

Exploring Long COVID: Healthcare Utilization Up to 360 Days after a COVID-19 Diagnosis—Results from Analysis of a Very Large US National Sample

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Abstract

The topic of the long-term effects of COVID-19, so-called “long-COVID”, has gained increased attention. The US federal government announced plans to develop an interagency national research action plan to uncover more insights into the long-term effects of COVID-19. This study contributes to our understanding of the long-term effects of COVID-19 by quantifying patterns of healthcare utilization up to 360 days after an initial COVID-19 diagnosis occurring during the beginning of the pandemic (March-August 2020) in a very large nationally representative population of insured adults. We quantify actual COVID-19-related utilization (as opposed to reported symptoms) by accessing claims data to calculate average medical visits per patient per month by type of encounter (e.g. inpatient stay, physician visit). In contrast to many recent reports in the media, our results show that COVID-19-related utilization declines substantially after the first-month post-diagnosis and continues to decline throughout the study period to very low levels.

Keywords

COVID-19 Utilization, Long-COVID Utilization

1. Background and Introduction

As of June 2022, there have been over 85 million cases of COVID-19 in the US since the start of the pandemic [1]. Preliminary estimates suggest 10% - 30% of people with a COVID-19 infection may experience Post-Acute Sequelae of SARS-CoV-2 (PASC) [2]. PASC includes both individuals who experience re-

current symptoms that may last weeks or months (*i.e.* “long COVID”) as well as individuals who experience new symptoms after their initial COVID-19 infection [3]. The federal government recently announced an interagency national research action plan to uncover more insights into the long-term effects of COVID-19 [4]. A key component of the plan is the National Institutes of Health (NIH)’s RECOVER Initiative, which is enrolling patients to build a nationwide study population to investigate both the COVID-19 recovery process and symptoms associated with PASC.

Our study contributes to the growing, ongoing research into the long-term effects of COVID-19 by quantifying patterns of healthcare utilization up to 360 days after an initial COVID-19 diagnosis occurring during the beginning of the pandemic (March-August 2020) in a very large nationally representative population of insured adults. We analyze actual COVID-19-related utilization (as opposed to reported symptoms) by accessing claims data to calculate average medical visits per patient per month by type of encounter (e.g. inpatient stay, physician visit).

To illustrate the potential impact of COVID-19 on healthcare utilization in a broader population, we apply these medical visit rates to two hypothetical populations infected early in the pandemic: 1 million commercially insured adults and 1 million Medicare Advantage beneficiaries assuming all of them had a diagnosis of COVID-19 between March and August 2020. For context, during our study period time frame, the CDC estimated that there were 6 million cases of COVID-19 in the US, with most occurring in adults. This approach yields estimates of the number of patients who sought care and the total number of visits over six follow-up periods covering 360 days from the date of initial COVID-19 diagnosis.

2. Data and Study Design

This study population is drawn from a sample of over 14.5 million adults aged 18 years and older covered by a large national insurer (*i.e.* commercial members aged 18 - 64 years and Medicare Advantage members aged 65 years or older) who were enrolled from initial COVID-19 diagnosis (between March 1 and August 31, 2020) and continuously enrolled for 360 days or more. To identify individuals with an initial COVID-19 diagnosis during that time period, CDC (Centers for Disease Control and Prevention) coding guidance was used to flag healthcare medical claims with International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) codes U07.1, B97.29, or J12.82 in any position on the claim [5]. The initial COVID-19 diagnosis date was defined as the discharge date of the initial visit with a COVID-19 diagnosis. While uncommon (1.8% - 3.6% of sample populations), patients with probable reinfections (*i.e.* evidence of a new COVID-19 diagnosis between 91 - 360 days after the initial diagnosis) were excluded [5] [6] as the focus of this analysis is to estimate patterns of care for adults in the year after initial diagnosis. Applying these crite-

