes**
						Any work impairment due to health[d] Total: 39% (28/72) Hospitalized: 58% (7/12) Non-Hospitalized: 35% (21/60)
Huang, 2022[31] China N=1192 100%/4%	12 and 24 months N=494 with FT or PT job pre-COVID; (unclear why 12 month follow-up for N=455)	Returned to original work 12 mo: 88% (401/455) 24 mo: 89% (438/494)	Due to decreased physical function 12 mo: 4% (18/455) 24 mo: 4% (21/494)		12 mo: 3% (12/455) 24 mo: 3% (14/494)	Not returned to pre-COVID level of work 12 mo: 24% (95/401) 24mo: 13% (55/438) Unwilling to return to original work 12 mo: 2% (10/455) 24 mo: 2% (10/494) Other reasons for not returning to work 12 mo: 3% (14/455) 24 mo: 2% (11/494)
Peters, 2022[19] Germany N=2053 (1930 with complete responses)	5 months N=2053		5% (107/2053)			Work Ability Index[e] (mean (SD)) *Patients with no symptoms at follow-up* Before COVID: 9.3 (1.3) Post-COVID: 8.9 (1.7)

Author, Year Country Number Enrolled (All with History of COVID-19 Unless Noted) Proportion of Enrolled Hospitalized/Proportion of Enrolled in ICU	Time of Assessment Number Working Pre-COVID	Returned to Work if Working Pre-COVID-19	Unable to Work Due to Illness	Employed Post-COVID-19 (Pre-COVID Employment Unknown)	Unemployed Post-COVID-19 (Reason Not Provided)	Other Outcomes
Patients with no symptoms at follow-up: 3%/0.4% Patients with symptoms: 9%/2.3%						*Patients with symptoms* Before COVID: 9.3 (1.2) Post-COVID: 6.8 (2.2) *p*<.001 vs patients with no symptoms
Jacobsen, 2021[22] Denmark N=7466 (ages 18-64 and available to the workforce); 876 hospitalized; 6590 non-hospitalized N=466 hospitalized for influenza 12%/0.3%	6 months N=876* (hospitalized) N=6590* (non-hospitalized) *Includes working, receiving benefits classified as work, and available to work	Returned to work within 4 weeks of positive test COVID (total group): 82% (6119/7466) COVID (hospitalized): 72% (627/870) Influenza (hospitalized): 92% (377/466) Returned to work at 6 months COVID (total): 98% (7344/7466)	Receiving sick leave benefits at 6 months COVID (total): 1.5% (109/7466) COVID (hospitalized): 7% (58/876) Influenza (hospitalized): 3% (11/416) COVID (non-hospitalized): 1% (51/6590)			Died, emigrated, or early retirement COVID (total): 0.2% (13/7466) COVID (hospitalized): 1% (9/876) COVID (non-hospitalized): 0.1% (4/6590) Relative risk for return to work within 3 months COVID hospitalized vs non-hospitalized RR=0.95, 95% CI [0.94, 0.96]

Author, Year **Country** **Number Enrolled (All with History of COVID-19 Unless Noted)** **Proportion of Enrolled Hospitalized/Proportion of Enrolled in ICU**	**Time of Assessment** **Number Working Pre-COVID**	**Returned to Work if Working Pre-COVID-19**	**Unable to Work Due to Illness**	**Employed Post-COVID-19 (Pre-COVID Employment Unknown)**	**Unemployed Post-COVID-19 (Reason Not Provided)**	**Other Outcomes**
		COVID - hospitalized 92% (809/876) Influenza – hospitalized 97% (402/416) COVID - non-hospitalized 99% (6535/6590)				COVID hospitalized vs influenza hospitalized RR=0.94, 95% CI [0.92, 0.96]
% ICU Not Reported						
Millet, 2022[29] USA N=170 52%/NR	12 months N=NR				Lost job within 1 year following COVID diagnosis Total: 32% (54/168) African American: 36% (16/44) Hispanic: 39% (31/79) Asian: 21% (3/14) Caucasian: 13% (4/31)	Experiencing financial distress due to COVID illness 1 year following diagnosis Total: 32% (55/170) African American: 37% (17/46) Hispanic: 39% (31/79) Asian: 21% (3/14) Caucasian: 13% (4/31)

Author, Year Country Number Enrolled (All with History of COVID-19 Unless Noted) Proportion of Enrolled Hospitalized/Proportion of Enrolled in ICU	Time of Assessment Number Working Pre-COVID	Returned to Work if Working Pre-COVID-19	Unable to Work Due to Illness	Employed Post-COVID-19 (Pre-COVID Employment Unknown)	Unemployed Post-COVID-19 (Reason Not Provided)	Other Outcomes
					OR for African American vs Caucasian = 4.47, 95% CI [1.27, 15.75]; *p*=.02 OR for Hispanic vs Caucasian = 4.46, 95% CI [1.39, 14.31]; *p*=.01 Asian vs Caucasian *p*=.42	
Hawlader, 2021[21] Bangladesh N=3244 26%/NR	6 months N=NR			53% (1714/3244)	4% (122/3244)	Other (no details provided) 43% (1408/3244)

Author, Year Country Number Enrolled (All with History of COVID-19 Unless Noted) Proportion of Enrolled Hospitalized/Proportion of Enrolled in ICU	Time of Assessment Number Working Pre-COVID	Returned to Work if Working Pre-COVID-19	Unable to Work Due to Illness	Employed Post-COVID-19 (Pre-COVID Employment Unknown)	Unemployed Post-COVID-19 (Reason Not Provided)	Other Outcomes
Westerlind, 2021[18] Sweden N=11,955 (2960 hospitalized, 8996 not hospitalized) 25%/NR	4 months N=11,748 (98%)* Cohort included only those receiving sick leave benefits					Sick leave due to COVID-19 At least 12 weeks: 13% (1592/11,955) Median duration: 35 days (Note: Data reported only for 11,955 enrolled)
Non-hospitalized or Hospitalized/ICU Not Reported						
Sørensen, 2022[28] Denmark N=152,880 (61,002 COVID positive, 91,878 COVID negative) 4%/NR	9 months N=NR			Full time COVID positive: 55% (33,516/61,002) COVID negative: 52% (47,717/91,878) Part time COVID positive: 9% (5457/61,002) COVID negative: 11% (9,956/91,878)	Unemployed or seeking job COVID positive: 1.5% (939/61,002) COVID negative: 1.3% (1,205/91,878)	Long term sick leave COVID positive: 0.7% (446/61,002) COVID negative 0.9% (791/91,878) Any sick leave between 4 weeks post-diagnosis and 9 month assessment COVID positive: 12.0% COVID negative: 7.7% Risk difference = 4.32%, 95% CI [4.00, 4.64]

Author, Year **Country** **Number Enrolled (All with History of COVID-19 Unless Noted)** **Proportion of Enrolled Hospitalized/Proportion of Enrolled in ICU**	**Time of Assessment** **Number Working Pre-COVID**	**Returned to Work if Working Pre-COVID-19**	**Unable to Work Due to Illness**	**Employed Post-COVID-19 (Pre-COVID Employment Unknown)**	**Unemployed Post-COVID-19 (Reason Not Provided)**	**Other Outcomes**
Lemhofer, 2021[32] Germany N=365 0%	3 months N=291 (age 18–64 years)		2% (7/291) (Classified by physicians as unfit for work)	88% (255/291)	7% (21/291) Unemployed or receiving pension payments	2% (5/291) Seeking a job
Nagata, 2022[16] Japan N=19,800 (154 self-report COVID NR	3 months N=19,800 (154 diagnosed with COVID-19; 19,646 not infected)				Unemployed for any reason COVID: 12% (19/154) No COVID: 4% (700/19,646) OR=3.79, 95% CI [2.28, 6.28]; *p*<.001	Unemployed because of 'negative reasons'* COVID: 5% (8/154) No COVID: 2% (443/19,646) OR=2.40, 95%CI [1.15, 5.01]; *p*=.02 *defined as "forced into an environment where they had to be" unemployed

Notes. All studies pre-January 2021 except Nanwani-Nanwani, Sørensen. Studies arranged by 1) % of total enrolled in ICU and 2) time of assessment.
[a] No significant difference in % returning to work between those receiving high-flow nasal oxygen or noninvasive ventilation and those receiving invasive ventilation; [b] Scale of 1 to 10 with 1 being lowest level of financial distress; [c] WHO Class 3-4=no continuous supplemental O_2 needed; Class 5=continuous supplemental O_2 only; Class 6=continuous positive airway pressure ventilation, bi-level positive airway pressure, or high-flow nasal oxygen; Class 7-9=invasive mechanical ventilation or extracorporeal membrane oxygenation; [d] Any response >0 on the Work Productivity and Impairment (WPAI) scale; [e] Work Ability Index (subjective rating of work capacity; 0=very poor, 10=very good).
Abbreviations. FT=full time; IQR=interquartile range; NR=not reported; PT=part time.

