

Medical Treatments and Costs of COVID-19 Claims and an Early Look at “Long COVID” in the California Workers’ Compensation System

Julia Zhang, PhD, Lucy Chen and YiChen Yu, MS

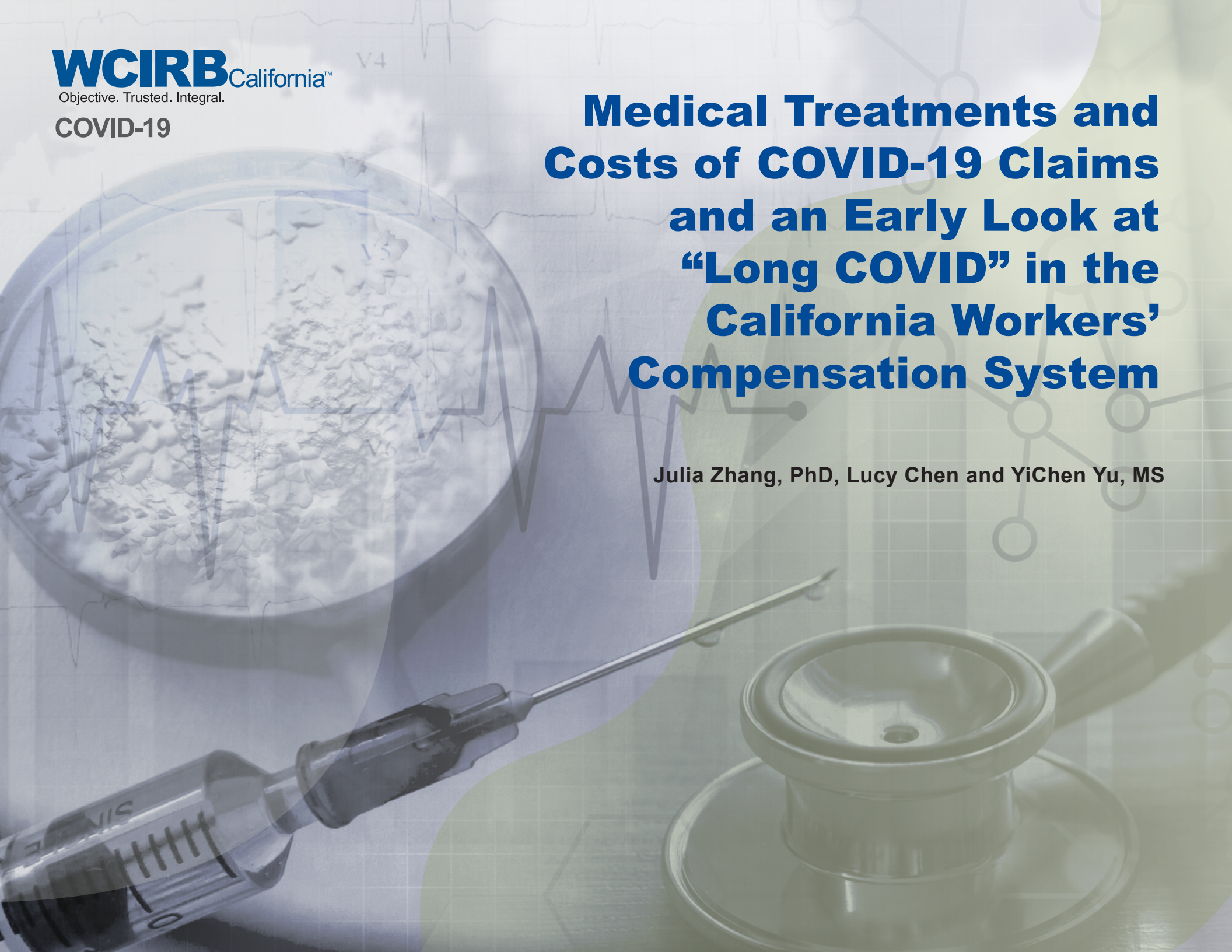


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Executive Summary

The COVID-19 pandemic that started in early 2020 has continued to cast a long shadow on California's residents, workforce, businesses and economy. Healthcare workers and other frontline workers who, in particular, had to continue working outside the home have faced substantial challenges arising from the pandemic. Since March 2020, more than 200,000 COVID-19 claims were reported to the California Division of Workers' Compensation, and many were from these frontline workers.¹ COVID-19 claims that involved medical treatments, especially hospitalization, can incur significant medical costs. The potential for post-acute sequelae of SARS-CoV-2 infection (PASC),² often referred to as "long COVID", occurring among a fraction of COVID-19 claims may further exacerbate the health consequences of COVID-19 on workers and increase the overall financial impacts to the workers' compensation system. However, at the time of this study, limited information has been published on the medical costs of treating COVID-19 in the workers' compensation system, and even less on the impact of long COVID.

The primary objective of this study is to provide a better understanding of the medical cost and treatment patterns of COVID-19 claims in the California workers' compensation system, including a very early look at the potential prevalence and cost impacts of long COVID. In addition, we compared the treatment patterns of COVID-19 claims in the workers' compensation system to those of COVID-19 patients covered by group health insurance³ in California to validate some of our findings.

¹ The total COVID-19 claims include denied claims and claims arising from both the self-insured and insured employers and were as of February 15, 2022. Workers' Compensation Information System (WCIS) of the Division of Workers' Compensation, California Department of Industrial Relations. <https://data.ca.gov/dataset/dwc-covid-19-claims>.

² This study followed the definition of long COVID developed by the U.S. National Institutes of Health (NIH). https://recovercovid.org/docs/pasc_initiative_fact_sheet.pdf.

³ In our study, COVID-19 patients with group health insurance were active workers with employer-sponsored health insurance coverage. The claims and medical billing data of these COVID-19 patients is referred to as group health data, which is from the IBM® MarketScan® Research Databases, including Commercial Claims and Encounter Database and Medicare Supplemental and Coordination of Benefits Database.

Key findings

Demographics of COVID-19 Claims:



- The WCIRB studied a sample of almost 6,000 insured COVID-19 workers' compensation claims in our study database with an accident date between March 2020 and March 2021 that incurred medical payments.⁴ The vast majority (90%) of these claims were for mild illness and did not require hospitalization. Additionally, 4% of these claims were for severe illness that required hospitalization without an ICU stay, 4% required ICU care for critical conditions, and 2% were death claims ([Table 1](#)).
- Compared to non-COVID-19 workers' compensation claims,⁵ these COVID-19 claims were more likely to involve hospitalization and fatality and were more concentrated among workers aged 50 and over ([Table 1](#) and [Figure 3](#)).



Medical Treatments and Costs of COVID-19 Claims:

- As expected, the average medical payments on COVID-19 claims increase significantly as infections become more severe ([Figure 6](#)). For COVID-19 claims with severe and critical infections, the payments for hospital admissions were the main cost driver ([Figure 9](#)). Almost 40% of critical COVID-19 claims involving ICU care required ventilator support, and their average inpatient costs were 3.5 times that of the inpatient costs for other critical COVID-19 claims without ventilator support ([Figure 12](#)).
- For claims with medical payments during the first six months of medical treatment, the average medical payments per COVID-19 claim were almost two times higher than those of non-COVID-19 claims. The cost differential was mostly driven by a significantly higher share of COVID-19 claims involving hospitalization and fatality (10%) than non-COVID-19 claims (about 1%) ([Table 1](#) and [Figure 6](#)).
- Comparing claims of similar disease severity and needing similar levels of medical care, COVID-19 claims generally had lower average medical payments at 6 months from initial treatment than non-COVID-19 claims ([Figure 6](#)). The average payments for hospital admissions of COVID-19 claims were also lower than those of non-COVID-19 claims ([Figure 9](#)). COVID-19 death claims, however, incurred higher medical costs than other death claims, partly driven by higher inpatient costs and longer hospital stays prior to the fatality ([Figures 9](#) and [10](#)).
- Within 6 months of the first medical treatment, COVID-19 claims closed faster than non-COVID-19 claims of same disease severity, except for death claims ([Figure 7](#)). Closed COVID-19 claims that involved hospitalization or death, however, had higher average claim costs than non-COVID-19 closed claims that also involved hospitalization or death. Overall, the average medical payments per closed COVID-19 claim over the first six months of medical treatment were almost two times higher than those of non-COVID-19 claims that were closed ([Figure 8](#)).
- While not consistently captured in workers' compensation data, the group health data analyzed in the study⁶ shows that COVID-19 working age patients with comorbidities were much more likely to be hospitalized ([Figure 5](#)). Among those hospitalized, COVID-19 patients with comorbidities had on average 25% higher average inpatient costs than those without comorbidities ([Figure 13](#)).
- Medical treatment patterns for COVID-19 patients with mild infections were similar between workers' compensation and group health insurance, while the patterns for those that required hospitalization differed somewhat in the two insurance systems ([Figures 14](#) and [15](#)).

⁴ The COVID-19 claims included in this study were a sample of COVID-19 claims reported in the workers' compensation system. These COVID-19 claims were reported with paid medical transactions to both the WCIRB medical transaction and indemnity transaction databases as of January 7, 2022. These COVID-19 claims include medical-only claims and claims with both medical and indemnity payments.

⁵ The non-COVID-19 claims included in the study as a comparative to COVID-19 claims were also a sample of workers' compensation claims. Similar to COVID-19 claims, these non-COVID-19 claims had an accident date between March 2020 and March 2021 and were reported with paid medical transactions to both the WCIRB medical transaction and indemnity transaction databases as of January 7, 2022. These non-COVID-19 claims include medical-only claims and claims with both medical and indemnity payments.

⁶ This study analyzed de-identified COVID-19 patient data in the IBM® MarketScan® Research Databases, including Commercial Claims and Encounters Database and Medicare Supplemental and Coordination of Benefits Database. The group health data has medical claims and medical service billing information of a large sample of patients with group health insurance in California between 2016 and 2020. The group health data does not include Medi-Cal data but does include medical data on a sample of Medicare-eligible California workers receiving both Medicare benefits and employer-sponsored health insurance coverage.

Estimated Prevalence and Cost of Long COVID:



- Cumulatively over a four-month post-acute care period, about 11% of workers with mild infections received medical treatments for long COVID symptoms in the workers' compensation system, while the share was higher for workers with severe (36%; hospitalization without ICU care) or critical (40%; hospitalization with ICU care) infections ([Figure 16](#)).
- The long COVID symptoms for workers treated in the workers' compensation system ranged from respiratory issues, such as shortness of breath and cough, to multisystem complications, which were more prevalent for patients requiring hospitalization. Almost 40% of hospitalized COVID-19 patients continued to receive care for pulmonary conditions and about 15% received care for cardiac conditions over the four-month post-acute care period after hospital discharge, while about 20% of mild patients received care for shortness of breath and about 16% received care for pulmonary conditions ([Figure 18](#)).
- At 4 months post-acute care, workers with severe or critical infections who were previously hospitalized and subsequently had long COVID symptoms had on average about 16% higher claim costs than non-COVID-19 claims that involved hospitalization ([Figure 19](#)).
- The prevalence of long COVID was slightly higher among patients with mild infections who were treated in the group health insurance system than those treated in the workers' compensation system. However, the prevalence of long COVID for patients with severe or critical infections was slightly higher in the workers' compensation system ([Figure 20](#)).
- For both workers treated in the workers' compensation and group health insurance systems, the monthly share of patients receiving treatments for long COVID symptoms appeared to decline over the four-month post-acute care period studied ([Figure 21](#) and [22](#)).

Limitations of this study are addressed throughout this report and summarized in the [Conditions and Limitations](#) section and must be considered when interpreting the findings.

Background

The COVID-19 pandemic that started in early 2020 has continued to cast a long shadow on California's residents, workforce, businesses and economy. Healthcare workers and other frontline workers who, in particular, had to continue working outside the home have faced substantial challenges arising from the pandemic. Since March 2020, more than 200,000 COVID-19 claims were reported to the California Division of Workers' Compensation, many from these frontline workers.⁷ In May 2020, the Governor issued a temporary Executive Order (N-62-20) providing for a rebuttable presumption of compensability for COVID-19 claims for all workers directed by their employers to work outside the home. In September 2020, the Governor signed Senate Bill No. 1159 into law which, among other provisions, established a rebuttable presumption to apply until January 1, 2023 to COVID-19 claims for first responders and certain healthcare workers as well as for other workers directed to work outside the home if the worker's employer suffers a COVID-19 "outbreak."⁸

While over 40% of accepted COVID-19 workers' compensation claims filed in California involved only indemnity benefits,⁹ the remaining COVID-19 claims required medical treatments, and some required intensive hospital care, including ventilator support. In addition, as information on the post-acute sequelae of SARS-CoV-2 infection (PASC), often referred to as "long COVID", continues to emerge, a fraction of COVID-19 patients has experienced long-term health complications needing additional medical care and potentially resulting in disability that may impair the ability to work or perform daily tasks. While there is a wide range of estimates on the prevalence of long COVID, mostly from studies of small patient populations, published research at the time of this study shows long COVID tended to be more prevalent among hospitalized COVID-19 patients (30% to 70%)¹⁰ than those with mild infections (around 10%).¹¹ The impacts of long COVID on workers who contracted COVID-19 and the workers' compensation system are potentially significant. However, at the time of this study, limited information has been published on the medical costs of treating COVID-19 in the workers' compensation system and even less on long COVID.¹²

This study is intended to provide a more thorough understanding of medical costs and treatment patterns of COVID-19 claims in the California workers' compensation system, including a very early look at the potential prevalence and cost impact of long COVID.

This study also compares the treatment patterns of COVID-19 claims and long COVID in the workers' compensation system with those of COVID-19 patients covered by group health insurance in California.¹³ This comparison was made for several reasons. First, given the emergency nature of the pandemic, published research has indicated that workers with COVID-19 may have initially used their group health insurance for COVID-19 treatment even if they may have contracted the coronavirus at the workplace. Second, despite many differences between workers' compensation and group health insurance, our estimates of the prevalence of long COVID among workers utilizing group health insurance for treatment can help validate the estimated prevalence of long COVID among workers receiving workers' compensation benefits when comparing similar worker populations included in the analysis. A comprehensive comparison of medical costs of treating COVID-19 between workers' compensation and group health insurance requires an in-depth review of the financing models and fee schedules of each system and is beyond the scope of this study. Nevertheless, a broad comparison of COVID-19 treatment patterns between the two insurance systems was included in the study and yielded interesting findings helpful for further research. Lastly, the group health data used in this study includes useful information of COVID-19 patients, such as comorbidities, that is not reliably captured in the workers' compensation data.

7 The total COVID-19 claims include denied claims and were as of February 15, 2022. Workers' Compensation Information System (WCIS) of the Division of Workers' Compensation, California Department of Industrial Relations. <https://data.ca.gov/dataset/dwc-covid-19-claims>.

8 Briefly, the Senate Bill No. 1159 defines a COVID-19 outbreak as when one of the following occurs: (1) if the employer has 100 employees or fewer at a specific place of employment, four employees test positive for COVID; (2) if the employer has more than 100 employees at a specific place of employment, four percent of the employees who reported to the specific place of employment test positive for COVID-19; and (3) a specific place of employment is ordered to close due to a risk of infection with COVID-19. https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=20190200SB1159.

9 COVID-19 in California Workers' Compensation – October 2021 Update, WCIRB. https://www.wcirb.com/sites/default/files/documents/wcirb_report-covid-19caworkerscomp.pdf.