ria produced a sample of 237,550 COVID-19 diagnosed patients that could be followed for 360 days [7]. See the Data Definitions Table in **Appendix (Table A1-A3)** for a complete listing of ICD-10-CM codes, definitions and logic for operationalizing the inclusion and exclusion criteria. Follow-up excludes the initial visit with a COVID-19 diagnosis and includes six periods that range in length from 30 to 90 days: 1) ≤ 30 days, 2) 31 - 90 days, 3) 91 - 180 days, 4) 181 - 240 days, 5) 241 - 300 days and 6) 301 - 360 days. Patients with subsequent COVID-19-related healthcare utilization were identified using ICD-10-CM codes (B97.29, U07.1, J12.82, B94.8, and M35.89) in any position on the claim [8]. Codes M35.8 and M35.81 were also indicative of sequelae of a COVID-19 diagnosis if code B94.8 was on the same claim line [8]. Patients with COVID-19-related healthcare utilization that crossed time periods are only counted in a single period based on the start date of the visit. Patients can have COVID-19-related utilization in none, all, or any subset of the six follow-up periods.

COVID-19-related healthcare utilization following initial diagnosis was further categorized by the type of encounter: inpatient stay, emergency room visit, physician visit (includes telehealth) or other visit (e.g. skilled nursing facility, physical therapy, home care). In addition, given patients may have one or more visits/stays in a follow-up period, mean utilization rates measured as per patient per month were also estimated for each of the six periods. These values were applied to a hypothetical population of 2 million COVID-19 patients (1 million commercially insured adults aged 18 - 64 years and 1 million Medicare Advantage enrollees aged ≥ 65 years) who were all diagnosed between March 1 and August 31, 2020 and survived for at least 360 days following their diagnosis. Estimates and example calculations are provided in **Appendix**.