Figure 2. Return to Work if Working Before COVID-19 – Studies of Patients Recruited Broadly

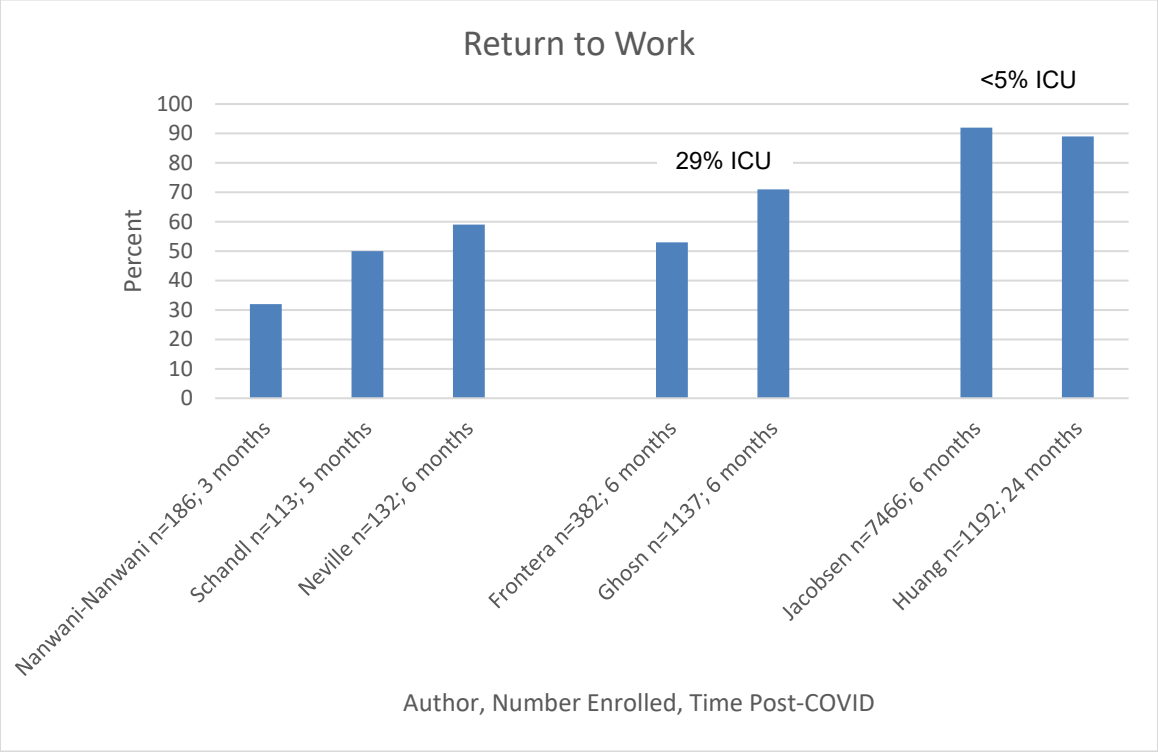
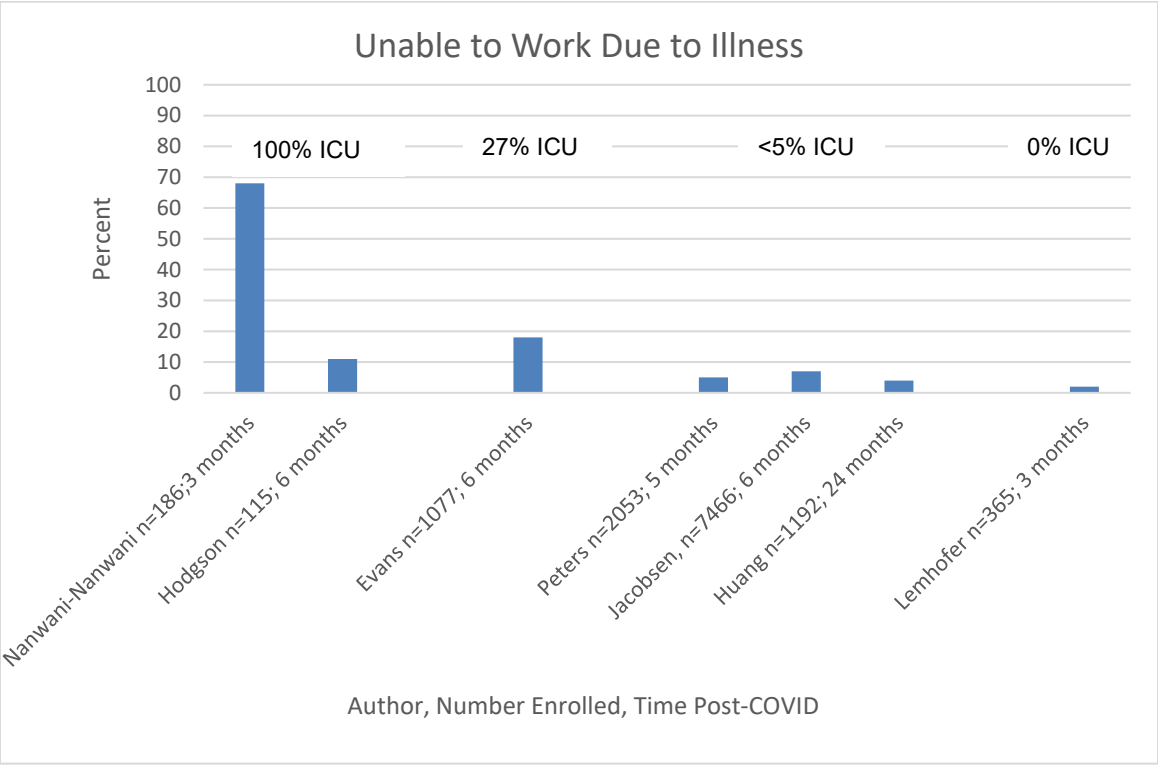


Figure 3. Unable to Work Due to Illness – Studies of Patients Recruited Broadly



Studies of Patients Hospitalized with ICU Status <100% or Not Reported

Return to Work if Working Before COVID-19 (Figure 2)

Studies limited to hospitalized patients (ICU status <100% or not reported), reported 53% to 92% of patients returning to work at 6 months.[22,24,25] One study reported 88% had returned to work at 12 months and 89% at 24 months.[31] In a study that included a comparator group of patients hospitalized with influenza, 92% of patients hospitalized with COVID-19 had returned to work at 6 months compared to 97% hospitalized with influenza.[22] In a second comparator group of patients with COVID-19 but not hospitalized, 99% had returned to work at 6 months. Another study included COVID-19 hospitalized patients who developed neurological complications and patients who did not develop neurological complications.[24] Forty-one percent of the group with neurological complications and 64% of the group without complications returned to work at 6 months.

Unable to Return to Work Due to Illness (Figure 3)

In 4 studies reporting, 5% to 18% were unable to return to work due to illness at 6 to 12 months.[19,22,23,31] In the study with the hospitalized for influenza comparator group, 7% of the COVID-19 patients and 3% of the influenza patients were unable to work.[22] In another of the studies, 27% were admitted to the ICU.[23] Overall, 18% were unable to return to work due to illness at 6 months and the proportions ranged from 11% in those with the least severe illness during hospitalization to 28% in those with the most severe illness.

Other Outcomes

A study from the UK (27% admitted to the ICU) reported that 19% changed occupations due to their health after COVID-19 including 35% of those with the most severe illness during hospitalization.[23] The study from China reported that 24% and 13% had not returned to their pre-COVID level of work at 12 and 24 months, respectively.[31] Another study reported scores for the Work Ability Index, a rating of work capacity with 0 indicating very poor and 10 indicating very good.[19] Scores at follow up were significantly lower ($p < .001$) for patients with persistent symptoms compared to patients without symptoms. One study of 170 patients from a university medical center in New Jersey reported outcomes by race/ethnicity.[29] Thirty-two percent had lost their job (reason for job loss not reported) in the year following their COVID diagnosis with job loss varying by race/ethnicity (job loss was report by 36% of African Americans, 39% of Hispanics, 21% of Asians, and 13% of Caucasians enrolled in the study). The differences were significant for African Americans versus Caucasians ($p = .02$) and Hispanics versus Caucasians ($p = .01$). A similar pattern was observed for the outcome of 'experiencing financial distress due to COVID illness 1 year following diagnosis' with 32% overall reporting financial distress (37% of African Americans, 39% of Hispanics, 21% of Asians, and 13% of Caucasians).

Studies of Non-hospitalized Patients

Return to Work if Working Before COVID-19

As noted above, among the non-hospitalized patients in 1 study, 99% had returned to work at 6 months.[22] Two studies reported employment post-COVID but did not provide pre-COVID work status.[28,32] One enrolled predominantly outpatients and included a comparator group of patients who tested negative for COVID-19. In that study, 64% of COVID-19 positive and 63% of

COVID-19 negative patients were employed full-time or part-time at 9 months.[28] The other study reported that 88% were working post-COVID.[32]

Unable to Return to Work Due to Illness

One reported that 2% of patients were unable to return to work at 3 months (Figure 3).[32] In the study cited above with a non-hospitalized comparator group, 1% were unable to work at 6 months.[22]

Other Outcomes

One study reported any use of sick leave between 4 weeks post-diagnosis and the 9 month assessment.[28] Among COVID-19 positive patients, 12% had used sick leave compared to 8% of COVID-19 negative patients. The risk difference was statistically significant. A study from Japan reported that 5% of COVID patients and 2% without COVID were unemployed for negative reasons defined as "forced into an environment where they had to be" unemployed.[16]

Studies of Patients Recruited from Post-COVID Clinics or with Residual Symptoms (Table 2)

Four studies reported outcomes for patients who attended post-COVID clinics[33-35] or who all reported residual symptoms during a follow-up call.[36] These patients would meet current diagnostic criteria for "Long COVID," with the majority reporting persistent symptoms at follow-ups ranging from 3 months[33] to 12 months.[35] Two were from the US[33,35] and 2 were from Europe or the UK.[34,36] All were case series with enrollments ranging from 100 to 1,325; only 1 enrolled more than 200.[34] Age (mean or median) ranged from 44 to 57 years and between 31% and 61% were male. Between 11%[35] and 100%[36] were hospitalized.