10 Huang L, Yao Q, Gu X, et al. 1-year outcomes in hospital survivors with COVID-19: a longitudinal cohort study. *Lancet*. 2021 Aug 28;398(10302):747-758; Logue JK, Franko NM, McCulloch DJ, et al. Sequelae in Adults at 6 Months After COVID-19 Infection. *JAMA Netw Open*. 2021;4(2):e210830; Carfi A, Bernabei R, Landi F, for the Gemelli Against COVID-19 Post-Acute Care Study Group. Persistent Symptoms in Patients After Acute COVID-19. *JAMA*. 2020;324(6):603–605; Groff D, Sun A, Ssentongo AE, et al. Short-term and Long-term Rates of Postacute Sequelae of SARS-CoV-2 Infection: A Systematic Review. *JAMA Netw Open*. 2021;4(10):e2128568







11 Sudre, C.H., Murray, B., Varsavsky, T. et al. Attributes and predictors of long COVID. *Nat Med* 27, 626–631 (2021).

12 Chua K, Conti RM, Becker NV. Assessment of Out-of-Pocket Spending for COVID-19 Hospitalizations in the US in 2020. *JAMA Netw Open*. 2021;4(10):e2129894.

13 The analysis of treatment patterns of COVID-19 patients with group health insurance was based on data of a sample of California workers with group health insurance, referred to as group health data. The group health data is from the IBM® MarketScan® Research Databases, including Commercial Claims and Encounters Database and Medicare Supplemental and Coordination of Benefits Database. The group health data has medical claims and medical service billing information of a large sample of patients with group health insurance in California between 2016 and 2020. The group health data does not include Medi-Cal data but does include medical data on a sample of Medicare-eligible California workers receiving both Medicare benefits and employer-sponsored health insurance coverage.

Research Questions

In this study, we addressed the following research questions:

- 1** What are the cost and treatment patterns of COVID-19 claims in the California workers' compensation system? How do these patterns differ by infection severity (mild, severe, critical and death)? How do these patterns differ from non-COVID-19 claims?  Page 15
- 2** What are the key drivers for the medical severity of COVID-19 claims? How do these drivers differ from non-COVID-19 claims?  Page 18
- 3** How do the patterns of medical treatments on COVID-19 claims in the California workers' compensation system compare to those of COVID-19 patients covered by group health insurance in California?  Page 21
- 4** What is the estimated prevalence of long COVID in the California workers' compensation system?  Page 23
- 5** What are the estimated costs of treating long COVID in the California workers' compensation system?  Page 26
- 6** How does the estimated prevalence of long COVID in the California workers' compensation system compare to that among workers covered by group health insurance in California?  Page 27

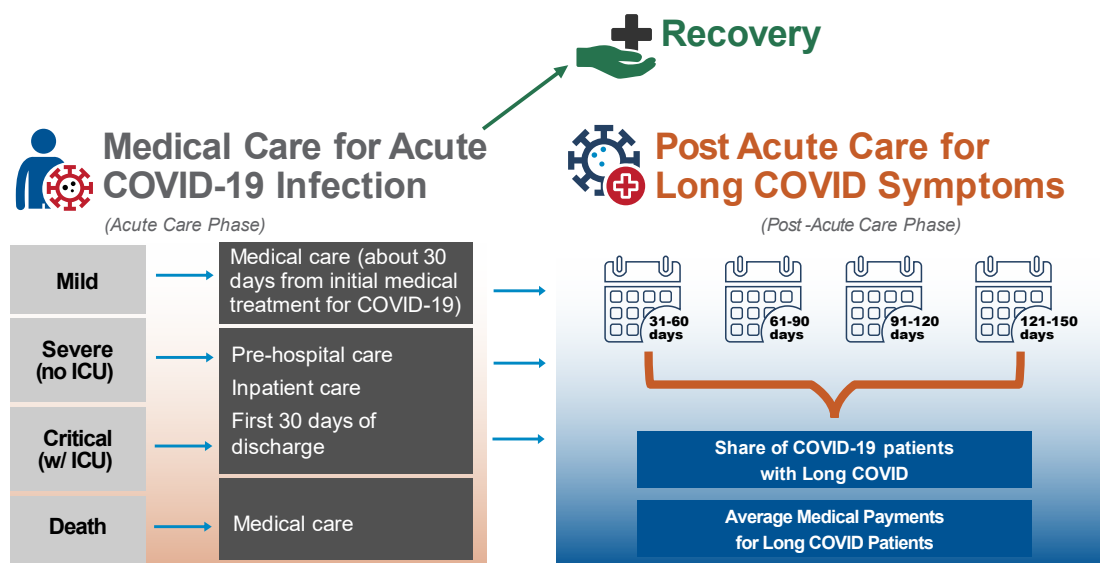
Research Methods

Research Framework

This study analyzed the medical treatments and costs of COVID-19 infections treated in either the workers' compensation or group health insurance system reflecting how COVID-19 impacts patients over time, based on information published by the CDC and other research at the time of this study (Figure 1).¹⁴ Consistent with published research,¹⁵ we categorized COVID-19 claims by infection severity, including mild, severe, critical and death, based on the level of medical care needed and patient outcome. We defined mild COVID-19 claims as those that did not require hospitalization, severe claims as those that required hospitalization but without an intensive care unit (ICU) stay, and critical claims as those that required hospitalization and ICU care. Death claims were those that resulted in fatality. Some death claims involved hospitalization, and in other cases they did not receive hospital care.

Medical care for the acute phase of COVID-19 infection for all infection types starts with an initial diagnosis of COVID-19 on the first medical visit. Acute care for mild infections was defined as medical treatments provided in the first 30 days. For severe and critical infections, acute care included pre-hospital medical care, inpatient care and medical treatments provided through the first 30 days following hospital discharge. Post-acute care for long COVID symptoms was defined to start after the acute care phase.

Figure 1 Framework for Analyzing COVID-19 Medical Treatment and Costs and Long COVID



Datasets

This study analyzed a sample of COVID-19 workers' compensation claims that had an accident date between March 2020 and March 2021 reported with paid transactions in both the WCIRB indemnity and medical transaction databases¹⁶ as of January 7, 2022. COVID-19 claims in the workers' compensation system were defined for the purposes of this study as those reported with a Cause of Injury or Nature of Injury Code 83 in the WCIRB's indemnity transaction data.¹⁷ We also analyzed non-COVID-19 claims reported in the WCIRB's indemnity and medical transaction databases with an accident date during the same period as the COVID-19 claims in the study. We analyzed paid medical services provided between March 2020 and December 2021 for both COVID-19 and non-COVID-19 claims as of January 7, 2022. Denied claims were excluded from the analysis.

¹⁴ Nasserie T, Hittle M, Goodman SN. Assessment of the Frequency and Variety of Persistent Symptoms Among Patients With COVID-19: A Systematic Review. *JAMA Netw Open*. 2021 May 3;4(5):e2111417; <https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/index.html>.

¹⁵ Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. *JAMA*. 2020;323(13):1239–1242.

¹⁶ The WCIRB medical transaction data reflects approximately 92% of the experience of insured employers in California and includes medical payments made to the providers. The data does not include: (a) medical payments made directly to injured workers; or (b) payments made to any known third-party who may be assigned medical management. The WCIRB indemnity transaction data reflects approximately 83% of the experience of insured employers in California based on eligibility and business exclusions. The indemnity transaction data includes workers' compensation claims reported with any payments or no payments. Both medical only and indemnity claims are reported in the indemnity transaction data. Death claims in the WCIRB indemnity transaction data were those with a valid death date and represent workers with active claims that died, but the deaths may not be compensable.

¹⁷ 83 in the Cause of Injury/Nature of Injury Code is designated for COVID-19 infection.

To compare patterns of COVID-19 medical treatment in the workers' compensation system with those covered by group health insurance in California, we analyzed de-identified COVID-19 patient data in the IBM® MarketScan® Research Databases, including Commercial Claims and Encounters Database and Medicare Supplemental and Coordination of Benefits Database (together referred to as "group health data" subsequently in the report). The group health data includes medical claims and medical service billing information of a large sample of patients with group health insurance plans in California between 2016 and 2020. The group health data was reported by health insurers and self-insured employers. The data includes individuals employed by mostly large employers and insured or administered by one of the large group health insurance plans. The group health data does not include Medi-Cal data but does include medical data on a sample of Medicare-eligible California workers receiving both Medicare benefits and employer-sponsored health insurance coverage.

COVID-19 patients in the group health data were defined as those with at least one paid medical service with an International Classification of Diseases (ICD) code for COVID-19 (U07.1) between March and December 2020. We further defined COVID-19 patients who were hospitalized as those with an inpatient diagnostic-related group (DRG) code for respiratory or viral infections (Table A1 in the Appendix).¹⁸ This approach focuses our analysis on patients admitted for COVID-19 as the primary diagnosis. Given that workers' compensation claims are typically filed by active workers, we limited the group health data to workers with ages 16 and above with active employment in 2020 to create a more comparable study sample.¹⁹ To compare with COVID-19 medical care provided in the workers' compensation system for claims in our study, we analyzed paid medical services provided for COVID-19 and long COVID symptoms (described in the next section) between March 2020 and December 2020 for COVID-19 patients in the group health data as of May 2021.²⁰

The group health data includes pre-pandemic longitudinal data of COVID-19 patients, such as paid medical services and the ICD code of the medical conditions that were treated. Using the pre-pandemic information of the COVID-19 patients from 2018 through February 2020, we identified those with any underlying comorbidities associated with higher risk for severe COVID-19 based on the list of comorbidities published by the Centers for Disease Control and Prevention (CDC).²¹

In both datasets, we identified the level of COVID-19 infection severity, including mild, severe, critical and death, based on primarily medical procedure code information.²² To facilitate comparison between COVID-19 patients treated in the workers' compensation system and those treated in the group health insurance system, we generally used the same methods to categorize claims into mild, severe, critical and death groups. However, due to different data reporting requirements, we used slightly different methods to identify COVID-19 deaths in the two datasets. In the workers' compensation data, we used the death information reported in the WCIRB indemnity transaction data.²³ In the group health data, COVID-19 deaths were identified using discharge status information reported in the health insurance claim form (UB-04 form).²⁴

Methods for Analyzing Long COVID

This study followed the definition of long COVID developed by the U.S. National Institutes of Health (NIH). The technical term for long-term effects of SARS-CoV-2 is post-acute sequelae of SARS-CoV-2 infection (PASC) (referred to as long COVID subsequently in the report).²⁵ According to the NIH, long COVID encompasses two types of symptoms: (1) symptoms that persist for weeks or even months after the acute phase of illness has passed and (2) new symptoms and findings that have emerged after the acute infection. We identified these ongoing and new symptoms after the acute COVID-19 infection using ICD information on the medical service record and therefore captured only those that were medically treated. Specifically, we developed a mapping of ICD codes and long COVID symptoms published at the time of this study by the CDC (Table A2 in the Appendix).²⁶ Given that our approach relies on ICD information, our estimates of long COVID symptoms are subject to the availability of ICD information and may change as more data becomes available. Also, categories for long COVID symptoms that we analyzed were primarily based on the organ systems impacted and do not represent a precise counting of different ICD codes involved in the treatment of a long COVID patient. The categories of long COVID symptoms, therefore,

18 See Table A1 in Appendix for the list of DRG codes used to define hospitalized COVID-19 patients.

19 The group health data has information on employment status for each patient. This study limited the study sample to patients with active full-time, part-time, or seasonal employment in 2020. The group health data also includes medical claims and billing information for spouse and dependents, and only those that met the age (ages 16 and above) and active employment criteria were included in the analysis.

20 Because the group health insurance plans typically cover medical treatments for all health concerns, our analysis of the group health data excluded medical services for non-COVID-19 illnesses so as to create a valid comparison of treatment patterns for COVID-19 patients between the group health insurance and workers' compensation systems.

21 CDC's information on underlying medical conditions associated with higher risks of severe COVID-19. <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html>.

22 Claims that required hospitalization (severe, critical and some death claims) were identified using Diagnostic-Related Group (DRG) code, Revenue code and Inpatient Current Procedural Terminology (CPT) code.

23 Claims with a valid death date in the WCIRB indemnity transaction data represent workers with active claims that died, but the deaths may not be compensable.

24 The UB-04 form, also known as the Form CMS-1450, is the uniform institutional provider claim form suitable for hospitals to use in billing payers.

25 NIH's factsheet on post-acute sequelae of SARS-CoV-2 Infection (PASC). https://recovercovid.org/docs/pasc_initiative_fact_sheet.pdf.

26 CDC's information on post-COVID conditions. <https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/index.html>.

only approximate different health complications of COVID-19. In addition, given that the group health data used in the study includes pre-pandemic data for the COVID-19 patients and some long COVID symptoms (e.g., cough, fatigue, chest pain) are non-specific and can be shared by many other health conditions, we excluded the symptoms that were treated before the COVID-19 infection from the long COVID analysis of the group health data.

Patients with long COVID who originally contracted mild COVID-19 were defined as those with treatment of any long COVID symptoms after the first 30-day period following the first medical visit, and patients with long COVID who originally contracted severe or critical COVID-19 were defined as those with treatment of any long COVID symptoms after 30 days from the hospital discharge. This study analyzed the prevalence of long COVID by the share of COVID-19 patients who received care for any long COVID symptoms after the acute care phase. Medical costs of treating long COVID in the workers' compensation system were analyzed using the average payments for medical treatments of long COVID symptoms and for other services (such as medical-legal evaluation) during the post-acute period per claim.

It is important to note that the datasets used for the long COVID analysis in both the workers' compensation system and group health insurance system include claims and medical billing data, which only capture paid medical services for long COVID symptoms and does not capture patients with long COVID symptoms that did not receive medical care or received care not covered by either workers' compensation or group health insurance. Therefore, it is likely that the true prevalence of long COVID is higher than reflected in our estimates in both insurance systems, yet the underestimation may be similar in the two systems. In addition, given that the understanding of long COVID will evolve as more long-term data on COVID-19 patients becomes available, we plan to update this long COVID analysis, and the updated results may differ from those presented in this report.

Research Findings

Demographics

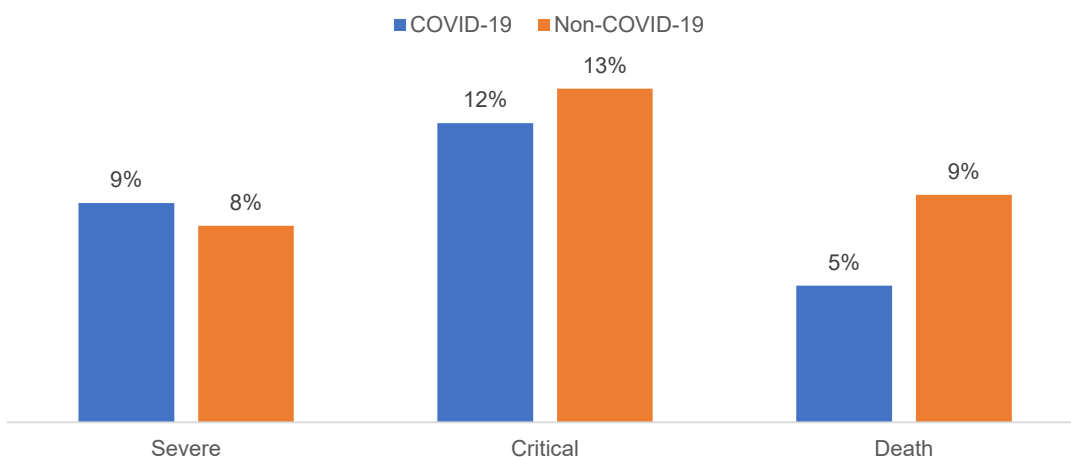
In total, excluding denied claims, almost 6,000 COVID-19 workers' compensation claims with an accident date between March 2020 and March 2021 were reported with paid medical transactions in both the WCIRB's medical transaction and indemnity transaction databases.²⁷ These COVID-19 claims account for about 3% of all workers' compensation claims reported in the WCIRB's medical transaction database during the same period. As shown in Table 1, 90% of these COVID-19 claims involved mild infections and did not require hospitalization, and 8% required hospitalization and had no fatality (4% without ICU care and 4% with ICU care). About 2% of these COVID-19 claims are death claims. In comparison, the vast majority (98.7%) of non-COVID-19 claims did not involve hospitalization and most of the remaining claims involved hospitalization without ICU care. In addition to having a significantly higher hospitalization rate, severe COVID-19 hospital claims also had a higher rate of hospital readmission, while critical and death COVID-19 hospital claims had a lower readmission rate than similar non-COVID-19 hospital claims (Figure 2).