3. Results (Figure 1 and Figure 2)

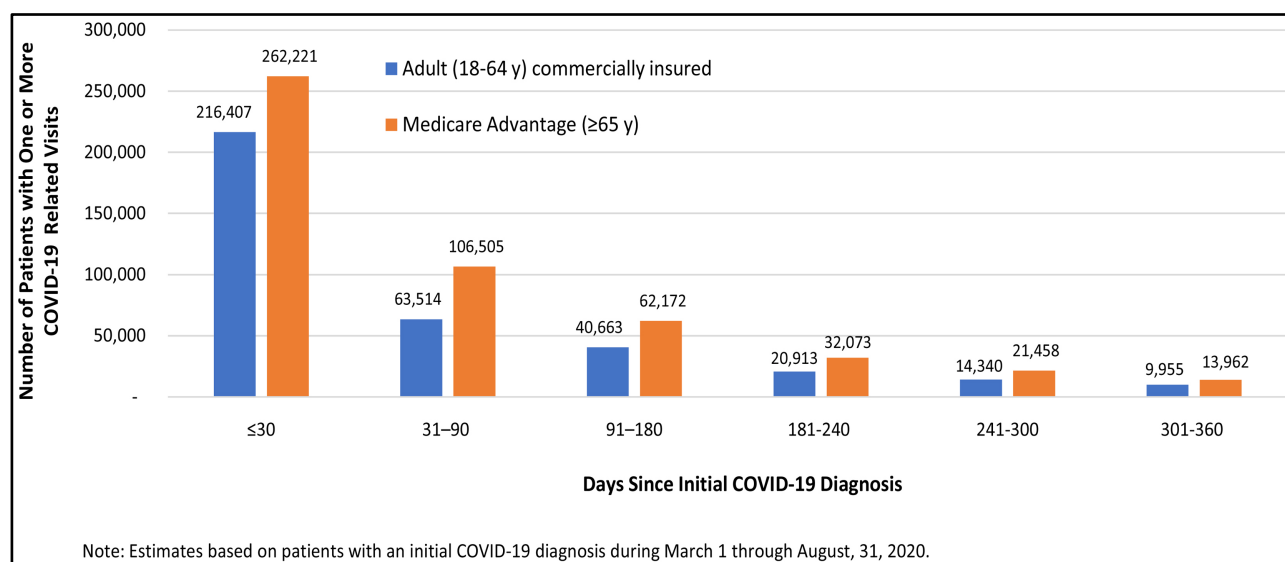