Return to work if employed prior to COVID-19 was reported by all 4 studies (Figure 4). Two of the studies enrolled predominantly non-hospitalized patients and reported that 69% had returned to work at 3 months[33] and 54% at 11 months.[35] One study reported outcomes overall and separately for hospitalized and non-hospitalized patients.[34] Overall, 43% had returned to full time work and 29% to part time work by 6 months. Among non-hospitalized patients, 76% had returned to full- or part-time work by 3 to 6 months post-acute COVID, 75% had returned to work by 6 to 9 months, and 76% had returned to work by 9 to 12 months. Among hospitalized patients, 64% had returned to full- or part-time work by 3 to 6 months. No other time period was reported for the hospitalized patients. In the study of exclusively hospitalized patients, 71% had returned to work at 4 months.[36]

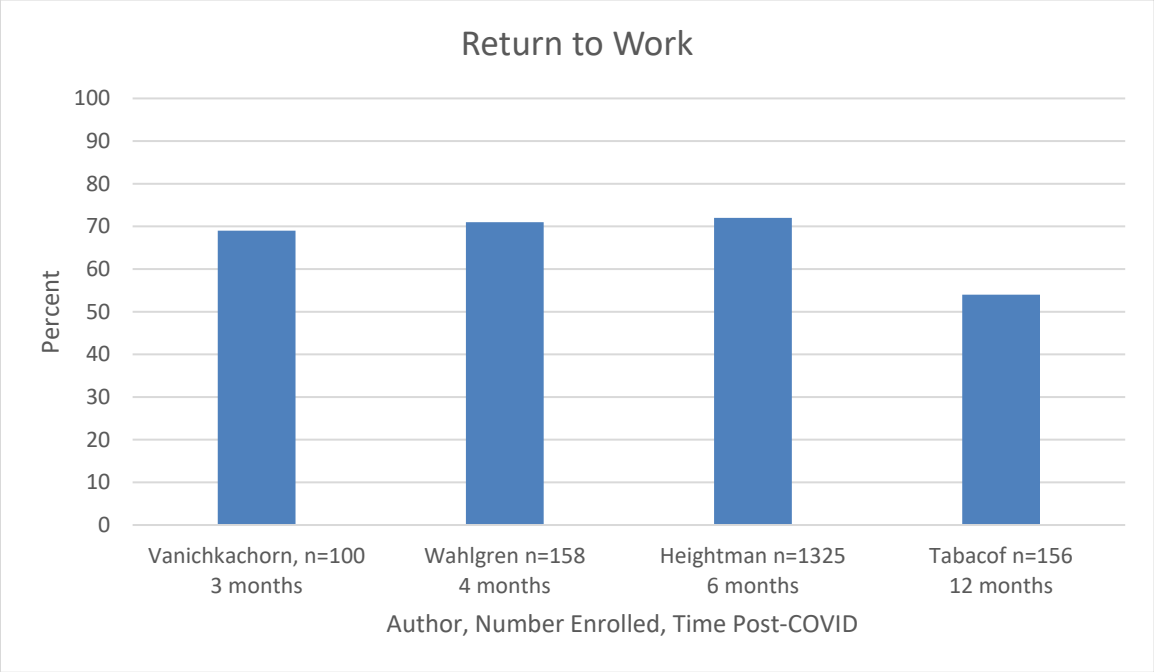
Table 2: Employment Outcomes from Studies of Patients Attending Post-COVID Clinics or All Reporting Residual Symptoms (*k* = 4)

Author, Year Country Number Enrolled (All with History of COVID-19 Unless Noted) Percent Hospitalized	Time of Assessment Number Working Pre-COVID	Returned to Work if Working Pre-COVID-19	Unable to Work Due to Illness	Employed Post-COVID-19 (Pre-COVID Employment Unknown)	Unemployed Post-COVID-19 (Reason Not Provided)	Other Outcomes
Vanichkachorn, 2021[33] USA N=100 25%	3 months N=91	69% (63/91)				46% (29/63) Unrestricted work duty
Wahlgren, 2021[36] Sweden N=158 100%	4 months N=90	71% (64/90)	27/155 (17%) including 21/90 (23%) employed pre-COVID		10/155 (7%) including 3/90 (3%) employed pre-COVID	Pensioner (post-COVID): 54/155 (35%) including 2/90 (2%) employed pre-COVID
Heightman, 2021[34] UK N=1325 (547 hospitalized, 566 non-hospitalized) 41%	6 months Hospitalized: N=95 at 3-6 months Non-hospitalized N=167 at 3-6 months*	Total (3–6 months)* FT: 43% (112/262) PT: 29% (75/262) Hospitalized (3–6 months)* FT: 44% (42/95) PT: 20% (19/95) Non-Hospitalized			Total (3–6 months)* 29% (75/262) Hospitalized (3–6 months)* 36% (34/95) Non-hospitalized 3-6 months* 25% (41/167)	

Author, Year Country **Number Enrolled (All with History of COVID-19 Unless Noted)** **Percent Hospitalized**	**Time of Assessment** **Number Working Pre-COVID**	**Returned to Work if Working Pre-COVID-19**	**Unable to Work Due to Illness**	**Employed Post-COVID-19 (Pre-COVID Employment Unknown)**	**Unemployed Post-COVID-19 (Reason Not Provided)**	**Other Outcomes**
*Time is time of *first assessment* (not serial assessments)	N=118 at 6-9 months* N=124 at 9-12 months*	3-6 months* FT: 42% (70/167) PT: 34% (56/167) 6-9 months* FT: 46% (54/118) PT: 29% (34/118) 9-12 months* FT: 40% (49/124) PT: 30% (37/124)			6-9 months* 25% (30/118) 9-12 months* 31% (38/124)	
Tabacof, 2022[35] USA N=156 11%	12 months N=102 full time	Returned to full time work: 54% (55/102)	Pre-COVID: 1% Post-COVID: 19% (estimated from bar graph)	Part time work Pre-COVID: 7% Post-COVID: 14% (estimated from bar graph)	Pre-COVID: 4% Post-COVID: 11% (estimated from bar graph)	Retired or medically retired Pre-COVID: 5% Post-COVID: 8%

Notes. All studies pre-January 2021 except Heightman, Tabacof.
Abbreviations. FT=full time; PT=part time.

Figure 4. Return to Work if Working Before COVID-19 – Patients from Post-COVID Clinics or with Residual Symptoms



Two studies reported the percentage unable to return to work due to illness. In the study of non-hospitalized patients, 19% were unable to work due to illness post-COVID compared to 1% pre-COVID.[35] The study of hospitalized patients reported that 23% of patients employed pre-COVID were unable to work post-COVID due to illness.[36] Three studies reported the percentage unemployed (reason not provided).[34-36]

Other employment-related outcomes included a study of predominantly non-hospitalized patients reporting that only 46% were able to return to unrestricted work duty at 3 months follow-up.[33] The other study of predominantly non-hospitalized patients reported that 8% were retired or medically retired post-COVID compared to 5% pre-COVID.[35] The study of hospitalized patients reported that 35% were retired post-COVID though only 2% of those who had been working pre-COVID.[36]

Studies of Patients Recruited via Social Media and/or Other Online Groups (Table 3)

Seven studies recruited participants via social or new media or targeted announcements to COVID-19 and Long COVID groups. These studies may provide less valid estimates of outcomes for the general population, as those who respond to recruitment announcements are more likely to be those who have had lingering difficulties post-COVID. The 7 social media studies were conducted in the UK or Europe,[39-41,43] southeast Asia,[38] or multiple countries.[37,42] All were case series, enrolling only those with a history of COVID-19. Enrollment ranged from 100[43] to 3,762[37] with 3 enrolling more than 1,000. Five studies reported mean or median age (range 40 to 48 years); another reported that 80% were between the ages of 30 and 59 years.[37] Between 8% and 41% were male (reported in 6 studies). Fewer than 30% were hospitalized in each of the studies. Follow-up ranged from 4 to 11 months.