In group health data used in this analysis, workers with COVID-19 infections that received medical care had a somewhat similar distribution of infection severity as those in the workers' compensation system (Table 1). The group health data has a higher share of mild COVID-19 cases. One of the factors leading to this difference is that workers with COVID-19 may have decided to seek care under group health insurance given the emergency nature of the pandemic, particularly in the first few months of the pandemic. In addition, COVID-19 deaths may be underrepresented in the group health data partly because group health insurance plans do not typically provide death benefits and group health claims data do not necessarily have information on death status of the patient.

Table 1 Distribution of COVID-19 and Non-COVID-19 Cases Included in the Study²⁸ by Disease Severity

	COVID-19 Workers' Compensation Claims (N = 5,877)	Non-COVID-19 Workers' Compensation Claims (N = 202,296)	California COVID-19 Group Health Patients (N = 25,071)
Mild (no Hospitalization)	90%	98.7%	96%
Severe (hospitalization, no ICU)	4%	0.9%	2%
Critical (with ICU care)	4%	0.3%	2%
Death	2%	0.1%	1%

Figure 2 Readmission Rate in the Workers' Compensation System²⁹



²⁷ COVID-19 claims reported to the WCIRB for purposes of this study were defined as COVID-19 claims reported in the First Report of Injury (FROI) data in the WCIRB indemnity transaction database as of January 7, 2022. COVID-19 claims reported in the WCIRB medical transaction database had medical payments and were a subset of all COVID-19 claims reported to the WCIRB.

²⁸ Both COVID-19 and non-COVID-19 claims were those with an accident date between March 2020 and March 2021 and that were reported with paid medical transactions to both the WCIRB medical transaction and indemnity transaction databases. COVID-19 patients in the group health data were those that had at least one medical treatment with a COVID-19 diagnosis (ICD code U07.1) between March 2020 and December 2020.

²⁹ For both COVID-19 and non-COVID-19 death claims, only those that involved hospitalization were included in the chart.

Consistent with published information, worker age was associated with COVID-19 severity in both workers' compensation and group health (Figure 3 and Figure 4). The association between worker age and COVID-19 severity was much stronger than for non-COVID-19 workers' compensation injuries (Figure 3). About 96% of the mild COVID-19 claims were reported by workers between ages 16 and 64 which is similar to that of mild non-COVID-19 claims. For severe and critical COVID-19 claims, about one-half were reported by workers between ages 50 and 64, higher than the share of non-COVID-19 claims that involved hospitalization (less than 40%). For death claims, over a quarter of COVID-19 claims were reported by workers over age 65 compared to about 15% for non-COVID-19 claims. For group health insurance patients, the age distributions for mild, severe and critical COVID-19 infections were similar to those in the workers' compensation system (Figure 4). There is a lower share of COVID-19 deaths for workers over age 65 in group health, potentially driven by an underrepresentation of deaths in the group health data.

Figure 3 Age Distribution of Injured Workers in the Workers' Compensation System by Disease Severity

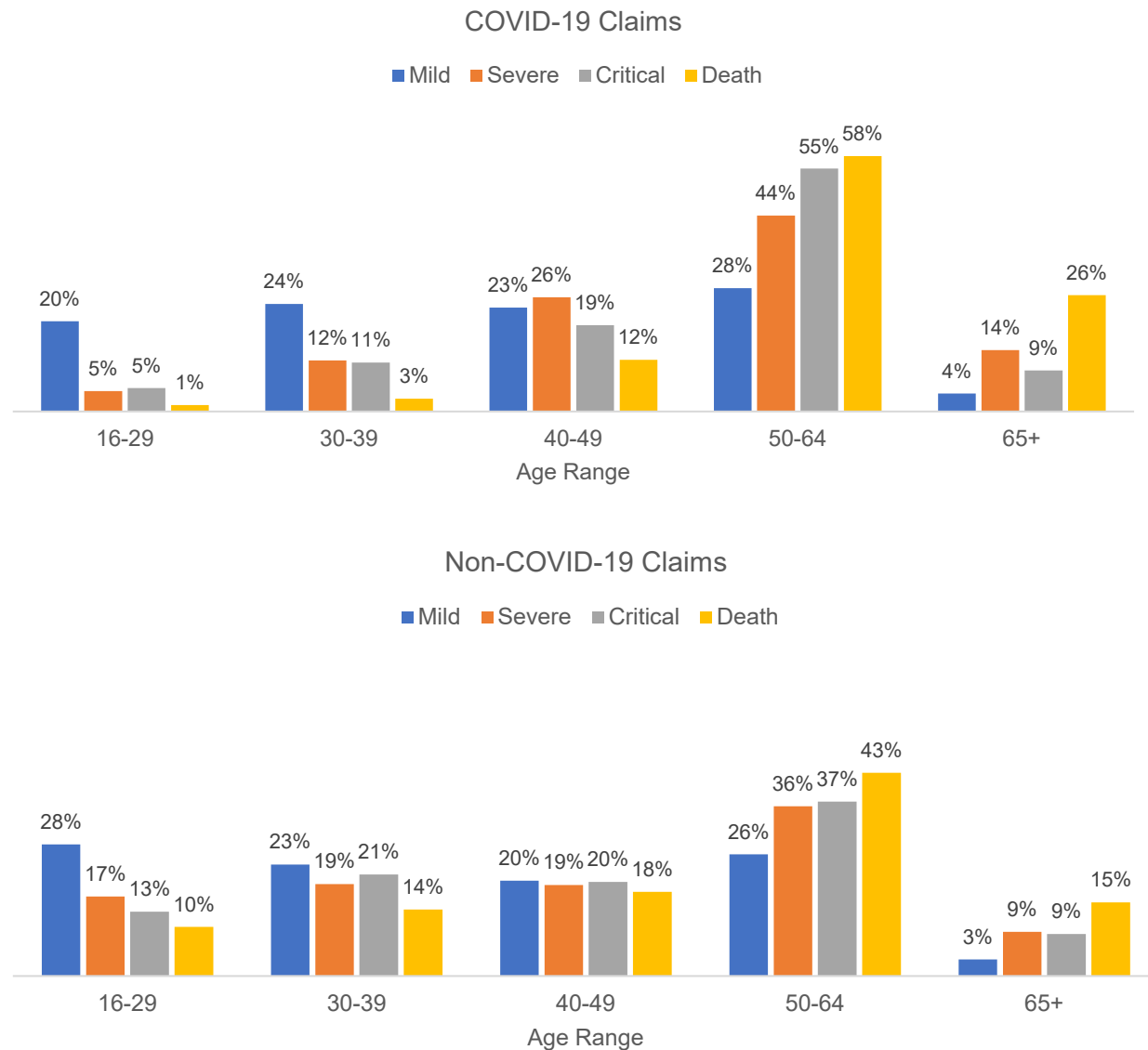
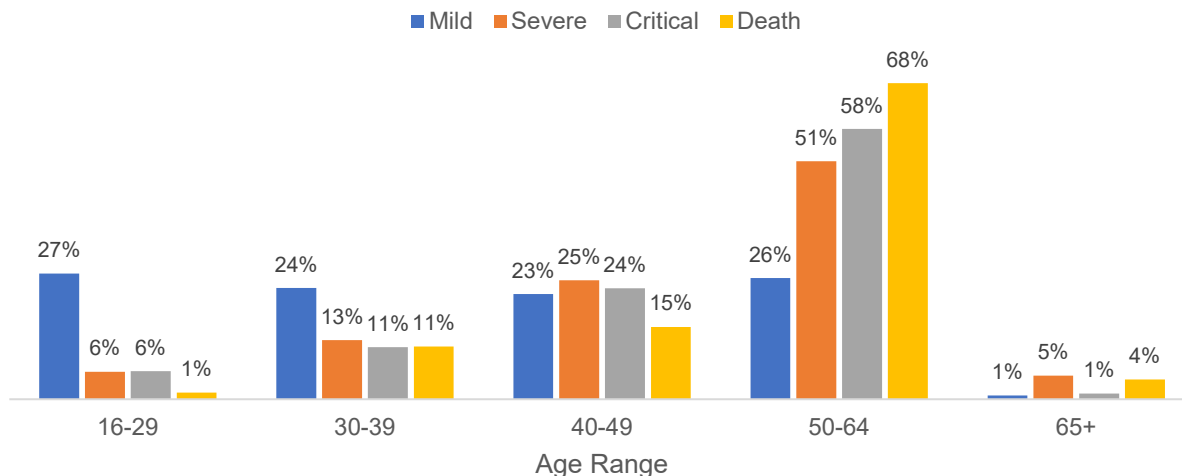
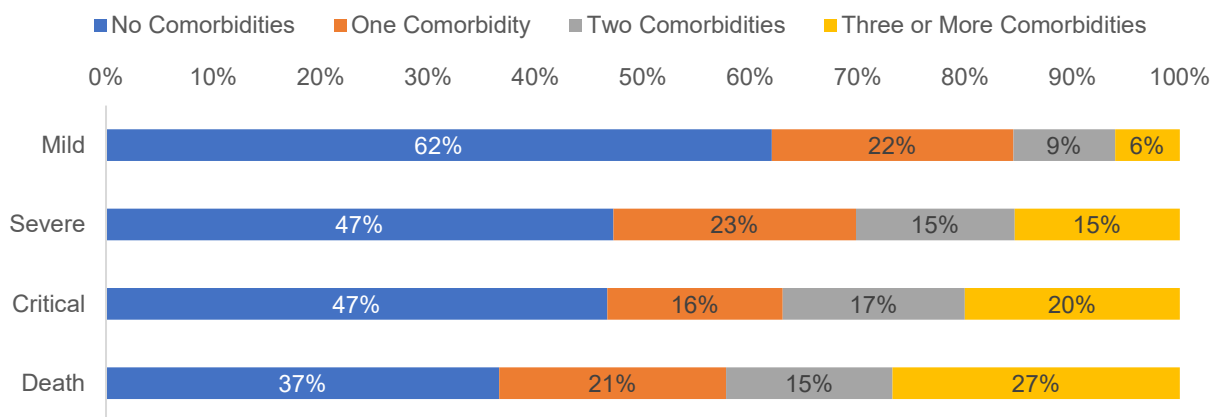


Figure 4 Age Distribution of California Workers Who Utilized Group Health Insurance for COVID-19 Care



Patients with certain comorbidities, such as hypertension, obesity and diabetes, are more likely to get severely ill from COVID-19.³⁰ The COVID-19 treatments of these patients tend to be more complex and costly. While we do not have reliable information on pre-injury health status for workers filing COVID-19 claims in the workers' compensation system, we were able to analyze the comorbidity information of workers in the group health data to gain a better understanding of the potential cost impacts of comorbidities on all COVID-19 claims (Figure 5). Less than 40% of the group health patients with mild COVID-19 infections had any comorbidities compared to more than 50% of patients with more severe infections. In addition, the number of comorbidities being treated appears to correlate with infection severity. The leading types of comorbidities of these COVID-19 patients include hypertension, obesity, diabetes and certain lung conditions (Figure A1 in the Appendix).

Figure 5 Distribution of Pre-Existing Comorbidities for COVID-19 Patients Who Utilized Group Health Insurance for COVID-19 Care³¹



³⁰ Coronavirus Disease 2019 Hospitalizations Attributable to Cardiometabolic Conditions in the United States: A Comparative Risk Assessment Analysis. O'Hearn M, Liu J, Cudhea F, Micha R, Mozaffarian D. *J Am Heart Assoc.* 2021 Feb;10(5):e019259; <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html>.

³¹ Group Health COVID-19 patients with comorbidities were identified using the pre-pandemic medical treatment and ICD information from 2018 through February 2020. The types of comorbidities we identified were those that associated with higher risk for severe COVID-19 based on the list of comorbidities published by the CDC at the time of this study. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/underlyingconditions.html>.

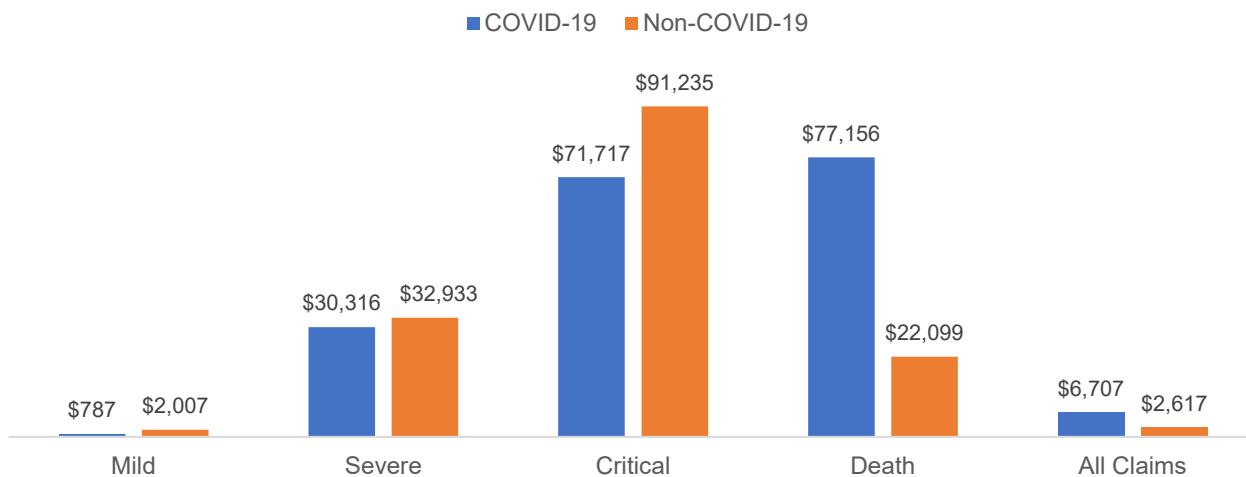
Medical Treatments and Costs of COVID-19 Claims

Research Question 1: What are the cost and treatment patterns of COVID-19 claims in the California workers' compensation system? How do these patterns differ by infection severity (mild, severe, critical and death)? How do these patterns differ from non-COVID-19 claims?