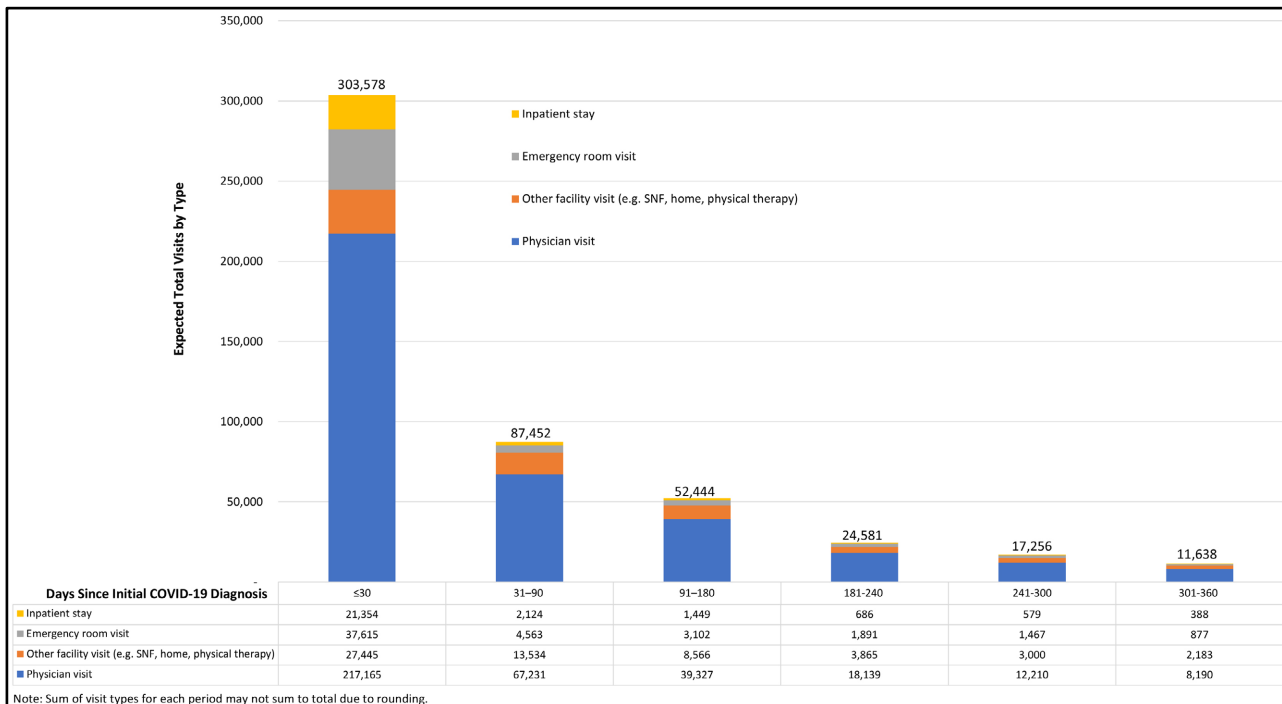
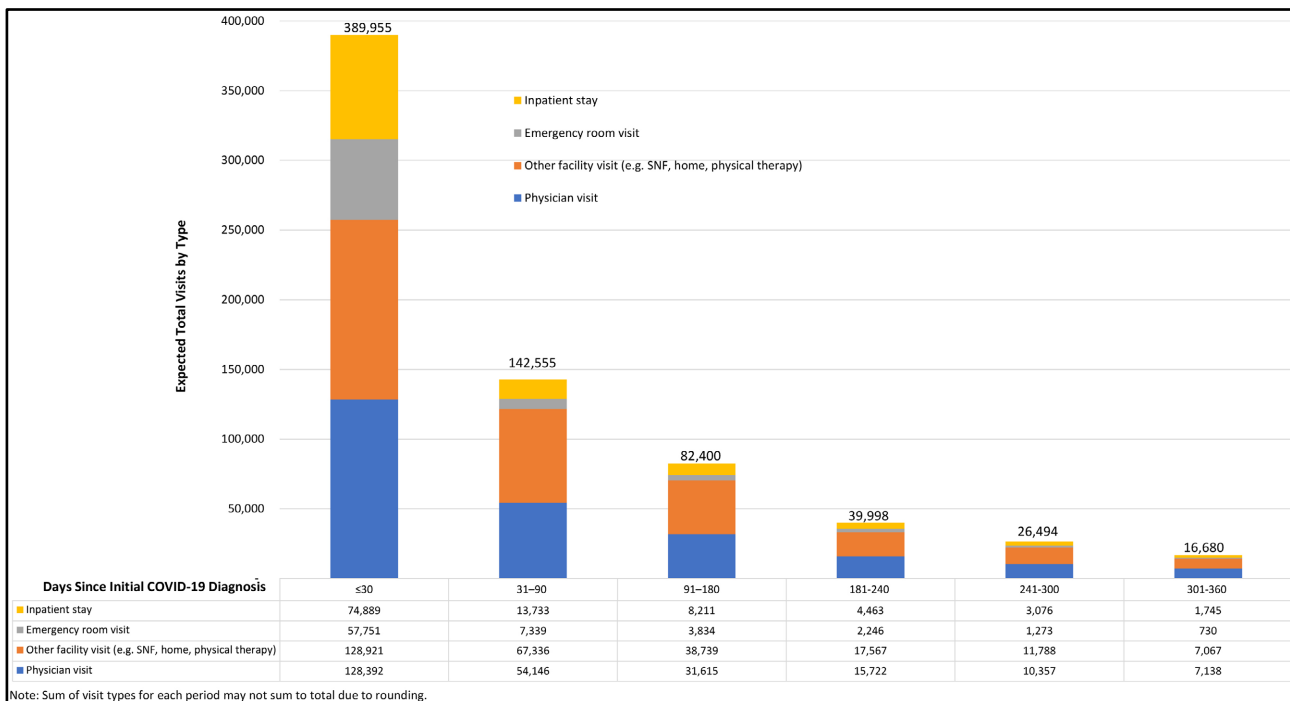