Four of the studies reported return to work among those working pre-COVID-19 (Figure 5).[37-40] Overall, 50% to 74% had returned to work at 4 to 6 months post-COVID. Three studies, all with over 90% reporting persisting symptoms, provided more detail. One study reported that 27% of those with persisting symptoms ("unrecovered") were working as many hours as pre-COVID compared to 49% of those without ("recovered") when assessed at 4 months post-COVID.[37] Forty-six percent of the unrecovered group and 39% of the recovered group were working reduced hours. Another study reported that 24% were fully returned to work at 6 months with an additional 26% partially returned.[39] The third study, a report from the Trades Union Congress (TUC) reported that 57% were working normal hours and 16% were working reduced hours.[40] This report was the only paper that reported unable to work due to illness, with 20% on paid sick leave and 3% on unpaid sick leave. Two studies reported the percentage unemployed (reason not provided) including 8% of the recovered patients and 23% of the unrecovered patients in 1 study[37] and 49% overall in the second study.[39]

Table 3. Employment Outcomes from Studies of Patients Identified via Social Media (*k* = 7)

Author, Year Country Number Enrolled (All with History of COVID-19 Unless Noted) Percent Hospitalized	Time of Assessment Number Working Pre-COVID	Returned to Work if Working Pre-COVID-19	Unable to Work Due to Illness	Employed Post-COVID-19 (Pre-COVID Employment Unknown)	Unemployed Post-COVID-19 (Reason Not Provided)	Other Outcomes
Davis, 2021[37] Multi N=3,762 (3505 unrecovered; 257 recovered*) 8% *Recovered defined as no symptoms at time of survey	4 months N=NR (outcomes reported only for those working before COVID-19)	Working as many hours as pre-COVID Recovered*: 49% Unrecovered: 27% Working reduced hours Recovered*: 39% (estimated from figure) Unrecovered: 46%			Recovered*: 8% (estimated from figure) Unrecovered: 23% (includes sick leave, disability leave, fired, quit, unable to find job that would accommodate them)	
Moy, 2022[38] Malaysia N=732 26%	4 months N=550	65% (356/550)				Affected work performance: 35% (194/550) Actions taken Reduced work hours: 73% (142/194) Took leave from work: 24% (46/194) Quit: 3% (6/194)
Lunt, 2022[39] UK	6 months	Fully: 24% (21/88) Partially: 26% (23/88)			Not returned to work or not	Workability (mean) Physical: 3.8 Psychological: 3.6

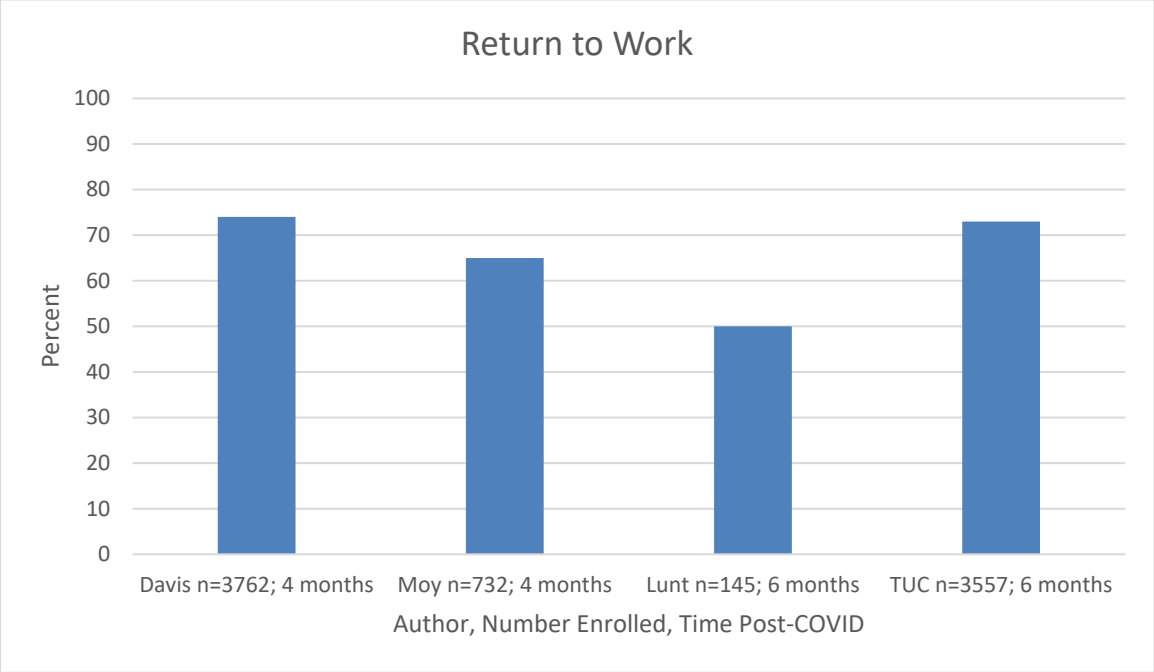
Author, Year Country Number Enrolled (All with History of COVID-19 Unless Noted) Percent Hospitalized	Time of Assessment Number Working Pre-COVID	Returned to Work if Working Pre-COVID-19	Unable to Work Due to Illness	Employed Post-COVID-19 (Pre-COVID Employment Unknown)	Unemployed Post-COVID-19 (Reason Not Provided)	Other Outcomes
N=145 12%	N=145 (88 completed work questions on survey)	(1 participant did not stop working)			anticipated: 49% (43/88)	(1=very good, 5=poor)
TUC Report, 2021[40] UK N=3,557 NR	6 months N=3,557	Normal hours: 57% Reduced hours: 16%	Paid sick leave: 20% Unpaid sick leave: 3%			Job loss, redundancy, retirement: 5%

Author, Year Country Number Enrolled (All with History of COVID-19 Unless Noted) Percent Hospitalized	Time of Assessment Number Working Pre-COVID	Returned to Work if Working Pre-COVID-19	Unable to Work Due to Illness	Employed Post-COVID-19 (Pre-COVID Employment Unknown)	Unemployed Post-COVID-19 (Reason Not Provided)	Other Outcomes
Vaes, 2021[41] The Netherlands N=1005 26%	6 months N=210 (88%)					Percentage of work time missed in previous week due to ill health 3 months: 73% 6 months: 52% Percentage of impairment while working 3 months: 66% 6 months: 60% Work productivity loss 3 months: 89% 6 months: 79%

Author, Year Country Number Enrolled (All with History of COVID-19 Unless Noted) Percent Hospitalized	Time of Assessment Number Working Pre-COVID	Returned to Work if Working Pre-COVID-19	Unable to Work Due to Illness	Employed Post-COVID-19 (Pre-COVID Employment Unknown)	Unemployed Post-COVID-19 (Reason Not Provided)	Other Outcomes
Faghy, 2022[42] Multi N=381 2%	7 months N=314					COVID Symptom affecting work *Moderate work activities* Not at all: 17% Some of the time: 35% A lot of the time: 48% *Vigorous work activities* Not at all: 20% Some of the time: 25% A lot of the time: 54% *Diligence of task completion* No: 22% Sometimes: 19% Yes: 60%
Norrefalk, 2021[43] Sweden N=100 "Few" hospitalized	11 months N=100			56% (56/100)		

Notes. Pre-January 2021 studies include Davis, Vaes; post-January 2021 studies include Lunt, Moy, TUC Report; pre- and post-January 2021 study: Faghy; Unclear time period: Norrefalk.

Figure 5. Return to Work (Full or Part) if Working Before COVID-19 – Studies of Patients Recruited via Social Media



Several of the studies reported on the effect of COVID-19 on work performance. A study from Malaysia, with 21% experiencing lingering symptoms at 4 months, reported that work performance was affected in 35%.[38] Actions taken included reducing work hours (73%), taking leave from work (24%), and quitting work (3%). Another study, with a high percentage experiencing symptoms at the time of assessment, reported how COVID symptoms affected work.[42] For moderate work activities, COVID symptoms affected work not at all (17%), some of the time (35%), or a lot of the time (48%). For vigorous work activities, symptoms affected work not at all (20%), some of the time (25%), or a lot of the time (54%). Sixty percent reported that COVID symptoms affected "diligence of task completion," with an additional 19% reporting "sometimes" affected. A third study, also with a high percentage reporting ongoing symptoms, reported impairment while working as 66% at 3 months and 60% at 6 months.[41] Work productivity loss was rated as 89% at 3 months and 79% at 6 months. In another study with a high percentage experiencing symptoms, mean workability (rated on a 5 point scale with 1 being very good and 5 being poor) was 3.8 for physical workability and 3.6 for psychological workability at 6 months post-COVID.[39]

KQ2: EDUCATION

***KQ2a:* What is the prevalence of adverse post-secondary education-related outcomes in adults with a history of COVID-19?**

***KQ2b:* Do post-secondary education-related outcomes differ in adults with a history of COVID-19 compared to those with no COVID-19?**

Three studies, 2 from Europe[28,43] and 1 from the US,[35] reported on post-secondary education student status. All 3 studies also reported employment-related outcomes and 'student' or

'studying' was given in response to a question about employment status. Reported values ranged from 4% to 10%, but without pre-COVID student status there is insufficient information to determine whether student status changed as a result of illness with COVID-19.

KQ3: CONTINUING CARE SERVICES

KQ3a. What is the prevalence of need for residential long-term care services, rehabilitation services, in-home services, or family caregiver services in adults with a history of COVID-19?

KQ3b. Does need for residential long-term care services, rehabilitation services, in-home services, or family caregiver services differ in adults with a history of COVID-19 compared to those with no COVID-19?

Twenty-four studies reporting long-term care, rehabilitation, in-home care, or caregiver services related outcomes were eligible for inclusion. Detailed study characteristics are presented in Supplemental Materials, Appendix C, Table 2 and outcomes are presented in Supplemental Materials, Appendix C, Table 4. Study quality ratings are reported in Supplemental Materials, Appendix C, Tables 5 and 6. Twenty-one studies were classified as case series, with most (15 out of 21) lacking a statistical comparison of outcomes. Three studies were rated as cohort studies of moderate quality. Two studies (a cohort and a case series) directly compared discharge disposition following hospitalization for COVID-19 to a matched group of patients hospitalized for conditions other than COVID-19.[44,45]

We organized studies based on ICU and hospitalization status, as these factors are strong independent predictors of continuing care needs. Two studies reported only on patients who were hospitalized in the ICU,[27,46] and 1 study reported on patients transferred from the hospital to a Long-Term Acute Care Hospital (LTACH).[47] Ten studies reported a range of ICU admissions within their respective pool of enrolled participants from 15% to 42%.[48-57] Seven studies were conducted in hospitalized patients and did not report the proportion of patients who were admitted to the ICU.[44,45,58-62] One study reported on a combination of hospitalized and non-hospitalized patients.[63]

Nineteen studies were conducted in the United States, 1 multi-nationally, and 1 each in Sweden, China, Australia, and the Netherlands. Most studies reported data from ≤5 hospitals, with 7 studies using data from ≥30 hospitals (range 30 to >1000).[26,44,50,53,59,62,63] The enrollment periods were generally during 2020, with 2 studies extending into the first quarter of 2021.[56,63] Three studies reported prior living residence including home or community living (*ie*, before hospitalization).[46,53,56] Little information was provided on the medical reason for hospital admission, health complications during hospitalization, time from infection to discharge, or symptoms at discharge. Studies rarely reported pre-hospitalization care needs or residential status. The majority of information is based on case series of hospitalized patients and their disposition at hospital discharge rather than longer-term use of care services or in hospitalized and non-hospitalized adults.