Research Questions

During the first 6 months of medical treatment, the average medical payments on COVID-19 claims increase as infections become more severe, a pattern that is expected and comparable to severities of non-COVID-19 claims. The overall average medical payments on COVID-19 claims, however, were almost two times higher than those on non-COVID-19 claims, mostly driven by a relatively high share (10%) of COVID-19 claims that involved hospitalization and death compared to non-COVID-19 claims (about 1%) (Figure 6 and Table 1).

Figure 6 Six-Month Average Medical Payments for COVID-19 and Non-COVID-19 Claims³²



The comparison of claims of similar levels of disease severity yields a different pattern. Specifically, COVID-19 claims generally had lower average medical payments at 6 months than non-COVID-19 claims, except for death claims (Figure 6). The cost differential between COVID-19 and non-COVID-19 claims of similar level of disease severity is partly due to different claim closing rates and different average costs of closed claims. Within 6 months of initial medical treatment, COVID-19 claims tended to close significantly faster than non-COVID-19 claims, while COVID-19 death claims closed more slowly than non-COVID-19 death claims (Figure 7). However, the average costs of closed COVID-19 claims were generally higher than non-COVID-19 claims that were closed during the same time period (Figure 8). Overall, for closed claims, average medical payments on COVID-19 claims were almost two times higher than on non-COVID-19 claims, due to a greater proportion of COVID-19 closed claims involving hospitalization or death.

³² To account for the payment lag in the WCIRB medical transaction data, we calculated the six-month medical severity for claims with accident dates from March 1, 2020 through October 31, 2020. Costs reflect medical payments within six months from the first medical treatment and do not include medical settlement payments.

Figure 7 Share of Closed Claims Within Six Months from the Initial Medical Treatment³³

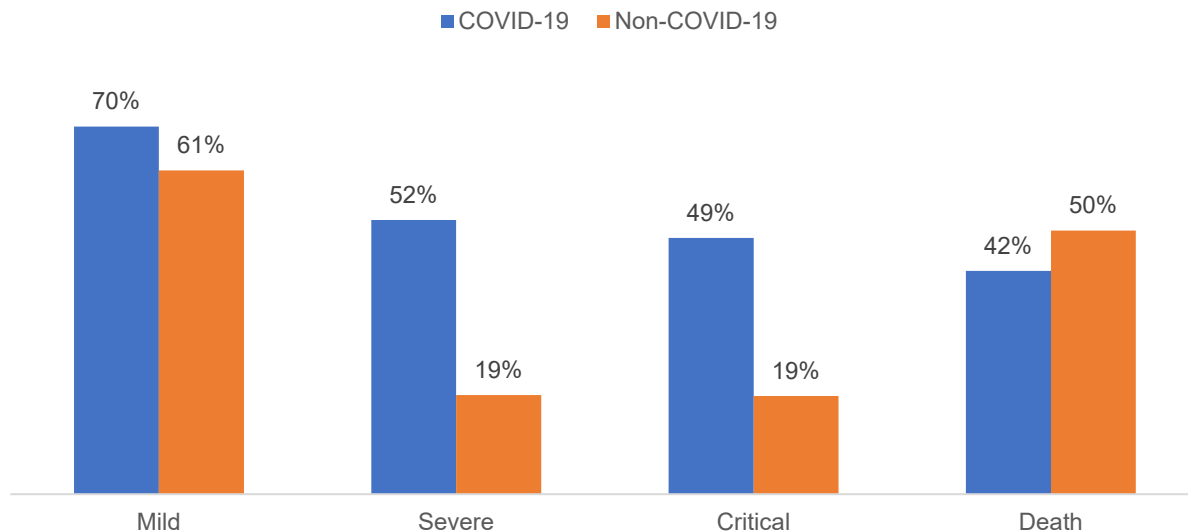
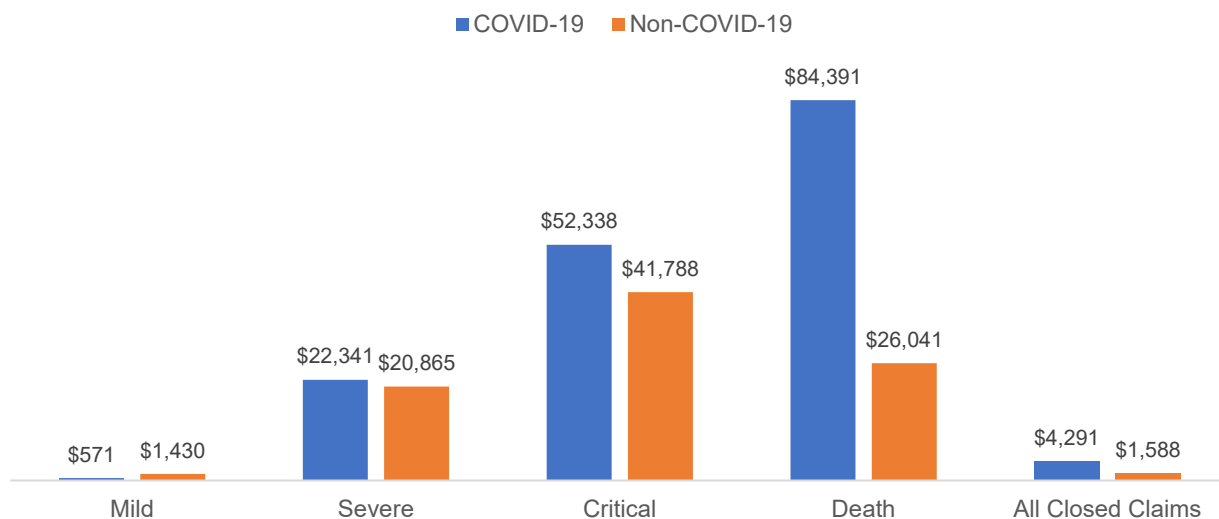


Figure 8 Six-Month Average Medical Payments for Closed Claims³⁴



Excluding death claims, the largest differential in the average claim costs between COVID-19 and non-COVID-19 claims was among mild claims, driven by (1) lower average payments for physician services (such as office visits) on COVID-19 claims, (2) fewer significant medical treatments required by patients with mild COVID-19 infections and (3) relatively limited effective therapeutics for mild COVID-19 infections (Table 2). In addition, mild COVID-19 claims had a higher share of average payments for medical-legal services than non-COVID-19 claims.

³³ Closed claims were identified using the reported claim status information from the WCIRB's indemnity transaction data.

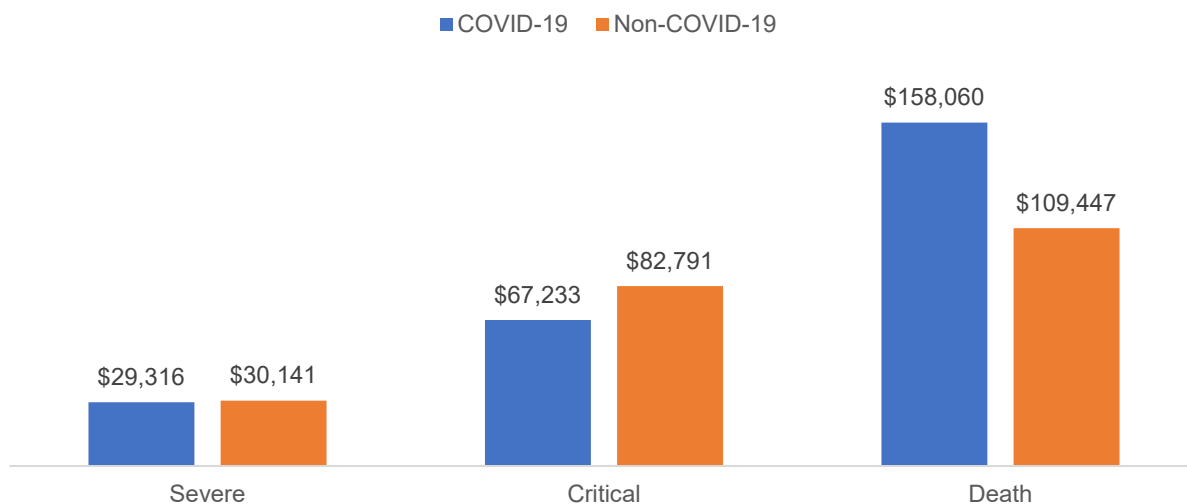
³⁴ To account for the payment lag in the WCIRB medical transaction data, we calculated the six-month medical severity for claims with accident dates from March 1, 2020 through October 31, 2020. Costs reflect medical payments within six months from the first medical treatment through the last medical treatment, and do not include medical settlement payments. Closed claims were identified using the reported claim status information from the WCIRB's indemnity transaction data.

Table 2 Distribution of Average COVID-19 Claim Costs by Service Types During the First Six Months of Medical Treatment

Service Type	COVID-19 Claims				Non-COVID-19 Claims			
	Mild	Severe	Critical	Death	Mild	Severe	Critical	Death
Physician Services	61%	2%	1%	0.1%	73%	10%	5%	6%
Inpatient	-	97%	93%	98%	-	81%	88%	86%
Outpatient	10%	0.3%	2%	0.2%	12%	3%	2%	3%
Pharmaceuticals	2%	0.2%	0.2%	0%	1%	0.4%	0.2%	0.2%
Medical Equipment and Supplies ³⁵	8%	0.3%	3%	0.1%	8%	5%	4%	1%
Medical-Legal	13%	0%	0%	0.5%	2%	0.2%	0%	0%
Other ³⁶	6%	0.2%	0.4%	1%	4%	1%	1%	4%

For severe claims that required hospitalization without ICU care, the average medical payments at 6 months for COVID-19 claims are similar to non-COVID-19 claims (Figure 6). However, the average medical payments on critical COVID-19 claims were lower than on non-COVID-19 claims, mostly due to lower (about 19%) average costs for hospital stays (Figure 9). The contrast in inpatient costs for these critical claims appears reasonable given that non-COVID-19 claims can involve a wide range of serious medical conditions, including significant trauma that may require more intensive medical treatments. For death claims, COVID-19 claims had significantly higher average medical payments, partly due to a higher share of death claims involving hospitalization and higher inpatient costs, than non-COVID-19 claims. As shown in Figure 9, the average inpatient costs were 44% higher on COVID-19 death claims than on non-COVID-19 claims. The potential drivers of higher inpatient costs for COVID-19 death claims that required hospitalization are discussed in the next section.

The cost of inpatient care on COVID-19 claims involving hospitalization account for more than 90% of the total medical costs paid during the first six months of medical treatment, which is higher than the share of payments for non-COVID-19 claims (Table 2). The higher payment share for inpatient care on COVID-19 claims was likely driven by the unique prognosis of COVID-19 and the level of intensive medical care needed particularly in the absence of effective therapeutics during the early months of the pandemic.

Figure 9 Average Payments for Inpatient Care³⁷ for Severe, Critical and Death Claims

³⁵ Medical equipment was identified using Healthcare Common Procedure Coding System (HCPCS) codes and represent products, supplies, and services not included in the CPT codes, such as ambulance services and durable medical equipment, prosthetics, orthotics, and supplies (DMEPOS) when used outside a physician's office.

³⁶ Other services include copy services, dental services, medical liens and other unclassifiable services.

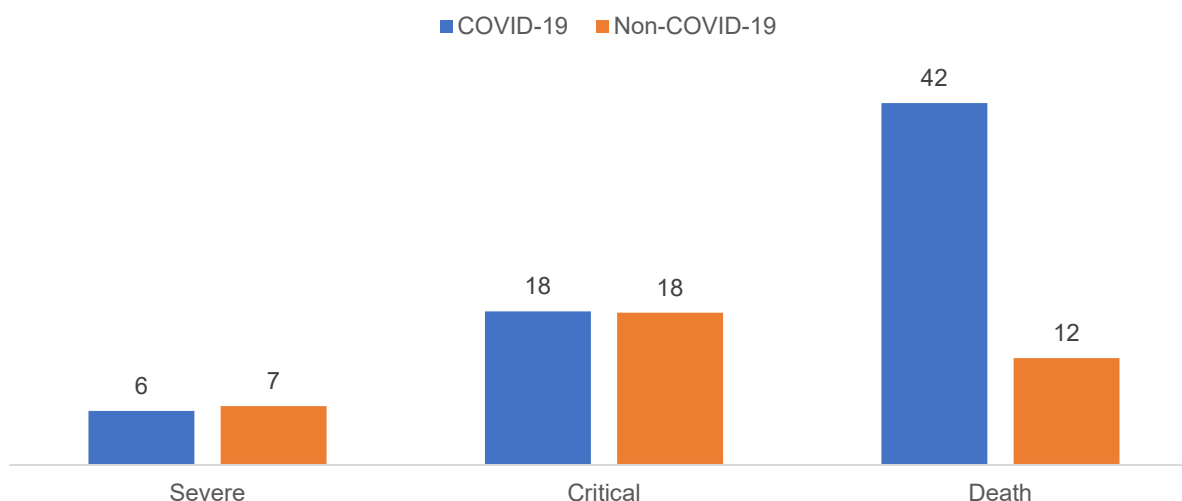
³⁷ To account for the payment lag in the WCIRB medical transaction data, we calculated the hospital payments for claims with accident dates from March 1, 2020 through October 31, 2020. Hospital payments were calculated as the medical payments for diagnostic-related procedures (DRGs), inpatient room and board charges or inpatient physician services. For death claims, only those who had hospital care were included in the chart.

Research Question 2: What are the key drivers for the medical severity of COVID-19 claims? How do these drivers differ from non-COVID-19 claims?

Research Questions

As discussed in the previous section, at 6 months from the initial medical treatment, COVID-19 claims involving hospitalization had much higher average costs than claims that did not require hospitalization. One key cost driver for hospitalization is length of hospital stay. As shown in Figure 10, critical claims for both COVID-19 and non-COVID-19 injuries tended to involve, on average, a longer hospital stay than the respective severe claims, which, by definition, did not include an ICU stay. In comparison to non-COVID-19 claims, COVID-19 claims involved a similar duration of hospital stay, except for death claims. COVID-19 death claims had an inpatient stay that was on average almost 3 times longer than for non-COVID-19 death claims, which often involved a very serious traumatic injury.