Figure 1. Estimated number of COVID-19 patients returning for care up to 360 days after initial diagnosis of 1 million adult (18 - 64 years) commercially insured patients and 1 million Medicare Advantage (≥ 65 years) patients.



(a)



(b)

Figure 2. (a) Estimated COVID-19-related visits up to 360 days after initial diagnosis of 1 million adult (18 - 64 years) commercially-insured patients. (b) Estimated COVID-19-related visits up to 360 days after initial diagnosis of 1 million Medicare Advantage (≥65 years) patients.

4. Discussion of Findings and Conclusions

Our findings are consistent with growing evidence that while the majority of pa-

tients utilize the most care in the first 30 days after a COVID-19 diagnosis, there is also a population of COVID-19 patients that require care beyond the first month, of varying amounts over varying time periods [7] [9] [10]. To illustrate the long-term effects of COVID-19 on healthcare utilization over one year, we applied the medical visit rates for the different follow-up periods to the two hypothetical population cohorts (of 1 million each) of insured adults who were diagnosed with COVID-19 in March through August 2020. The results in **Figure 2(a)** and **Figure 2(b)** show that the magnitude of the short-, medium- and long-term effects of COVID-19 on healthcare utilization can be quite substantial; over 300,000 visits were estimated for the first 30 days after initial diagnosis of 1 million commercially insured patients (18 - 64 years) and nearly 390,000 visits were estimated within the first 30 days after initial diagnosis of 1 million Medicare Advantage (65 years or older) patients. Utilization in every follow-up period was higher for the Medicare Advantage patients when compared to commercially insured adults consistent with CDC data demonstrating a strong association between age and the risk of poor outcomes after a COVID-19 diagnosis [11]. Data on the types of visits reveal further differences in utilization by age/insurance category that may reflect the generally poorer health status and greater severity of illness of persons 65 years of age and older relative to persons under age 65 years. As shown in **Figure 2(a)** and **Figure 2(b)**, inpatient stays, emergency room visits, and other facility visits which include skilled nursing facility stays, home visits, and physical therapy were more common for the Medicare Advantage population than the commercial population. Overall, physician visits represented a higher share of total visits for the commercial population than the Medicare Advantage population. By the final follow-up period, 301 - 360 days post-diagnosis, commercially insured adults had fewer COVID-19-related inpatient stays (388 vs. 1745) and other facility visits (2183 vs. 7067), but greater COVID-19-related emergency room utilization (877 vs. 730) and physician visits (8190 vs. 7138) relative to the Medicare Advantage population. In total, the hypothetical population of 2 million adult COVID-19 patients could have utilized nearly 1.2 million healthcare visits over 360 days.

While based on a very large sample of patients, our study has limitations in capturing COVID-19-related utilization after initial diagnosis. First, individuals who tested positive for COVID-19, but did not receive a diagnosis were not captured; accurate and complete COVID-19 test results were not available through claims data during the study period. Second, coding guidance for documenting COVID-19-related utilization *after initial diagnosis*, including PASC, did not exist at the time we crafted our methodology. Terminology and definitions used to describe recurrent and new symptoms after initial COVID-19 infection vary across organizations (e.g. CDC vs. WHO) [12] [13] and a specific ICD-10-CM code (U09.9 post-COVID condition, unspecified) [14] was first added on October 1, 2021, which is after our study period. Third, given the novel nature of COVID-19, disentangling its sequelae from pre-existing or subsequent unrelated conditions is not cur-

rently possible. Additional research, as well as refinement of definitions for and characterization of recurrent and new symptoms after initial COVID-19 infection, are needed to more accurately track and quantify COVID-19-related utilization after initial diagnosis given a large number of past and ongoing COVID-19 infections and diagnoses within the US and globally.

Finally, although our analysis provides valuable insight into the potential long-term effects of COVID-19 after initial diagnosis on healthcare utilization, our estimates are applicable to a specific time period and the variant of COVID-19 that was prevalent early in the pandemic and before vaccines and certain treatments were available. As such, the estimates are unlikely to be generalizable beyond adult-insured patients initially diagnosed with COVID-19 in March through August 2020. Additional research is needed under varying conditions to understand how different COVID-19 variants, vaccination status, treatments, and multiple infections impact the long-term effects of COVID-19. However, our findings suggest that future healthcare utilization due to “long-COVID” may be lower than “upper range” estimates that are based on smaller samples and/or self-reported survey data. This conclusion can have important implications for healthcare delivery system planning as well as actuarial premium calculations for future time periods. And, in addition, continued study of health system data to further understand COVID-19-related healthcare utilization in the US is essential to assist policymakers, health plans, and providers with planning for ongoing care and potential future surges.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Table A1. Data definitions.