Discharge Disposition

Overview of Studies

Fourteen studies described discharge disposition descriptively with the following discharge disposition types: home (including assisted living) with or without home health services (range 21% to 93%), SNF/sub-acute (range 3% to 62%), acute or inpatient rehabilitation (range 0% to 14%), long-term acute care hospital (range 0% to 12%), nursing home (3%) and other (range 2% to 8%) (Table 5).[27,46,48-51,53-59] Examples of discharge dispositions indicated in the "Other" category include hospice, placement issues, discharged or left against medical advice. Table 5 contains study characteristics and discharge disposition results. Discharge to home is depicted in Figure 6.

100% ICU Admission

Three studies reported discharge disposition on patients who were all hospitalized in the ICU.[27,46,47] Neville et al collected data via a survey sent to ICU survivors at least 3 months post hospital discharge. By 3 months, 93% of respondents reported currently living at home. It is unclear whether participants were discharged directly from the hospital. Alser et al reports about one-third of patients discharging from the hospital to home, with a majority (62%) discharging to sub-acute rehabilitation or a SNF. Saad et al reported data on patients' discharge disposition after discharge to an LTACH from the ICU. The majority (52%) discharged from the LTACH to acute inpatient rehabilitation, with 19% transferred back to the hospital for further care.

1% to 99% ICU Admission

Ten studies reported ICU admissions from 15% to 42% of eligible participants.[48-57] In most cases, the majority of patients discharged home, with a range of 4% to 26% discharging to acute/sub-acute care/SNF. There was 1 notable exception. Frontera et al showed significant differences in discharge disposition between those with a neurological disorder plus COVID-19 ($N = 606$) and those with COVID-19 only ($N = 3,885$). In this case series, a greater proportion of patients with a neurologic disorder and COVID-19 discharged to an institutionalized setting, including a long-term acute care hospital, sub-acute rehabilitation, acute inpatient rehabilitation, and nursing homes, compared to those with COVID-19 but without a neurologic disorder ($p \leq 0.001$).

100% Hospitalized, % ICU Not Reported

Seven studies reported on hospitalized patients but did not indicate whether or not those admitted to the ICU were included and categorized as such.[44,45,58-62] Two studies had a non-COVID comparator group. In a cohort study by Hägg et al ($N = 967$), a greater proportion of patients without COVID-19 was discharged home compared to those with COVID-19 (59% vs 44%, $p < 0.001$). In a large case series by De Havenon et al ($N = 2,086$ patients with ischemic stroke and COVID-19, $N = 166,586$ controls with ischemic stroke), patients with ischemic stroke and COVID-19 had lower odds of discharge to home or acute rehabilitation compared to patients with ischemic stroke and pneumonia (OR=0.63, 95% CI [0.54, 0.73]). One study compared sub-groups within those hospitalized with COVID-19. Claflin et al compared patients with COVID-19 dichotomized as having neurological complications ($N = 81$) or not ($N = 215$). A greater proportion of patients with the combination of COVID-19 and neurological complications discharged to sub-acute/SNF compared to those with COVID-19 alone ($p < 0.0001$). The

remaining 4 studies showed the majority of patients discharged home, with a range of 10% to 21% discharging to acute/sub-acute care/SNF. Two studies further compared variation in discharge disposition within sub-populations including those with potentially avoidable readmission status, and racial or ethnic categories. In a case series by Gavin et al, patients hospitalized with COVID-19 were grouped and compared by potentially avoidable readmission (PAR) status ($N = 550$ without PAR and $N = 62$ with PAR). Patients with PAR had a higher proportion of discharges to acute or subacute rehabilitation compared to those without PAR status (30.6% vs 16.5%, $p = .006$). Nimgaonkar et al explored differences between Black ($N = 645$) and all other patients ($N = 529$) in terms of discharge disposition of hospitalized patients with COVID-19. Significant differences existed between groups across all discharge disposition categories ($p < .001$), with Black patients exhibiting a higher proportion of discharge to home with home health care (25.7% vs 23.1%) and a lower proportion to home without services (42.0% vs 47.6%) and Skilled Nursing Facility (SNF)/acute rehab (17.7% vs 24.0%). Qureshi et al explored differences in what they defined as routine (home) versus non-routine (short-term hospitals, intermediate care, and SNF) discharge dispositions between racial and ethnic categories among patients with COVID-19 who were hospitalized or had at least 1 emergency department visit (White $N = 18,888$, African American $N = 10,025$, Hispanic $N = 19,366$, Asian or Pacific Islander $N = 998$). Compared to patients identified as White, patients across all other ethnic and racial categories had higher proportions of discharge to home and less to short-term hospitals, intermediate care, or SNFs.

<100% Hospitalized

One study reported discharge outcomes on a mix of hospitalized and non-hospitalized patient populations with COVID-19.[63] Most patients were discharged to home with a range of 51% (inpatient) to 79% (outpatient). A larger proportion of hospitalized patients were discharged to a SNF.

Table 5: Care Services – Study Characteristics and Discharge Disposition Outcomes

Author, Year Country Study Design % ICU	Setting N Enrolled (n Discharged)	Outcomes Reported					
		Discharge Disposition					
		Home, Home Health, and/or Assisted Living	SAR/SNF	Acute Inpatient Rehab	LTACH	NH	Other/Mixed
100% ICU							
Alser, 2021[46] US Case series (general population) 100% ICU	1 hospital N=235 enrolled (N=175 discharged)	Home or home health: 33%	SAR/SNF: 62%				Short-term general hospital: 4%
Neville, 2022[27] US Case series (general population) 100% ICU	2 hospital systems N=275 enrolled (N=205 survived, N=132 completed survey) Note: Time of assessment was 182 days (median) post-discharge	Home: 93% Assisted living: 0.8%	SNF: 3%				2%
Saad, 2022[47] US Case series (general population) 100% ICU	2 LTACH hospitals N=158 enrolled (N=141 discharged)	Home: 21%		52%		8%	Acute care hospital: 19%

Author, Year Country Study Design % ICU	Setting N Enrolled (n Discharged)	Outcomes Reported					
		Discharge Disposition					
		Home, Home Health, and/or Assisted Living	SAR/SNF	Acute Inpatient Rehab	LTACH	NH	Other/Mixed
15% to 42% ICU							
Lavery, 2020[53] US Case series (general population) 15% ICU	4 hospitals N=126,137 enrolled (N=106,543 discharged)	Home: 60% Home health: 10%	SNF: 15%				Hospice: 4% Discharged to other facilities or left against medical advice: 5%
Loerinc, 2021[54] US Case series (general population) 22% ICU	2 hospitals N=310 enrolled and discharged	Home: 91%	SNF: 8%				DPH facility: 1% Placement issues: 3% Unstable housing: 2%
Roberts, 2021[56] US Case series (general population) 23% ICU (discharged home), 39% ICU discharged institution)	2 hospitals N=273 enrolled (N=230 discharged)	Home: 72%					Institution[c]: 28%

Author, Year Country Study Design % ICU	Setting N Enrolled (n Discharged)	Outcomes Reported					
		Discharge Disposition					
		Home, Home Health, and/or Assisted Living	SAR/SNF	Acute Inpatient Rehab	LTACH	NH	Other/Mixed
Erben, 2021[51] US Case series (general population) 30% ICU	3 Mayo Clinic campuses N=915 enrolled (N=820 discharged)	Home: 86%		14%			
Changal, 2021[48] US Case series (general population) 33% ICU	2 hospitals N=280 enrolled (N=238 discharged)	Home: 73%	SNF: 25%				
Changal, 2021[49] US Case series (general population) 33% ICU	2 hospitals N=268 enrolled (N=227 discharged)	Home: 73%	SNF: 26%				
Taupin, 2021[57] US Case series (general population) 38% ICU	1 hospital N=576 enrolled and discharged	Home: 36% Home with services: 20%				43%	

Author, Year Country Study Design % ICU	Setting N Enrolled (n Discharged)	Outcomes Reported					
		Discharge Disposition					
		Home, Home Health, and/or Assisted Living	SAR/SNF	Acute Inpatient Rehab	LTACH	NH	Other/Mixed
Frontera, 2021[52] US Case series (special population[d]) 40% ICU (Neuro-COVID), 19% ICU (COVID-19 only)	4 hospitals **COVID-19 only**: N=3885 enrolled (N=3,107 discharged) **Neuro-COVID**: N=606 enrolled (N=382 discharged)	**COVID-19 only**: Home: 82%	SAR: 3%	3%	1%	11%	
		Neuro-COVID: Home: 53%	SAR: 4%	8%	4%	32%	
Domecq, 2021[50] Multi (US 85%) Case series (general population) 42% ICU	168 hospitals, 16 countries N=20,608 enrolled (N=16,702 discharged)	Home: 61% Assisted living: 7%	SNF: 5%				Other: 7% NR: 19%
McCarthy, 2020[55] US Case series (general population) 42% ICU	1 hospital N=247 enrolled (N=213 discharged)	Home: 67%	SNF: 9% SAR: 12%		12%		