Figure 10 Average Hospital Length of Stay (Days) for COVID-19 Claims that Involved Hospitalization



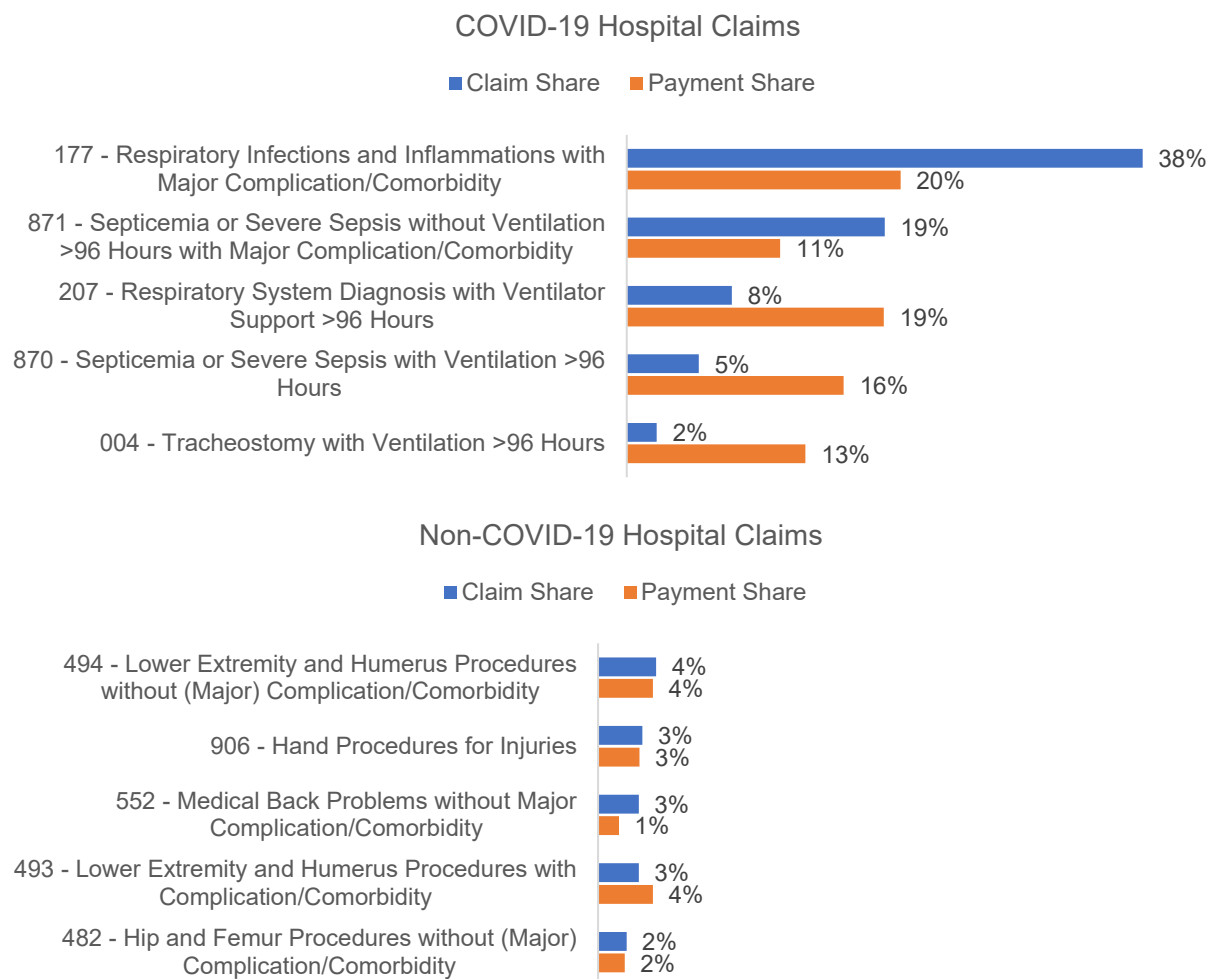
Another key factor driving inpatient cost differentials between COVID-19 and non-COVID-19 claims are differences in the diagnoses that underlie the medical treatment. For inpatient procedures, diagnostic-related groups (DRGs) relate the severity of a patient's illness and complexity of treatments to the costs incurred by the hospital.³⁸ Not surprisingly, the top five DRGs differ for COVID-19 hospital claims and non-COVID-19 hospital claims as workers with COVID-19 were primarily admitted for respiratory infection or diseases,³⁹ while other injured workers were admitted for various types of workplace injuries that required very different inpatient procedures (Figure 11).⁴⁰ More than 70% of COVID-19 hospital claims had one of the top five DRGs related to respiratory diseases, which together account for about 80% of the hospital payments for these claims. Only about 14% of non-COVID-19 hospital claims had any of the respiratory infection inpatient procedures that are common for COVID-19 claims.

³⁸ The DRGs are the basis of Medicare's hospital reimbursement also used for the workers' compensation and group health systems. [https://www.cms.gov/icd10m/version37-fullcode-cms/fullcode_cms/Design_and_development_of_the_Diagnosis_Related_Group_\(DRGs\).pdf](https://www.cms.gov/icd10m/version37-fullcode-cms/fullcode_cms/Design_and_development_of_the_Diagnosis_Related_Group_(DRGs).pdf).

³⁹ DRG Definitions Manual by Centers for Medicare & Medicaid Services. https://www.cms.gov/icd10m/version37-fullcode-cms/fullcode_cms/P0001.html.

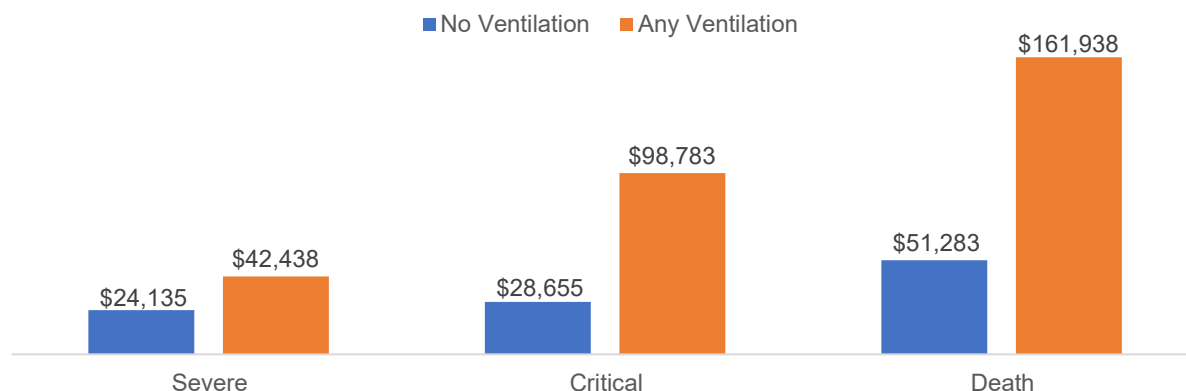
⁴⁰ We included only severe, critical and death hospital claims with valid DRG transactions (about 70% of COVID-19 hospital claims and 80% of non-COVID-19 hospital claims) in the DRG analysis.

Figure 11 Top Five Diagnostic-Related Groups for COVID-19 Hospital Claims and Non-COVID-19 Hospital Claims⁴¹



COVID-19 patients who were critically ill and in need of ICU care were more likely to require ventilator support than other ICU patients. In the workers' compensation data used in the study, almost 40% of critical COVID-19 claims involved ventilator support for an extended period (> 4 days), double the share of severe claims that required ventilator support. Hospital stays for COVID-19 are more expensive when ventilator support is required. As shown in Figure 12, on average, critically ill COVID-19 patients who needed ventilator support incurred about 3.5 times the inpatient costs than those that did not require a ventilator. The cost differential is similar for COVID-19 deaths.

Figure 12 Payments for Hospital Admissions for COVID-19 by Ventilator Support⁴²

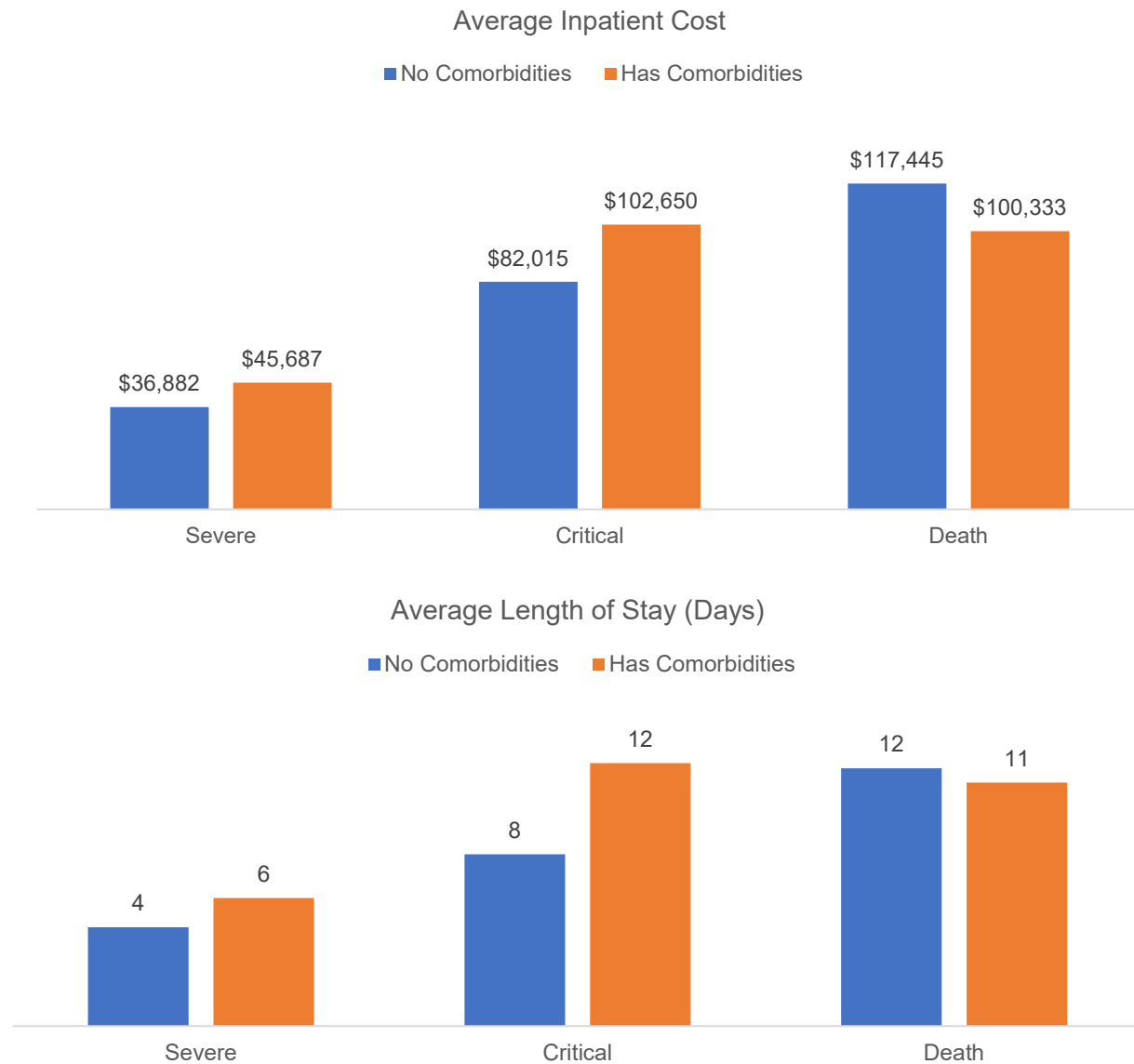


⁴¹ We included only severe, critical and death hospital claims with valid DRG transactions (about 70% of both COVID-19 hospital claims and 80% of non-COVID-19 hospital claims) in the DRG analysis.

⁴² Ventilator support was identified based on the inpatient procedure codes (DRG code), so the chart includes only hospital claims with valid DRG transactions.

While we do not have reliable information on comorbidities for workers who were treated for COVID-19 in the workers' compensation system, we analyzed the group health data to compare the average payments for inpatient care for COVID-19 patients with comorbidities to those without (Figure 13). For both severe and critical COVID-19 infections, the presence of comorbidities is associated with higher average inpatient costs (about 25%) and a longer hospital stay. The pattern is different for COVID-19 infections resulting in death, potentially due to a slightly shorter hospital stay for those with comorbidities. The association between comorbidities and inpatient costs observed for workers covered by group health insurance is likely similar to that in the workers' compensation system.

Figure 13 Average Payments for Hospital Admissions and Length of Stay for Group Health COVID-19 Patients by Comorbidity

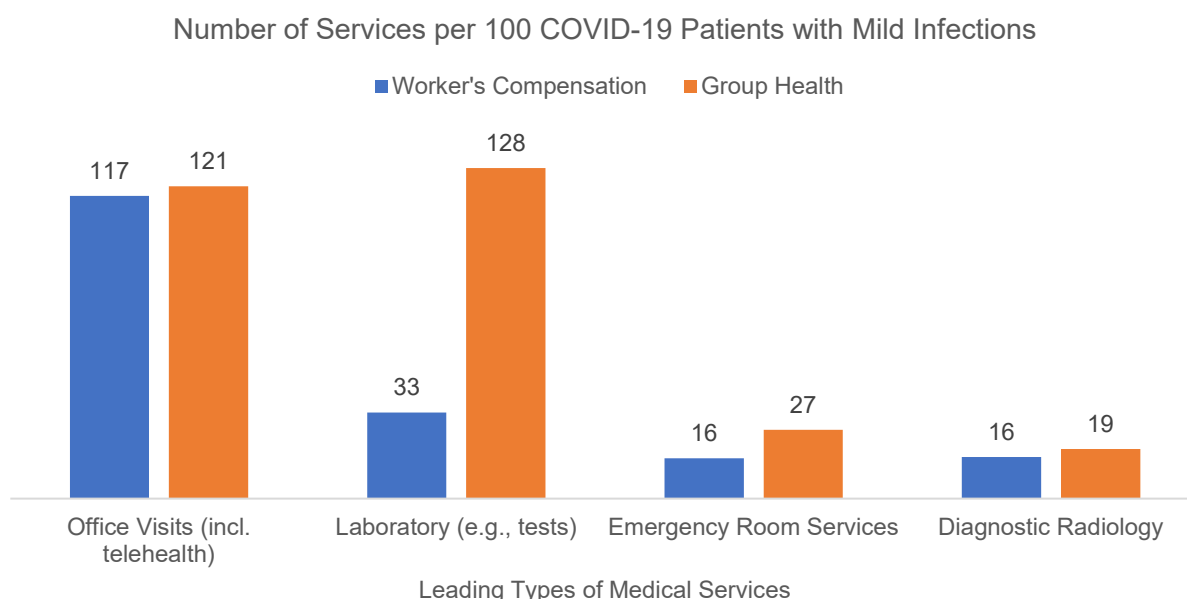


Research Question 3: How do the patterns of medical treatments on COVID-19 claims in the California workers' compensation system compare to those of COVID-19 patients covered by group health insurance in California?

Research Questions

During the first six months of medical treatment, the mix of medical services provided to workers with mild COVID-19 is generally similar between workers' compensation and group health insurance. As shown in Figure 14, in both insurance systems, on average, each patient had at least one office visit for COVID-19 during the first six months. Laboratory services, including COVID-19 tests, were utilized more under group health insurance. This is not surprising as COVID-19 tests have been free of charge to patients and relatively easy to access in group health. Also, workers with an accepted workers' compensation claim are more likely to have a positive COVID-19 test prior to the claim being filed.