Term	Definition
Confirmed COVID-19 Diagnosis	An ICD-10 diagnosis code U07.1 in any position on the claim.
Probable COVID-19 Diagnosis	An ICD-10 diagnosis code B97.29 or J12.82 in any position on the claim.
Initial COVID-19 Diagnosis Date	The discharge date of the initial visit/stay with a COVID-19 diagnosis.
COVID-19 Diagnosis Related Health Care Utilization	<p>An ICD-10 diagnosis code U07.1, B97.29, J12.82, B94.8, M35.89, M35.8, or M35.81 in any position on the claim. For codes M35.8 and M35.81, B94.8 needs to be on the same claim line to be considered COVID-19 related. Each follow-up time period does not include the initial visit/stay with a COVID-19 diagnosis. Patients can have a health care claim in each of the follow-up time periods. Utilization that crosses time periods will only be counted in one time period (based on the start date of the visit/stay).</p> <p>The initial visit/stay is assigned hierarchical in the following order: inpatient stay, ER visit (if occurred prior to or on day 1 of SNF/other facility visit), other facility visit, then physician visit.</p> <p>Utilization definitions based on claims:</p> <ol style="list-style-type: none"> 1) If an ER visit occurs during another facility visit, then both an ER and other facility visit are counted. ER visits are not counted if they occur during an inpatient stay. 2) Physical therapy and rehabilitation visits are counted a maximum of 1 per 30-day period. 3) Chiropractor visits are not counted towards a medical visit. 4) Any visits that were solely for the purpose of COVID-19 testing (to ensure patient no longer has COVID-19), are not counted towards a medical visit. 5) Home enteral nutrition therapy is not counted towards a medical visit.
COVID-19 reinfection	A COVID-19 test or exposure 91 - 360 days post initial COVID-19 diagnosis (ICD-10 diagnosis codes: Z11.52, Z11.59, Z03.818, Z20.828, or Z20.822 in the primary position on the claim) followed by a COVID-19 diagnosis (ICD-10 diagnosis codes: U07.1, B97.29, or J12.82 in the primary position on the claim) within 7 days.

Table A2. Total unique patients and percent with ≥ 1 COVID-19-related medical visit for adult (18 - 64 years) commercially-insured patients and Medicare Advantage (≥ 65 years) patients.

18 - 64 y (N = 167,647)	≤ 30 days from initial COVID19 Dx		31 - 90 days from initial COVID19 Dx		91 - 180 days from initial COVID19 Dx		181 - 240 days from initial COVID19 Dx		241 - 300 days from initial COVID19 Dx		301 - 360 days from initial COVID19 Dx	
Total unique patients with ≥ 1 COVID19 Dx ^d related medical visit	36,280	21.64%	10,648	6.35%	6817	4.07%	3506	2.09%	2404	1.43%	1669	1.00%
MA65+ (N = 69,903)	≤ 30 days from initial COVID19 Dx		31 - 90 days from initial COVID19 Dx		91 - 180 days from initial COVID19 Dx		181 - 240 days from initial COVID19 Dx		241 - 300 days from initial COVID19 Dx		301 - 360 days from initial COVID19 Dx	
Total unique patients with ≥ 1 COVID19 Dx ^d related medical visit	18,330	26.22%	7445	10.65%	4346	6.22%	2242	3.21%	1500	2.15%	976	1.40%

Table A3. (a) Expected total unique patients (18 - 64 y) with ≥ 1 healthcare visit/claim through 360 days given 1 million patients with a COVID-19 diagnosis and expected total visits by type. (b) Expected total unique patients (MA 65+) with ≥ 1 healthcare visit/claim through 360 days given 1 million patients with a COVID-19 diagnosis and expected total visits by type.

(a)						
18 - 64 y	≤ 30 days from initial COVID19 Dx	31 - 90 days from initial COVID19 Dx	91 - 180 days from initial COVID19 Dx	181 - 240 days from initial COVID19 Dx	241 - 300 days from initial COVID19 Dx	301 - 360 days from initial COVID19 Dx
Total unique patients with ≥ 1 COVID19 Dx ^d related medical visit	216,407	63,514	40,663	20,913	14,340	9955
(b)						
MA65+	≤ 30 days from initial COVID19 Dx	31 - 90 days from initial COVID19 Dx	91 - 180 days from initial COVID19 Dx	181 - 240 days from initial COVID19 Dx	241 - 300 days from initial COVID19 Dx	301 - 360 days from initial COVID19 Dx
Total unique patients with ≥ 1 COVID19 Dx ^d related medical visit	262,221	106,505	62,172	32,073	21,458	13,962