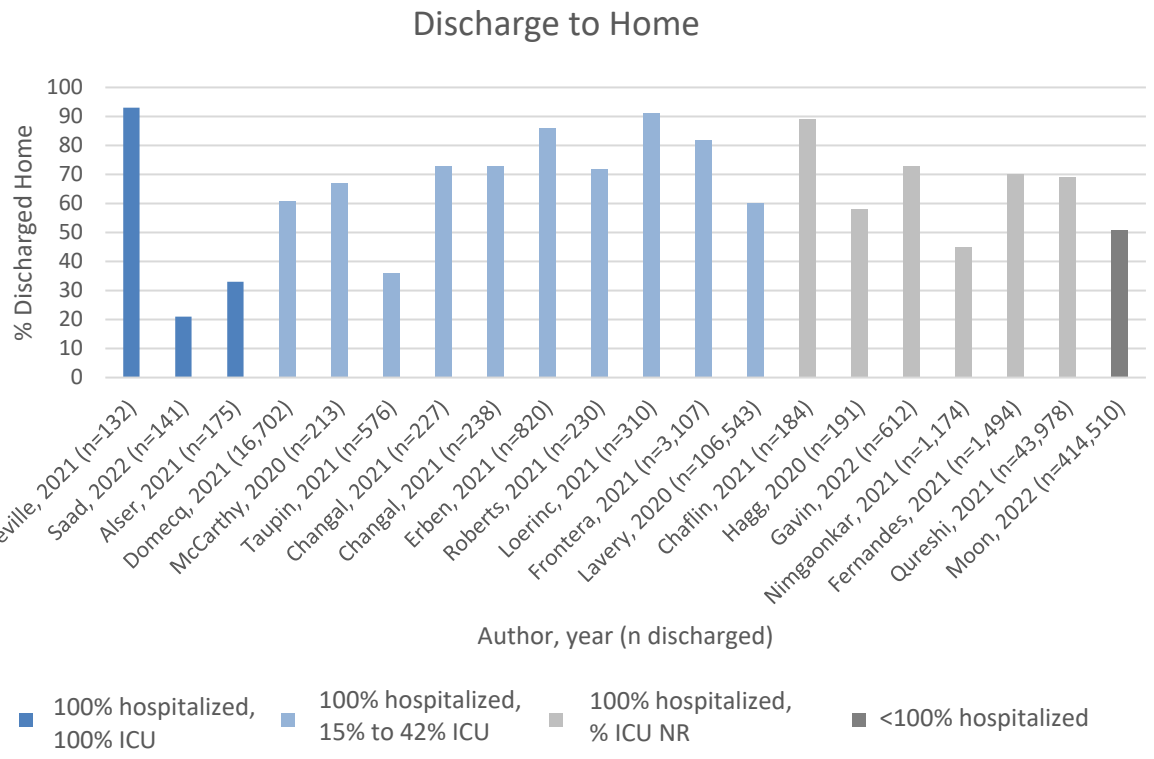
Author, Year Country Study Design % ICU	Setting N Enrolled (n Discharged)	Outcomes Reported					
		Discharge Disposition					
		Home, Home Health, and/or Assisted Living	**SAR/SNF**	**Acute Inpatient Rehab**	**LTACH**	**NH**	**Other/Mixed**
% ICU Not Reported							
De Havenon, 2020[44] US Cohort (special population[f]) % ICU NR	568 hospitals **IS-controls**: N=166,586 enrolled (N=155,721 discharged) **IS-COVID**: N=2,086 enrolled (N=1,452 discharged)	x[a]		x[a]			
Hägg, 2020[45] Sweden Cohort (special population[e]) % ICU NR	1 hospital **With COVID-19**: N=250 enrolled (N=191 discharged) **Without COVID-19**: N=717 enrolled (N=688 discharged)	**With COVID-19**: Home: 58%					
		Without COVID-19: Home: 61%					
Claflin, 2021[58] US Case series (special population[d]) % ICU NR	1 hospital **COVID-19 only**: N=215 enrolled (N=184 discharged) **Neuro-COVID**: N=81 enrolled (N=63 discharged)	**COVID-19 only**: Home: 89%	SAR/SNF: 10%	1%	0%		0%
		Neuro-COVID: Home: 40%	SAR/SNF: 33%	11%	8%		8%
Fernandes, 2021[59] US Case series (general population) % ICU NR	>1000 hospitals N=1737 enrolled (N=1494 discharged)	Home: 70%	SNF: 20%	10%			

Author, Year Country Study Design % ICU	Setting N Enrolled (n Discharged)	Outcomes Reported					
		Discharge Disposition					
		Home, Home Health, and/or Assisted Living	SAR/SNF	Acute Inpatient Rehab	LTACH	NH	Other/Mixed
Gavin, 2022[60] US Case series (general population) % ICU NR	2 hospitals N=612 enrolled and discharged	Home: 73% Hospital at home: 10%	17% (acute OR subacute rehab)				
Nimgaonkar, 2021[61] US Case series (general population) % ICU NR	5 hospital systems N=1461 enrolled (N=1174 discharged)	Home: 45% Home health: 30%	SAR/SNF: 21%		x		5%
Qureshi, 2021[62] US Case series (general population) % ICU NR	62 healthcare facilities N=49,277 enrolled (N=43,978 discharged)	Home: 69%					Non-routine[b]: 31%

Author, Year Country Study Design % ICU	Setting N Enrolled (n Discharged)	Outcomes Reported					
		Discharge Disposition					
		Home, Home Health, and/or Assisted Living	SAR/SNF	Acute Inpatient Rehab	LTACH	NH	Other/Mixed
<100% hospitalized							
Moon, 2022[63] US Case series (general population) ~33% hospitalized (23% ICU)	909 hospitals **Inpatient**: N=481,216 enrolled (N=414,510 discharged) **Outpatient**: N=973,564 enrolled (N=971,122 discharged)	**Inpatient**: Home: 51% Home health: 13%	SNF: 18%				Hospice: 4% Other: 13%
		Outpatient: Home: 79% Home health: 0.4%	SNF: 1%				Hospice: 0.1% Other: 20%

Notes. [a] Relevant outcome reported was "favorable discharge," which is defined as discharge to home or acute rehab; [b] "Non-routine discharge" included destinations other than home, such as short-term hospitals or other facilities including intermediate care and SNF; [c] "Discharge to an institution" included inpatient rehabilitation facility, skilled nursing facility, long-term care hospital, or discharge to another acute care facility; [d] Special population: neuro-COVID; [e] Special population: geriatric (defined as patients admitted to geriatric unit); [f] Special population: ischemic stroke,
Abbreviations. DPH=Department of Public Health; ICU=intensive care unit; SAR=subacute rehabilitation; SNF=skilled nursing facility; LTACH=long-term acute care hospital; NH=nursing home.

Figure 6. Discharge to Home (COVID-19 Patients)



Abbreviations. ICU=intensive care unit.

Caregiver Support and Healthcare Follow-up after Hospital Discharge (Table 6)

Two studies report new caregiver support.[27,54] Loerinc et al used electronic health record data to report 53% of hospitalized patients ($N = 310$) required new caregiver support at hospital discharge. Neville et al used a mailed survey and reported 15% of ICU hospitalized patients ($N =$ 132 out of 205 eligible for follow-up) required new caregiver support at 6 months post hospital discharge.

Three studies described healthcare use post hospital discharge, with variable use of outpatient services 6 to 24 months after symptom onset.[26,31,54] Loerinc et al reported that 83% of hospitalized patients ($N = 310$) were recommended for outpatient primary care follow-up, with 29% referred to a specialist. Hodgson et al reported that 47% did not seek further outpatient support, 8% accessed psychological services, and 3% saw a dietician. In the study by Huang et al, 18% had an outpatient clinic visit at 12 months post-acute COVID with 19% at 24 months. At both 12 and 24 months, 13% had been hospitalized.

Two studies reported on continuing rehabilitation needs.[26,41] Vaes et al used data from survey responses collected from online Long COVID peer support groups to compare self-reported rehabilitation use between persons with confirmed COVID-19 ($N = 239$) and suspected COVID-19 ($N = 766$) 3- and 6-months post symptom onset.[41] In those with confirmed COVID-19, a greater proportion received physical therapy or rehabilitation services 3 to 6 months post infection compared to the first 3 months (physical therapy 62% vs 32%, rehabilitation 12% vs 4%; $P < .05$). Fifty-seven percent of those with suspected COVID-19 reported physical therapy

use 3 to 6 months post symptoms onset (*P* value not reported). In the study by Hodgson et al, 33% of patients (*N* = 122), all of whom were hospitalized in the ICU, received physical therapy within 6 months of ICU admission[26].