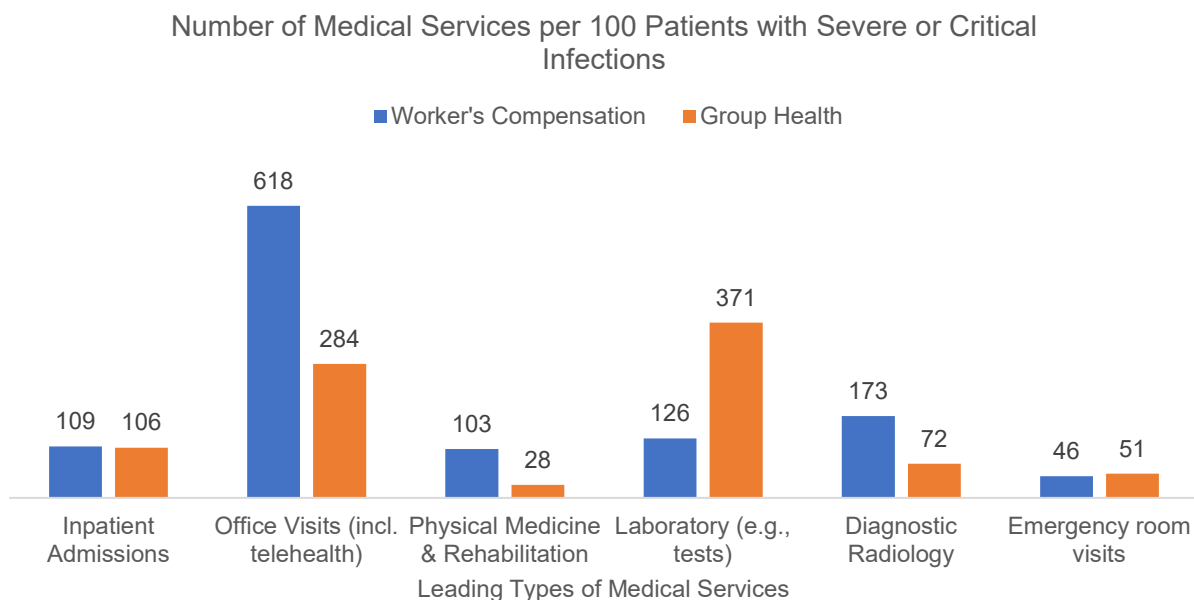
Figure 14 Comparison of Leading Medical Services on Mild COVID-19 Patients During First Six Months of Medical Treatment Between Workers' Compensation and Group Health Insurance



As expected, COVID-19 patients that required hospitalization had a different mix of medical services than those with a mild illness. Inpatient services, as the leading service type, accounted for the majority of medical costs for COVID-19 hospital claims in both insurance systems. As shown in Figure 15, the average number of hospital admissions per 100 patients in group health was similar to the workers' compensation system.

Besides inpatient care, utilization of other leading types of services tended to differ between the two systems. COVID-19 patients requiring hospitalization under group health insurance had more laboratory tests done than those treated in the workers' compensation system. However, COVID-19 patients in the workers' compensation system had significantly more office visits and rehabilitation services. This may be related to the requirements for primary treating physicians to submit periodic progress reports that assess if workers are medically ready to return to work as well as a focus on occupational rehabilitation in the workers' compensation system.

Figure 15 Comparison of Leading Medical Services on Severe or Critical COVID-19 Patients During First Six Months of Medical Treatment Between Workers' Compensation and Group Health Insurance



Early Look at Long COVID in the Workers' Compensation System

Sequelae after an acute COVID-19 infections ("long COVID") have been widely reported and have become a growing concern for health care providers and individuals who have had COVID-19.⁴³ The potential long-term cost impacts of long COVID on healthcare systems and disability insurance programs are also increasingly concerning. For workers who contracted COVID-19, the possibility of having persistent long-term health complications from COVID-19 may mean longer recovery time before returning to work or some level of impairment that affects their ability to perform their pre-illness job tasks. A 2021 study of almost 1,300 COVID-19 survivors in China found that 12 months after the initial diagnosis, only 88% of previously employed individuals had returned to work and not all those returning to work had returned to the previous level of work.⁴⁴ While more long-term data for post-COVID-19 infections is needed to fully understand the impacts of long COVID on workers and the workers' compensation system, we attempted to estimate the prevalence of long COVID and costs of treating long COVID based on the workers' compensation data available at the time of this study (*Research Questions 4 and 5*). We also applied similar research methods to group health data to use the estimates of long COVID in group health as potential validation of our estimates in the workers' compensation system (*Research Question 6*). Since the group health data that we used for the analysis are limited to medical services provided in 2020 and are not sufficiently robust for long COVID cost analysis, we did not compare the cost impacts of long COVID between the two systems.

⁴³ Sudre, C.H., Murray, B., Varsavsky, T. *et al.* Attributes and predictors of long COVID. *Nat Med* 27, 626–631 (2021); Logue JK, Franko NM, McCulloch DJ, et al. Sequelae in Adults at 6 Months After COVID-19 Infection. *JAMA Netw Open.* 2021;4(2):e210830. Groff D, Sun A, Ssentongo AE, et al. Short-term and Long-term Rates of Postacute Sequelae of SARS-CoV-2 Infection: A Systematic Review. *JAMA Netw Open.* 2021;4(10):e2128568.

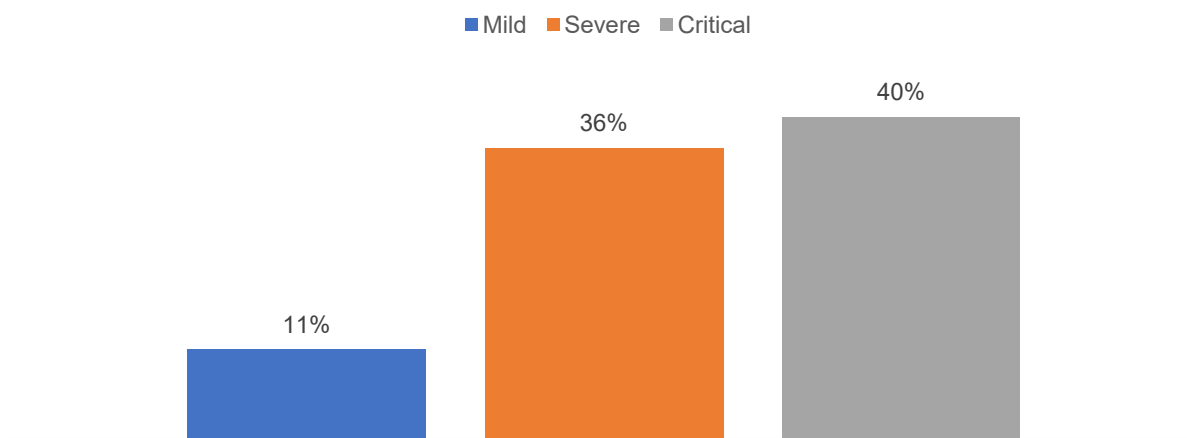
⁴⁴ Huang L, Yao Q, Gu X, et al. 1-year outcomes in hospital survivors with COVID-19: a longitudinal cohort study. *Lancet.* 2021 Aug 28;398(10302):747-758.

Research Question 4: What is the estimated prevalence of long COVID in the workers' compensation system?



Consistent with published research,⁴⁵ in this study, long COVID appears to be more prevalent among COVID-19 claims that involved hospitalization than mild claims. As shown in Figure 16, about 11% of COVID-19 claims with mild infections involved medical treatments for long COVID symptoms on a cumulative basis over four months following acute care, while the estimated share of severe and critical COVID-19 claims receiving treatments for long COVID symptoms over four months was 36% and 40%, respectively.⁴⁶ Claims with potential long COVID were those that involved continuing post-acute care for COVID-19 or any COVID-19 sequelae impacting different organ systems, such as the respiratory, cardiac or neurological system. It is also common for COVID-19 patients to start seeking care several months after acute care, potentially if the persistent symptoms worsened and required medical attention, or if new symptoms emerged. This is part of the reason that the cumulative prevalence of long COVID over four months shown in Figure 16 is slightly higher than the monthly estimates in Figure 17, which represent the share of COVID-19 claims that continued to receive care for long COVID symptoms in each month following acute care.

Figure 16 Estimated Share of COVID-19 Claims with Long COVID Four Months after Acute Care⁴⁷ in the Workers' Compensation System



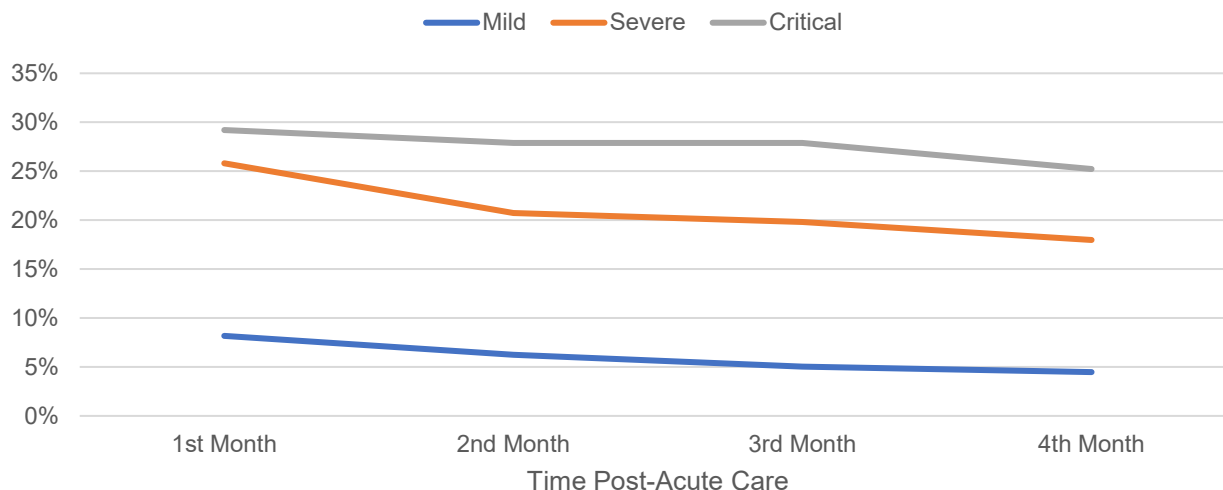
Prevalence of long COVID, however, declined after the acute care phase regardless of the initial severity of COVID-19. As shown in Figure 17, the share of mild COVID-19 claims that received treatment for long COVID symptoms decreased from 8% in the first month to 4% in the fourth month post-acute care. Similarly, the monthly prevalence of long COVID among severe claims decreased from 26% in the first month to 18% in the fourth month. The prevalence of long COVID decreased less rapidly for critical claims, from 29% to 25%, during the same time period.

⁴⁵ Huang L, Yao Q, Gu X, et al. 1-year outcomes in hospital survivors with COVID-19: a longitudinal cohort study. *Lancet*. 2021 Aug 28;398(10302):747-758; Logue JK, Franko NM, McCulloch DJ, et al. Sequelae in Adults at 6 Months After COVID-19 Infection. *JAMA Netw Open*. 2021;4(2):e210830; Carfi A, Bernabei R, Landi F, for the Gemelli Against COVID-19 Post-Acute Care Study Group. Persistent Symptoms in Patients After Acute COVID-19. *JAMA*. 2020;324(6):603-605; Groff D, Sun A, Ssentongo AE, et al. Short-term and Long-term Rates of Postacute Sequelae of SARS-CoV-2 Infection: A Systematic Review. *JAMA Netw Open*. 2021;4(10):e2128568; Sudre, C.H., Murray, B., Varsavsky, T. *et al*. Attributes and predictors of long COVID. *Nat Med* 27, 626-631 (2021).

⁴⁶ Four months after acute care for mild claims are between 31 and 150 days of the initial medical treatment; for severe and critical claims, four months after acute care are between 31 and 150 days of the hospital discharge.

⁴⁷ Four months after acute care for mild claims are between 31 and 150 days of the initial medical treatment; for severe and critical claims, four months after acute care are between 31 and 150 days of the hospital discharge. The percentages represent the shares of COVID-19 claims that had at least one medical visit for long COVID symptom(s) over four months following acute care. A claim with multiple medical visits for long COVID symptoms was counted only once in the calculation for the long COVID prevalence.

Figure 17 Monthly Trend of Long COVID Prevalence in the Workers' Compensation System⁴⁸



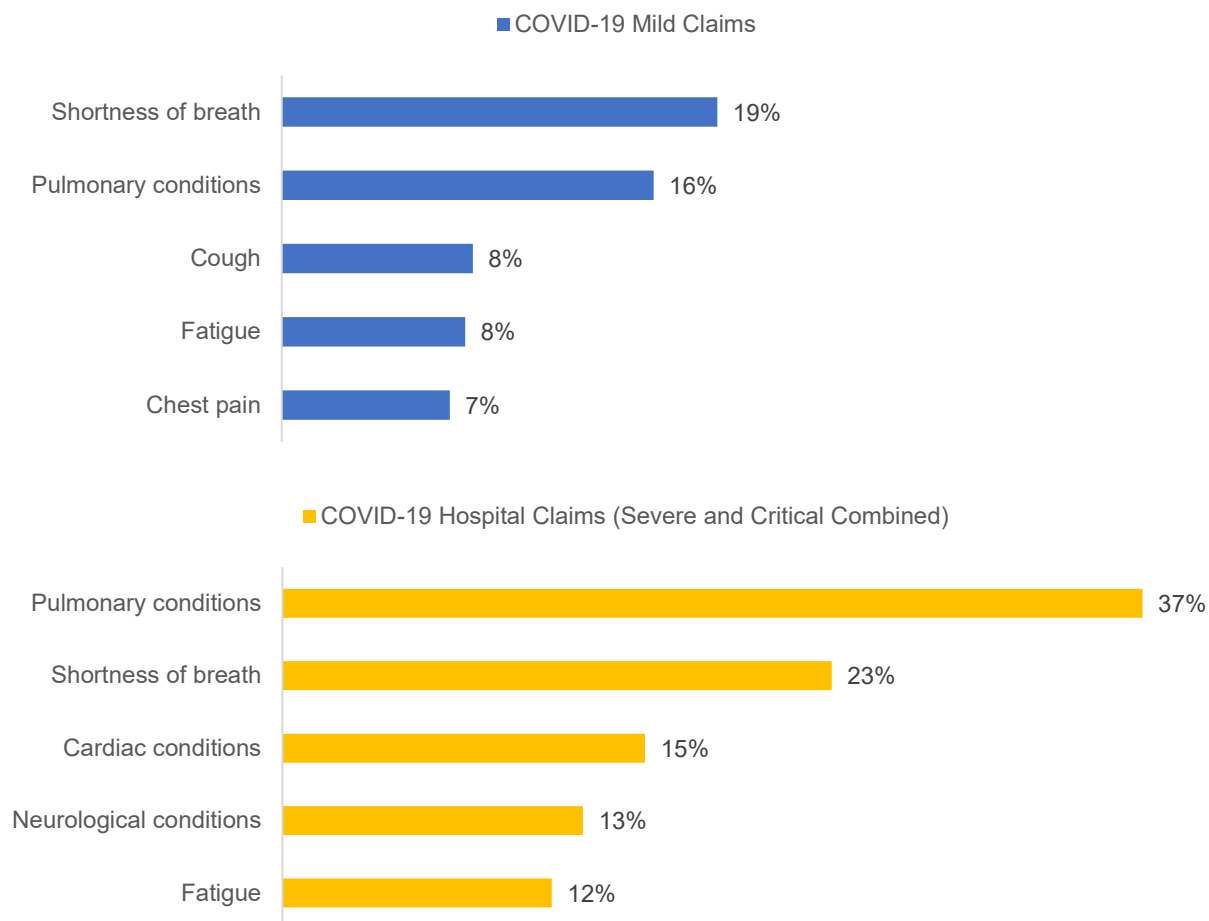
It is important to note that the estimated prevalence of long COVID using the workers' compensation medical transaction data is subject to the availability of ICD information on the reported transactions of medical services. For example, the reporting of pharmaceutical transactions and payments do not always include ICD information. It is possible that workers with an active COVID-19 claim may have experienced long COVID symptoms or taken medication to relieve those symptoms. However, because the database used in the study does not have information on long COVID symptoms that were not treated in the workers' compensation system or consistently reliable ICD information on pharmaceutical transactions, these workers were not identified as being treated for long COVID. Therefore, it is likely that the true prevalence of long COVID among workers who filed a COVID-19 workers' compensation claim is higher than our estimates, as what we captured in the analysis were those with more serious health complications of COVID-19 that warranted significant medical attention.

The long COVID symptoms for which workers received medical treatments in the workers' compensation system ranged from respiratory issues, such as shortness of breath and cough, to multisystem complications, which were more prevalent for patients with severe or critical infections (Figure 18). For workers who previously had a mild infection and subsequently had long COVID over four months following the acute phase, more than a third continued to receive medical care for COVID-19,⁴⁹ almost 20% received medical care for shortness of breath, and about 16% for pulmonary conditions. The array of long COVID symptoms is more severe for COVID-19 patients that were previously hospitalized. For example, about half of discharged patients continued to receive care for COVID-19 at least once over four months, almost 40% received care for pulmonary conditions and about 15% received care for cardiac conditions.

⁴⁸ Post-acute care phase is defined differently for mild, severe and critical infections. For patients with mild infections, post-acute care starts after the first 30 days of initial medical treatment. For patients with severe or critical infections, post-acute care starts after 30 days from the hospital discharge. The monthly estimates represent the share of COVID-19 claims that continued to receive care for long COVID symptoms in each month following acute care. It is possible that a COVID-19 claim was included in some months but not other months in the four-month post-acute period.

⁴⁹ A fraction of COVID-19 claims continued to have paid medical services with an ICD code for COVID-19 (U07.1) after the acute care phase, and for the purpose of this study these claims were counted as those with long COVID.

Figure 18 Leading Types of Long COVID Symptoms Treated on COVID-19 Claims in the Workers' Compensation System⁵⁰



⁵⁰ Long COVID symptoms were identified using ICD information on the medical service record and therefore captured only those that were medically treated. Specifically, we developed a mapping of ICD codes and long COVID symptoms published at the time of this study by the CDC (Table A2 in the Appendix). <https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/index.html>.

Research Question 5: What are the estimated costs of treating long COVID in the California workers' compensation system?

Research Questions

Based on the estimated prevalence of long COVID in the workers' compensation system, we analyzed the average costs of claims potentially involving long COVID over the four months following acute care, the longest post-acute care period for which we have robust data for long COVID analysis at this time. Our data for long COVID analysis is still sparse and this analysis was intended to provide an early look at the cost impacts of long COVID and compare the patterns to those of non-COVID-19 claims.

We compared COVID-19 claims that involved medical treatment for long COVID following acute care to non-COVID-19 claims that continued to have payments for medical treatments during the same time period. For mild claims, the average payments on claims with potential long COVID at four months were lower than on non-COVID-19 claims (Figure 19). These potential long COVID claims share a similar mix of medical services as other non-COVID-19 claims (Table 3). Medical-legal expenses were significantly higher on these potential long COVID claims.

Long COVID data on severe and critical COVID-19 claims were limited, so we combined these claims to estimate the potential cost impacts of long COVID (Figure 19). Claims involving long COVID post hospitalization had higher (about 16%) average medical payments at four months, mostly for home health services, medical equipment (such as portable oxygen support and ambulance services) and outpatient care, including rehabilitation care.

Figure 19 Four-Month Average Payments for COVID-19 Claims with Potential Long COVID and Non-COVID-19 Claims After Acute Care⁵¹

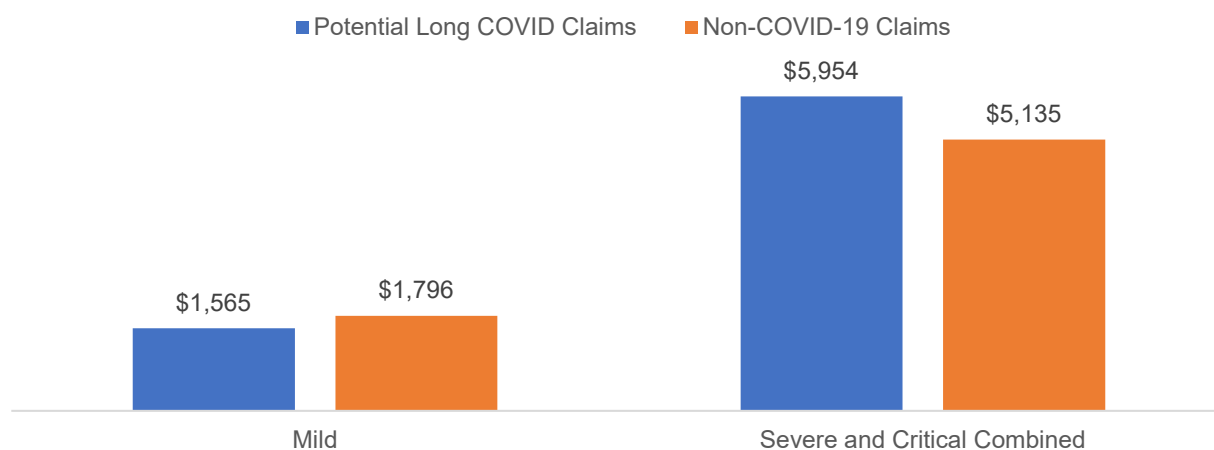


Table 3 Payment Distribution by Service Type for Potential Long COVID Claims and Non-COVID-19 Claims Over Four Months After Acute Care⁵²

Service Types	Potential Long COVID Claims		Non-COVID-19 Claims	
	Mild	Severe and Critical Combined	Mild	Severe and Critical Combined
Physician Services	71%	32%	75%	52%
Pharmaceuticals	3%	4%	1%	2%
Outpatient	3%	25%	10%	12%
Medical Equipment and Supplies ⁵³	5%	36%	7%	27%
Medical-Legal	13%	0%	3%	1%
Other ⁵⁴	4%	4%	4%	6%

⁵¹ Non-COVID-19 claims included in the chart can have various types of workplace injuries and it is possible for non-COVID-19 claims to have an acute care phase that is longer or shorter than that of COVID-19 claims. For our study purpose, we assumed that the post-acute care phase of non-COVID-19 claims is somewhat comparable to COVID-19 claims.

⁵² Post-acute care phase for severe or critical claims was defined after the first 30 days of hospitalization discharge, therefore inpatient services were not part of the medical services for these claims.

⁵³ Medical equipment was identified using Healthcare Common Procedure Coding System (HCPCS) codes and represent products, supplies, and services not included in the CPT codes, such as ambulance services and durable medical equipment, prosthetics, orthotics, and supplies (DMEPOS) when used outside a physician's office.

⁵⁴ Other services include copy services, dental services, medical liens and other unclassifiable services.

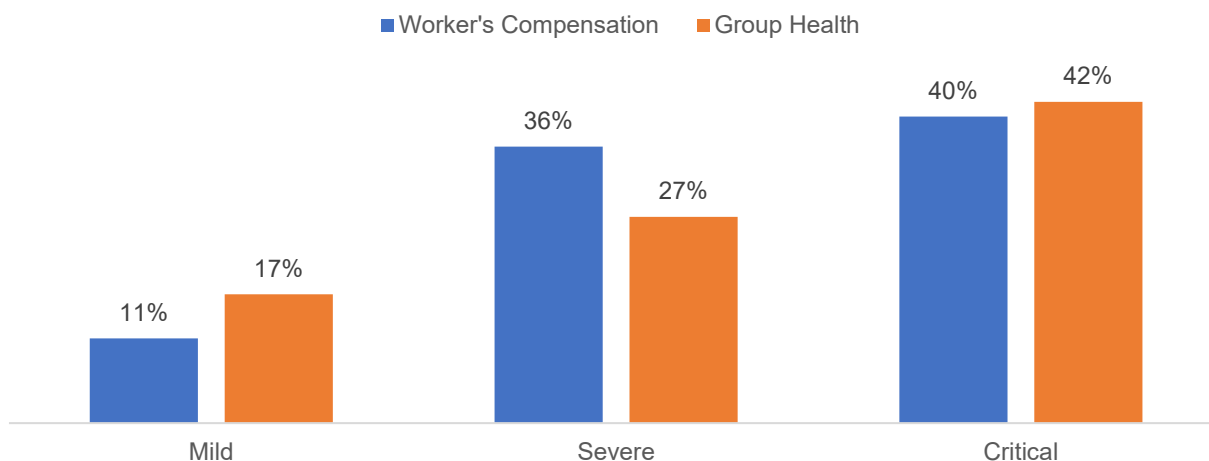
Research Question 6: How does the estimated prevalence of long COVID in the California workers' compensation system compare to that of workers covered by group health insurance in California?

Research Questions

Cumulatively over the four months following acute care, about 17% of COVID-19 group health patients with mild infections received care for long COVID symptoms, higher than the estimated prevalence of long COVID in the workers' compensation system (Figure 20). The higher estimated prevalence of long COVID among workers covered by group health insurance is potentially reflective of many private health insurers voluntarily opting to temporarily waive copayments or deductibles related to COVID-19 care.⁵⁵ Lower levels of cost sharing in group health plans as a result of the temporary changes in private health coverage may affect workers' decisions on whether to seek care in the workers' compensation system if they are fully insured under group health insurance.

For patients with severe or critical infections, the respective estimates of long COVID in group health was similar to the estimates in the workers' compensation system. Despite some differences between workers' compensation and group health insurance, similar estimates in the California worker population between the two insurance systems based on consistent methodologies add confidence to our early estimates of long COVID in the workers' compensation system.

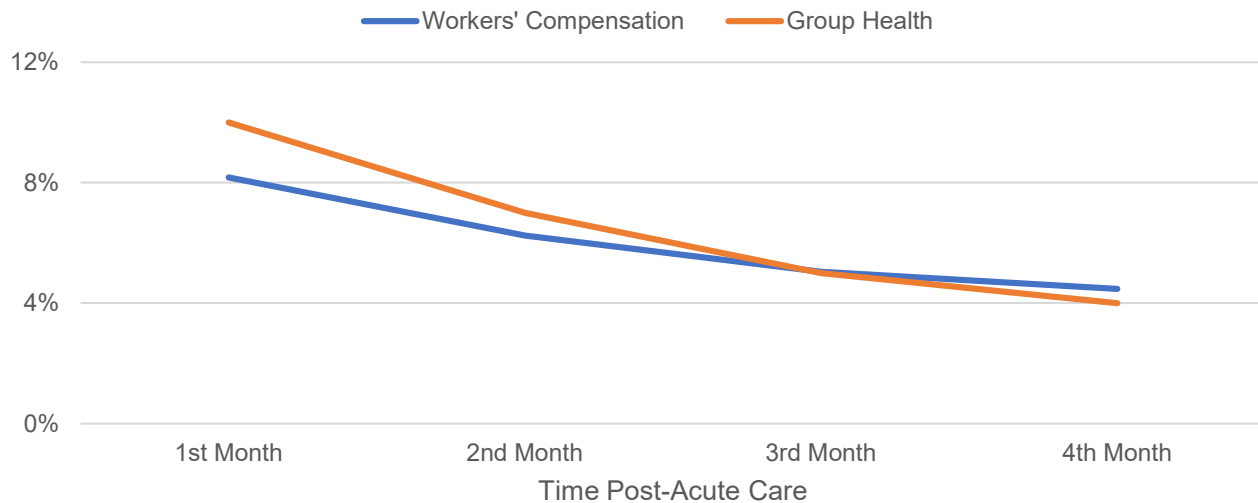
Figure 20 Comparison of the Estimated Prevalence of Long COVID Among COVID-19 Cases Over Four Months Post-Acute Care Between Workers' Compensation and Group Health Insurance



We also compared the monthly trend of long COVID prevalence. For patients with mild COVID-19, despite a slightly higher share of long COVID in the first month after acute care under group health insurance, the prevalence of long COVID in both insurance systems declined over the four-month period. The rate of decline was similar between workers' compensation and group health insurance. As shown in Figure 21, 10% of patients with mild COVID-19 infections treated under group health insurance received treatment for long COVID in the first month, and the share dropped to 4% in the fourth month. In comparison, the prevalence of long COVID in the California workers' compensation system dropped from 8% to 4% during the same period.

⁵⁵ Cost-sharing waivers and premium relief by private plans in response to COVID-19. Research Brief. August 20, 2020. Peterson Center on Healthcare and Kaiser Family Foundation; <https://www.healthsystemtracker.org/brief/cost-sharing-waivers-and-premium-relief-by-private-plans-in-response-to-covid-19/>.

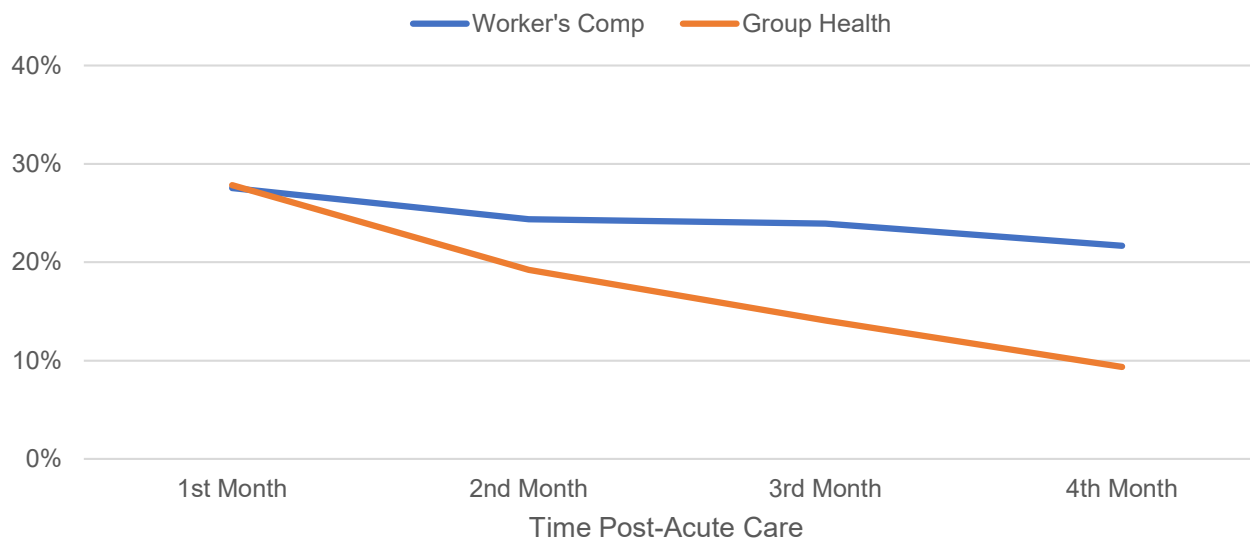
Figure 21 Comparison of Monthly Trend of Long COVID Prevalence Among Mild Infections Between Workers' Compensation and Group Health Insurance⁵⁶



However, the monthly estimates of long COVID among more severely ill COVID-19 patients appear slightly different in the two systems (Figure 22). Based on the early data, in the workers' compensation system, the relatively high prevalence of long COVID among hospitalized patients persisted over four months after acute care, while the prevalence of long COVID among hospitalized patients under group health insurance dropped from 28% to 9% over the same period.

It may be too early to speculate as to the reasons for the different trajectories of long COVID among hospitalized patients in workers' compensation and group health insurance given the limited data, but early research indicated that high medical care costs associated with hospitalization may provide incentives for workers with private health insurance to file a workers' compensation claim if they believe they contracted the illness at their workplace.⁵⁷ In addition, the availability of workers' compensation indemnity benefits for income loss, for instance, during the recovery from COVID-19 can provide some financial cushion that private health insurance cannot. Therefore, without alternative disability insurance to cover some portion of lost income, more severely ill workers requiring additional time to recover may have used workers' compensation instead of group health insurance if they believe they contracted the illness at their workplace.