Table 6. Care Services - Care Needs-related Outcomes

Author, Year Country Study Design % ICU	Setting N Enrolled (n Followed Up)	Time of Outcome Assessment	Outcomes Reported		
			Post COVID-19 Care Needs		
			New Caregiver Support	Continuing Healthcare Needs	Continuing Rehabilitation Needs
100% ICU					
Hodgson, 2021[26] Australia Case series 100% ICU	30 hospitals 100% hospitalized (100% ICU) N=212 enrolled (N=122 followed up)	6 months after ICU admission		Did not seek further outpatient support: 47% Accessed psychology services: 8% Saw a dietician: 3%	Attended physical therapy: 33%
Neville, 2022[27] US Case series 100% ICU	2 hospital systems 100% hospitalized (100% ICU) N=275 enrolled (N=132 followed up)	6 months post-hospital discharge	16		
4–22% ICU					
Huang, 2022[31] China Case series 4% ICU	1 hospital 100% hospitalized (4% ICU) N=2218 enrolled (N=1169 followed up at 1 yr, N=1187 followed up at 2 yrs)	6 months, 1 year, and 2 years post-symptom onset		**At 1 year**: Outpatient clinic visit: 18% Hospitalization: 13% ED visit: 1% **At 2 years**: Outpatient clinic visit: 19% Hospitalization: 13% ED visit: 1%	

Author, Year Country Study Design % ICU	Setting N Enrolled (n Followed Up)	Time of Outcome Assessment	Outcomes Reported				
			Post COVID-19 Care Needs				
			New Caregiver Support	Continuing Healthcare Needs	Continuing Rehabilitation Needs		
Loerinc, 2021[54] US Case series 22% ICU	4 hospitals 100% hospitalized (22% ICU) N=310 enrolled and followed up	Post-discharge	53%	**Recommended follow-up appointments:** Primary care: 83% PCP identified at discharge: 70% Specialist appointment[a]: 29%			
<100% hospitalized, % ICU NR							
Vaes, 2021[41] Netherlands Case series % ICU NR	Community 26% hospitalized (confirmed cases) N=1556 enrolled (**Confirmed COVID-19**: N=239 followed up **Suspected COVID-19**: N=766 followed up)	3 (T1) and 6 (T2) months post-onset of COVID-19 symptoms T0: symptom onset			*Symptom onset to 3 months post-acute COVID-19*	*3 months to 6 months*	*p-value*
					Confirmed COVID-19		
					Physiotherapy: 32% Rehabilitation: 4%	62% 12%	*p*<0.05
					Suspected COVID-19		
					Physiotherapy: 24% Rehabilitation: 1%	57% 4%	NR

Notes. [a] Specialists: cardiology, nephrology, urology, pulmonology, rheumatology, oncology, endocrinology, infectious disease, gastroenterology, psychiatry, surgery, neurology, palliative care.
Abbreviations. PCP=primary care provider; yr=year.

DISCUSSION AND CONCLUSIONS

KEY FINDINGS

Our review of employment, education, and care outcomes in adults following COVID-19 found:

KQ 1 Employment

- Return to work and inability to work due to illness 3–24 months following COVID-19 varied widely and was likely associated with disease severity (as assessed by need for hospitalization and/or ICU care), symptom persistence, and time from initial infection.
- Employment outcomes were worse for those hospitalized in the ICU compared to those non-ICU hospitalized; employment outcomes were best for patients who did not require hospitalization.
- Studies limited to survivors of ICU hospitalization for COVID-19 reported approximately 50% to 60% of patients returned to work by 6 months.
- Studies of hospitalized patients, which included some ICU patients, reported a range of 53% to 92% of survivors back at work by 6 months.
- For outpatients with COVID-19 not selected on the presence of persistent symptoms, the impact of COVID-19 on employment appeared to be small: 1% were unable to return to work at 6 months in 1 study; in another study, no difference in percentage employed at 9 months was observed between COVID-19 positive and negative patients.
- Studies of patients attending post-COVID clinics or limited to those reporting residual symptoms reported 54% to 75% had returned to work full or part-time at 6 to 12 months.

KQ 2 Education

- Information was insufficient to determine the association of COVID-19 status with post-secondary education outcomes.

KQ 3 Continuing Care Needs

- Studies focused on discharge disposition for adults hospitalized for COVID-19. Results ranged widely, few had comparators, and most did not report medical reason for hospital admission or health complications during hospitalization, discharge health status or symptoms, or pre-COVID-19 care needs.
- There was no information on post-COVID care needs for non-hospitalized adults.
- Limited data suggested ICU survivors were more likely to be discharged to a SNF or equivalent and were less likely to be discharged home than non-ICU survivors. Ranges varied widely.
- One study of ICU survivors reported that 3% were residing at a SNF at 6 months follow-up; however, a third of the patients were missing discharge status. Another study of ICU survivors reported that 62% were discharged to a SNF, although longer-term status was not reported. Other studies reported outcomes for a mix of ICU and non-ICU hospitalized

patients. These studies reported that 3% to 43% were reported discharged to SNF or equivalent.

- In the 1 study with a non-COVID-19 comparator group, 58% of survivors admitted to a Swedish inpatient geriatric unit with COVID-19 were discharged home compared to 61% of those without COVID-19.

Limitations in the evidence and its current applicability include:

- Few studies had non-COVID control comparators, thus limiting conclusions.
- To date, no studies have enrolled a representative sample of all individuals who have had COVID-19.
- No studies evaluated Veteran status or Veterans within the Veterans Health Administration.
- Wide variations in populations, disease severity, methods, outcomes, and findings.
- Little reporting on employment, education, or post-hospitalization care needs according to symptom status at assessment time (*ie,* whether patients had Long COVID).
- Limited information on most patient or disease characteristics of interest beyond hospitalization or ICU status (*ie,* race/ethnicity, place of residence, socioeconomic status, COVID-19 treatments received, vaccination status, COVID-19 variant) and outcomes not reported by patient or disease characteristics.
- Most studies occurred prior to the Delta and Omicron variants, vaccine availability, or wide population immunity (*ie,* studies enrolled adults who had COVID-19 in 2020 and early 2021).
- Treatments are now available for hospitalized and at-risk non-hospitalized adults.
- Changes have occurred in public health recommendations and in employment and education policies and practices.

DISCUSSION

Our Evidence Brief evaluating employment, education, and continuing care outcomes of COVID-19 found that a history of COVID-19 is associated with negative employment and continuing care outcomes. We found insufficient information on the effects of COVID-19 on education; studies reporting student status after COVID-19 did not report student status prior to infection, precluding any conclusions about the impact of COVID-19 on educational outcomes. The prevalence of deleterious effects of COVID-19 on employment and care needs varied with follow-up duration, need for hospitalization or ICU care, and recruitment setting (*ie,* general population vs post-COVID clinic). However, differences across studies preclude accurate assessment of their independent and absolute effects. Few studies included a comparator group, limiting definitive conclusions about the association of these outcomes with, and incremental effects of, COVID-19. Finally, many of the studies recruited highly selected populations or were based on subgroups of patients from a broader population of those with COVID-19. Reported findings, especially absolute effect estimates, should therefore by interpreted with caution.

We organized employment results based on perceived potential to provide the most representative estimates of outcomes for a general population of COVID-19 survivors. Thus, we categorized studies as coming from a general population (mostly individuals previously hospitalized, including those admitted to ICU), post-COVID clinics (mostly non-hospitalized), and social media or online response groups (predominately non-hospitalized and from outside the US). Three studies reporting employment outcomes recruited participants from Long Covid or PASC clinics or rehabilitation programs, and 1 study selected participants on the basis of persistent symptoms. These studies generally reported higher rates of unemployment post-COVID than studies that did not select on persistent symptoms. Only 2 studies reporting employment outcomes included a comparator group. One study compared hospitalized patients with COVID-19 to patients hospitalized with influenza.[22] In that study, 92% of patients hospitalized with COVID-19 had returned to work at 6 months compared to 97% hospitalized with influenza (5 percentage points difference). One study of outpatients that included a comparator group (patients who tested negative for COVID-19) reported that full- or part-time employment at 9 months did not differ between COVID-19 positive and negative patients (64% in each group); employment status prior to COVID-19 testing was not reported.[28]

In single arm studies limited to COVID-19 patients admitted to ICU, 50% to 65% of patients were reported working at 5 to 6 months post-hospitalization.[20,27] One study reported 86% had returned to work at 12 months.[30] All were small, single institution, and, as noted, had no comparator group; thus effects attributable to COVID-19 are not clear. Other studies without comparator groups reported 53–92% of hospitalized patients (ICU status often not reported) working at 6 months;[22,24,25] 1 reported 88% had returned to original work at 12 months.[31]

Employment outcomes were generally better in patients who did not require hospitalization: 1 study reported 1% of individuals treated as outpatients were unable to work at 6 months.[22] In another, 88% were working at 3 months follow-up, although pre-COVID-19 employment status was not reported.[32] Studies limited to patients attending post-COVID-19 clinics or reporting persistent symptoms reported 54% to 75% returning to work by 6 to 12 months.[33-36]

Most studies on continuing care needs were conducted in the United States and reported on hospital discharge disposition. However, few reported on symptom or morbidity status at discharge or residence prior to hospitalization. Discharge to home with or without home health services varied widely.

Few studies of continuing care needs post-hospitalization included a comparator group. One study assessing care needs in patients with COVID-19 admitted to a geriatric care unit included a comparator group of patients admitted without COVID-19.[45] Fifty-eight percent of survivors with COVID-19 were discharged home compared to 61% of those without COVID-19. One study of patients with ischemic stroke found that those with COVID-19 were less likely to be discharged home than those without COVID-19.[44]

In studies without a comparator group, ranges for continuing care outcomes varied widely and may overestimate any association directly related to COVID-19. One study of ICU survivors reported that only 3% were discharged to a SNF or equivalent; however, a third of the patients were missing discharge status.[27] Another study of ICU survivors reported that 62% were discharged to a SNF or equivalent[46] Other studies with a mix of ICU and non-ICU hospitalized patients[48-57] and studies not reporting percentage cared for in an ICU[44,45,58-61] reported that 3–

43% were reported discharged to SNF or equivalent. Additional studies reported discharge dispositions varied according to race and ethnicity,[61,62] presence of neurologic disorders,[52,58] and potentially avoidable readmissions status.[60]

Most studies may have limited applicability to individuals with COVID-19 currently. Studies were conducted prior to widespread vaccination, rapid "home" testing, variant emergence, and availability of effective therapies for at-risk patients. These factors have led to lower morbidity and mortality for many non-hospitalized and hospitalized individuals with COVID-19.[64,65] Additionally, considerable changes in the US work and educational environments along with relaxing of public health measures post-infection may result in fewer individuals with COVID-19 having adverse effects on work, education, or continuing care access.

One small study suggested that people of color may have had worse employment outcomes post-infection;[29] 2 studies reported differences in rates of discharge to home and to a SNF/subacute rehabilitation facility for Black or African American patients compared to White patients.[61,62] These studies highlight the need for further rigorous research to evaluate post-COVID outcomes by race/ethnicity.

One study published after our search reported on persistent symptoms after SARS-CoV-2 infection and the association with work and study.[66] The Long-COVID in Scotland Study invited every adult in Scotland with a positive PCR test for SARS-CoV-2 to participate along with a comparison group who had a negative test and never had a positive test. Nineteen percent of responders who had had symptomatic infection reported ongoing difficulty working and studying compared to 11.6% of those never infected (absolute difference 7.4%). The low response rate and potential bias in those who responded preclude definitive conclusions from these data.

The US Census Bureau recently added questions about persistent symptoms after COVID-19 to the Household Pulse Survey.[67] Based on the most recent edition of that survey, the Bureau estimates that of over 119 million Americans who report having had COVID-19, 4.4 million (3.7%) report long-term symptoms that reduce their ability to carry out day-to-day activities "a lot." Extending the use of these and other standardized questions to other surveys would provide valuable data to better estimate the impact of COVID-19 on employment, educational attainment, and impairment of daily activities.

LIMITATIONS

Our report and the included evidence have several limitations, including: 1) lack of non-COVID-19 comparators, 2) variability in outcome assessment and reporting, 3) selected and varied populations, 4) lack of reporting on subpopulations of interest, 5) lack of information on educational outcomes, 6) lack of data on longer-term care needs (*eg,* beyond hospital discharge and in those not hospitalized), 7) poorly reported description of individuals' symptom status (*ie,* Long COVID), 8) poor current applicability to adults with COVID-19 because most studies occurred in the early pandemic phase, and 9) no studies reported on Veterans. These limitations preclude reliable estimates for our outcomes and may overestimate absolute differences between those with and without COVID-19, especially when trying to determine the current sequelae of COVID-19 infection.

Most studies were case series and included selected populations. No studies enrolled a representative sample of all individuals who have had COVID-19, and many evaluating post-

hospitalization outcomes were typically selected and involved administrative data collection. Many did not report employment and post-hospitalization care needs according to demographic factors, baseline employment or educational type or status, prior place of residence or care needs, comorbidities, COVID symptom status, COVID variant, treatments received, or vaccination status.

With rare exceptions, we cannot attribute employment findings to Long COVID or prior (resolved) COVID-19. In the early period of the COVID-19 pandemic, when these studies were conducted (2020 and early 2021), public health recommendations, social norms, and the economic environment may have resulted in barriers to employment and education that were not directly related to an individual's SARS-CoV-2 infection; these barriers may have included concern for personal safety, requirements for masking and social distancing, and closures of businesses, schools, and universities. As public health recommendations and social norms have become less restrictive, the impact of these factors likely has lessened. Most studies did not report reasons for unemployment, educational enrollment status, and discharge disposition; as a result, we were often unable to attribute outcomes of interest to sequelae of infection versus other impacts of the pandemic.

A key limitation in employment outcomes is variability in definitions used. Some studies only reported proportion of patients employed at follow-up, with no information about pre-employment status or reasons for not working. Others specifically reported only unemployment due to illness. We are aware of 2 work-specific scales that may be appropriate for assessing work capacity and workload: Work Ability Index (WAI) and Work Productivity and Activity Impairment (WPAI).[68]

Although we found little evidence about the effects of COVID-19 on educational status, any conclusions that might have been drawn from the 2020-early 2021 period would likely have limited relevance to the present (given the return to in-person learning and dormitory living, as well as changes in online learning). Similarly, the limited availability of personal protective equipment and closure of sub-acute care facilities in the early pandemic may have impacted patient recovery in ways that are unlikely now. However, we do not wish to imply that negative employment, education, or care need outcomes that occurred in the early COVID era but have since resolved cannot have lasting downstream effects. While job hiring, employment, education, and business activity have improved, changes in job status and positions, educational achievement, accumulated debt, and other adverse effects of at least temporary reductions in employment and education likely remain; all of these probably place additional strains on extended care facilities and home care needs, including family caregiver support availability.

Studies reporting on care outcomes typically assessed disposition only at time of hospital discharge and did not provide information on pre-hospitalization status, limiting our ability to draw conclusions regarding the impact of COVID-19 on these outcomes. We found few studies of caregiver burden or long-term care needs for individuals with, but not hospitalized for, COVID-19. We also have little to no information on the reason for longer-term care needs such as whether they are due to "Long COVID" symptoms (*eg,* brain fog, fatigue) or from major organ damage (*eg,* stroke, myocardial infarction, acute respiratory illness). As treatments have become available and criteria for hospitalization have changed, care outcomes after hospitalization now may differ from those reported earlier in the pandemic.

FUTURE RESEARCH

The SARS-CoV-2 virus will likely remain a significant threat to human health for the foreseeable future. For policy and planning purposes, it is critical that high-quality estimates of the impacts of COVID-19 infection on employment, on educational outcomes, and on care needs are available and that these estimates are updated to reflect changes in the biomedical and societal landscape with respect to COVID-19 as they occur. Our findings in this Evidence Brief highlight an important gap in the understanding of the impacts of COVID-19 on these important outcomes. Robust, standardized, longitudinal assessments of health and well-being across systems and settings, including pre-morbid evaluation, are needed to facilitate real-time monitoring of trends.[69] We suggest the following to assess employment, education, and care needs among adults with COVID-19:

1. Retrospective and prospective cohorts should be carefully constructed to obtain patient, disease, and outcome information in a standardized fashion from a large and representative population of individuals including both hospitalized and non-hospitalized adults, those who have received vaccination versus not, and according to COVID-19 variants, symptom severity, type, and current status. Age, race/ethnicity, comorbidities, pre-infection employment and educational status should be collected, as well as the existence of persistence symptoms (*ie*, Long COVID).
2. Studies evaluating employment outcomes should evaluate employment type and locale (*eg*, manual labor, telework) in addition to number of hours worked. Other important employment outcomes include work ability, change in occupation or site, workplace and work schedule accommodations or modifications, leaving the work force, and financial status. These studies should also evaluate whether changes in employment are due to direct effects of COVID-19 infection versus indirect effects of the pandemic on the economy or individual employment preferences.
3. Studies evaluating educational outcomes should report pre-infection educational and degree completion status, delays in degree completion, education accommodations or modifications, loss of internship or post-graduate opportunities, student-related debt, and post-education occupation.
4. Studies evaluating continuing care needs should report pre-infection place of residence and needs. Studies of hospitalized patients should follow patients beyond initial discharge to eventual place of residence and long-term care needs, including the role and effect on community caregivers (family, neighbors, home health aides, *etc*). Studies of continuing care needs of outpatients with COVID-19 are lacking and needed.
5. Additional research is needed to include individuals underrepresented in currently available literature including those who are asymptomatic, have only mild disease, or those who may not have access to health care or may not be tracked in health care systems.

CONCLUSIONS

Our Evidence Brief evaluating employment, education, and continuing care outcomes of COVID-19 found that a history of COVID-19 from 2020 to early 2021 was associated with negative impacts on employment as well as post-hospitalization continuing care needs. Effects

varied widely but appeared to be associated with disease severity (as measured by hospitalization and ICU status) and symptom persistence, though negative effects likely decreased over time. Importantly, few studies had non-COVID control comparators, thus limiting conclusions. All studies included selected populations; none enrolled a representative sample of all individuals who have had COVID-19, and no studies explicitly evaluated Veterans. We found insufficient evidence on education outcomes and little to no data on subgroups of interest. Studies were limited by lack of, or inadequate, comparators; variability in methods of outcomes assessment and reporting; recruitment or reporting of highly selected populations; and lack of information on long-term symptom status. Dramatic changes have occurred from early 2021 to the present in levels of natural immunity, vaccination availability, at-home self-testing use, treatment options, and SARS-CoV-2 variants. The employment, education, and health care environment as well as public health recommendations and social practice norms have also changed over time. Therefore, current outcomes likely differ from those reported here. Future research is needed to study the long-term effects of COVID-19 on employment, education, and care needs for individuals infected with SARS-CoV-2 early in the pandemic (pre-2021) as well as for those infected more recently, given the rapidly changing medical, public health, and societal landscape.

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