Figure 22 Comparison of Monthly Trend of Long COVID Prevalence Among Severe and Critical Infections Between Workers' Compensation and Group Health Insurance⁵⁸



⁵⁶ The monthly estimates represent the share of COVID-19 patients that continued to receive care for long COVID symptoms in each month following acute care. It is possible that a COVID-19 patient was included in some months but not in other months in the four-month post-acute period.

⁵⁷ RAND. COVID-19 in the California Workers' Compensation System: A Study of COVID-19 Claims and Presumptions Under Senator Bill 1159. January 2022.

⁵⁸ The monthly estimates represent the share of COVID-19 patients that continued to receive care for long COVID symptoms in each month following acute care. It is possible that a COVID-19 patient was included in some months but not in other months in the four-month post-acute period.

Conclusions

Building on information published on the characteristics of COVID-19 workers' compensation claims, we conducted an in-depth analysis of the cost and treatment patterns of COVID-19 claims based on almost 6,000 COVID-19 California workers' compensation claims with an accident date between March 2020 and March 2021 that were reported with medical payments in the WCIRB medical transaction data as of January 2022. Despite a higher than typical share of claims involving only indemnity benefits, COVID-19 claims with medical payments had several key medical characteristics that distinguish these claims from non-COVID-19 claims. While the vast majority of COVID-19 claims involved a mild infection that did not require hospitalization, COVID-19 claims were more likely to involve hospitalization, intensive care, and fatality than non-COVID-19 claims. As a result, the average medical payments per COVID-19 claim during the first six months of medical treatment were almost two times higher than the average medical payments per non-COVID-19 claim. For claims of similar disease severity, however, COVID-19 claims generally incurred lower average medical payments over 6 months than non-COVID-19 claims, except for COVID-19 death claims, which were more likely to involve hospitalization, have higher inpatient costs and longer hospital stays than non-COVID-19 death claims. In addition, within six months, COVID-19 claims closed faster than non-COVID-19 claims regardless of disease severity, except for death claims. The average medical payments per closed COVID-19 claim, however, were almost two times higher than those for non-COVID-19 claims that were closed.

For COVID-19 hospital claims, hospital admissions, length of stay and ventilator support were key cost drivers. While not captured in the workers' compensation data, our analysis of group health data showed that workers with comorbidities were much more likely to be hospitalized for COVID-19 and had higher average inpatient costs than those without comorbidities.

With growing concerns of the long-term health consequences of COVID-19, in this study we also attempted to gain an early understanding of the prevalence of long COVID and the potential cost impacts of long COVID on workers and the workers' compensation system. Based on limited available data, we found that over a four-month period of post-acute care, about 11% of workers who previously had a mild infection and almost 40% of workers that were previously hospitalized received medical treatments for long COVID symptoms. Our early estimates of long COVID in the workers' compensation system are generally consistent with our estimates of a sample of California workers who utilized group health insurance for COVID-19 care. We also had some early observations that workers with more severe COVID-19 infections that resulted in long COVID had higher claim costs during the four-month acute care period than workers being treated for non-COVID-19 workers' compensation claims during the same period. As scientific research and information on long COVID continues to emerge and more post-acute infection data becomes available, the WCIRB plans to update this long COVID analysis and explore estimating the extent of permanent disability associated with COVID-19 in the workers' compensation system.

Conditions and Limitations

- The analysis of the California workers' compensation claims is based solely on the experience of insured employers and does not reflect self-insured employer experience. The analysis of the COVID-19 patients who utilized group health insurance for COVID-19 care is based on a sample of workers of both insured and self-insured employers in California and does not reflect the entire group healthcare system.
- The COVID-19 workers' compensation claims included in the analysis are a sample of COVID-19 claims with medical payments reported in the WCIRB medical and indemnity transaction databases as of January 7, 2022. We conducted reasonableness checks on the sample, such as age and industry mix, and believed the sample is a good representation of COVID-19 claims in the workers' compensation system. As more COVID-19 claims with medical payments become available in the WCIRB databases, the WCIRB will update the analysis of the medical treatment and cost patterns of COVID-19 claims. The results may be different from those presented in this report.
- As mentioned in this report, the estimated prevalence of long COVID using the workers' compensation medical transaction data may underestimate the true prevalence of long COVID for several reasons. First, our analysis used ICD information on medical service records to identify patients with long COVID symptoms. As a result, our results are subject to the availability of ICD information on the reported transactions of medical services in the datasets. In addition, the medical transaction data that we used for the long COVID analysis includes only paid medical services and therefore reflected only long COVID symptoms that were treated in the workers' compensation system. It is likely that the true prevalence of long COVID among workers who filed a COVID-19 workers' compensation claim is higher than our estimates, and what we captured in the analysis were those with more serious health complications of COVID-19 that warranted significant medical attention. In addition, given the rapidly evolving scientific understanding of long COVID, the ICD information that we used to identify long COVID symptoms in this study was based on the published information available at the time of the analysis. The WCIRB will continue to incorporate updates in the medical literature in future analyses of long COVID.
- The workers' compensation data in this study reflects information on claims submitted by insurers to the WCIRB through submissions of indemnity transaction data and medical transaction data. While the individual insurer data submissions are regularly checked for consistency and comparability with other data submitted by the insurer as well as with data submitted by other insurers, the source information underlying each insurer's data submission is not audited by the WCIRB.

Appendix

Table A1 List of Diagnostic-Related Group Codes Used to Identify Group Health Patients Hospitalized for COVID-19

DRG Code	DRG Description
003	ECMO or Tracheostomy with Mechanical Ventilation >96 Hours or Principal Diagnosis Except Face, Mouth and Neck with Major O.R. Procedures
004	Tracheostomy with Mechanical Ventilation >96 Hours or Principal Diagnosis Except Face, Mouth and Neck without Major O.R. Procedures
166	Other Respiratory System O.R. Procedures with MCC
167	Other Respiratory System O.R. Procedures with CC
168	Other Respiratory System O.R. Procedures without CC/MCC
177	Respiratory Infections and Inflammations with MCC
178	Respiratory Infections and Inflammations with CC
179	Respiratory Infections and Inflammations without CC/MCC
189	Pulmonary Edema and Respiratory Failure
193	Simple Pneumonia and Pleurisy with MCC
194	Simple Pneumonia and Pleurisy with CC
195	Simple Pneumonia and Pleurisy without CC/MCC
199	Pneumothorax with MCC
200	Pneumothorax with CC
201	Pneumothorax without CC/MCC
204	Respiratory Signs and Symptoms
205	Other Respiratory System Diagnoses with MCC
206	Other Respiratory System Diagnoses without MCC
207	Respiratory System Diagnosis with Ventilator Support >96 Hours
208	Respiratory System Diagnosis with Ventilator Support ≤ 96 Hours
865	Viral Illness with MCC
866	Viral Illness without MCC
870	Septicemia or Severe Sepsis with Mechanical Ventilation >96 Hours
871	Septicemia or Severe Sepsis without Mechanical Ventilation >96 Hours with MCC
872	Septicemia or Severe Sepsis without Mechanical Ventilation >96 Hours without MCC

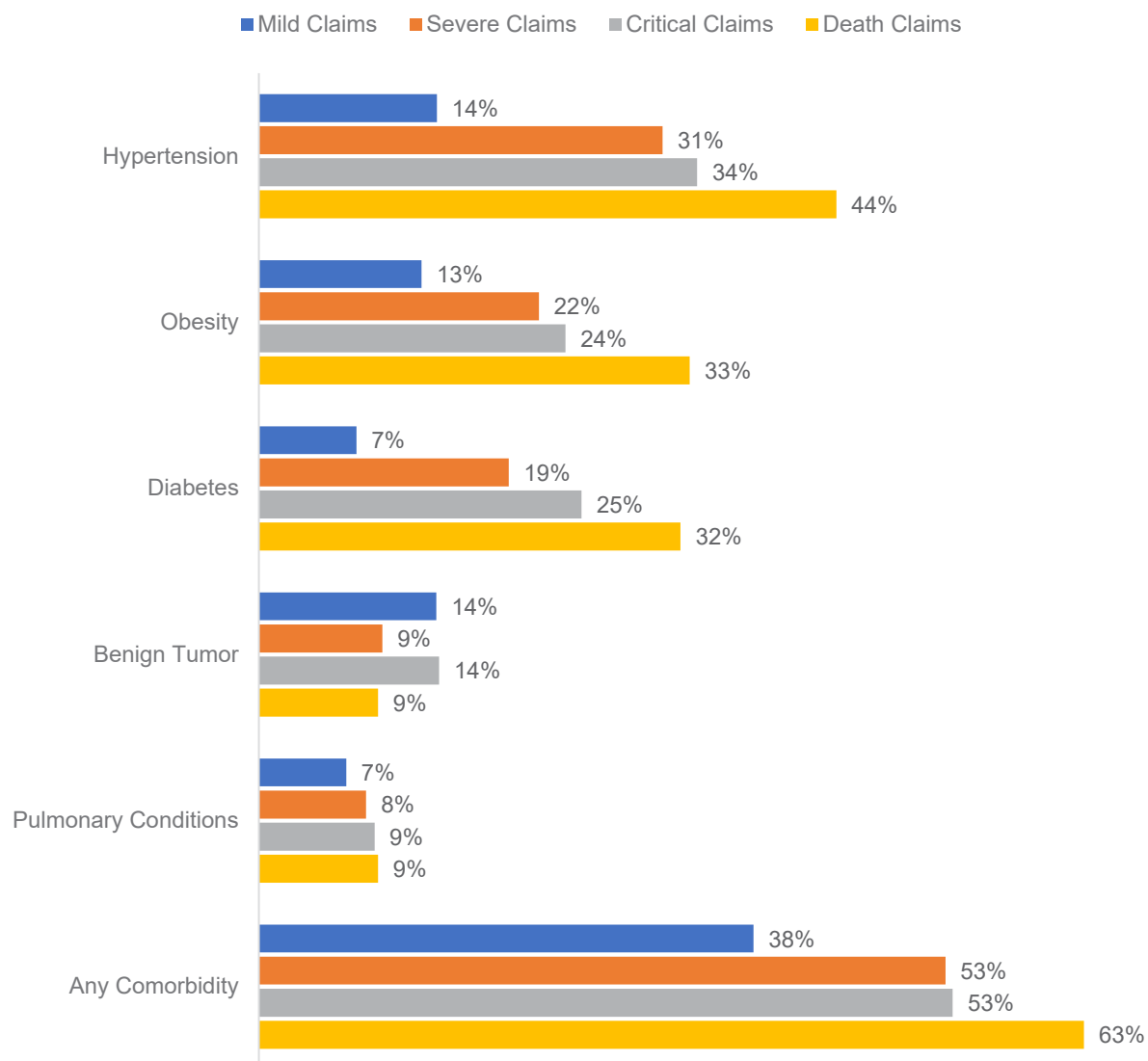
Table A2 The International Classification of Diseases Information Used to Identify Long COVID Symptoms⁵⁹

ICD-10	Long COVID symptoms	ICD-10 Description
F01-F09	Mental health conditions	Mental disorders due to known physiological conditions
F33-F39	Mental health conditions	Mood [affective] disorders
F40-F48	Mental health conditions	Anxiety, dissociative, stress-related, somatoform and other nonpsychotic mental disorders
F99	Mental health conditions	Unspecified mental disorder
G00-G09	Neurological conditions	Inflammatory diseases of the central nervous system

⁵⁹ <https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/index.html>; Given the rapidly evolving scientific understanding of long COVID, the ICD information that we used to identify long COVID symptoms in this study was based on the published information available at the time of the analysis. The WCIRB will continue to incorporate updates in the medical literature in future analyses of long COVID. In addition, there has been evidence for a broad spectrum of neurological and cardiac symptoms reported by long COVID patients, therefore we have maintained most of the ICD codes for cardiac and neurological conditions in our mapper. Groff D, Sun A, Ssentongo AE, et al. Short-term and Long-term Rates of Postacute Sequelae of SARS-CoV-2 Infection: A Systematic Review. *JAMA Netw Open*. 2021;4(10):e2128568.

ICD-10	Long COVID symptoms	ICD-10 Description
G10-G14	Neurological conditions	Systemic atrophies primarily affecting the central nervous system
G20-G26	Neurological conditions	Extrapyramidal and movement disorders
G30-G32	Neurological conditions	Other degenerative diseases of the nervous system
G35-G37	Neurological conditions	Demyelinating diseases of the central nervous system
G40-G47	Neurological conditions	Episodic and paroxysmal disorders
G50-G59	Neurological conditions	Nerve, nerve root and plexus disorders
G60-G65	Neurological conditions	Polyneuropathies and other disorders of the peripheral nervous system
G70-G73	Neurological conditions	Diseases of myoneural junction and muscle
G80-G83	Neurological conditions	Cerebral palsy and other paralytic syndromes
G89-G99	Neurological conditions	Other disorders of the nervous system
I05-I09	Cardiac conditions	Chronic rheumatic heart diseases
I10-I16	Cardiac conditions	Hypertensive diseases
I20-I25	Cardiac conditions	Ischemic heart diseases
I26-I28	Cardiac conditions	Pulmonary heart disease and diseases of pulmonary circulation
I30-I5A	Cardiac conditions	Other forms of heart disease
I60-I69	Cardiac conditions	Cerebrovascular diseases
I70-I79	Cardiac conditions	Diseases of arteries, arterioles and capillaries
I80-I89	Cardiac conditions	Diseases of veins, lymphatic vessels and lymph nodes, not elsewhere classified
I95-I99	Cardiac conditions	Other and unspecified disorders of the circulatory system
J00-J06	Pulmonary conditions	Acute upper respiratory infection
J09-J18	Pulmonary conditions	Influenza and pneumonia
J20-J22	Pulmonary conditions	Other acute lower respiratory infection
J30-J39	Pulmonary conditions	Other diseases of upper respiratory tract
J40-J47	Pulmonary conditions	Chronic lower respiratory diseases
J80-J84	Pulmonary conditions	Other respiratory diseases principally affecting the interstitium
J90-J94	Pulmonary conditions	Other diseases of the pleura
J95	Pulmonary conditions	Intraoperative and postprocedural complications and disorders of respiratory system, not elsewhere classified
J96-J99	Pulmonary conditions	Other diseases of the respiratory system
M79	Myalgia	Myalgia
N17-N19	Kidney conditions	Acute kidney failure and chronic kidney disease
N25-N27	Kidney conditions	Other disorders of kidney and ureter
R00	Abnormal heartbeat	Abnormal heartbeat
R05	Cough	Cough
R06	Shortness of breath	Shortness of breath
R07	Chest pain	Chest pain
R19	Diarrhea	Diarrhea
R41	Brain fog	Brain fog
R43	Loss of smell and taste	Disturbances of smell and taste
R50	Fever	Fever
R51	Headache	Headache
R52	Pain, unspecified	Pain, unspecified
R53	Fatigue	Fatigue
U07.1	COVID-19	COVID-19

Figure A1 Leading Types of Comorbidities Among Group Health COVID-19 Patients





1901 Harrison Street, 17th Floor
Oakland, CA 94605
888.CA.WCIRB

wcirb.com