



# Quantifying Long Term Effects of COVID-19 on Health Care Costs

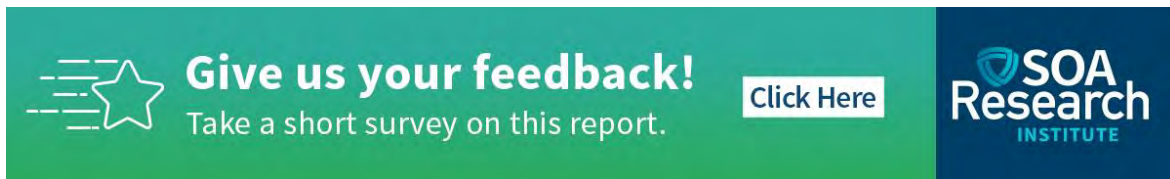
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# Quantifying Long Term Effects of COVID-19 on Health Care Costs

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# Quantifying Long Term Effects of COVID-19 on the Health Care System


## Executive Summary

In early 2020, COVID-19 made its way to the United States and has had a very disruptive impact on many different aspects of our societal functions. The impact of the disease itself as well as the delivery of Health Care resulted in big changes to previous cost patterns and medical expense trends. As COVID-19 made its way through the population it became clear that the disease was having a lasting effect on many infected individuals. Months after diagnosis and recovery, many people continued to suffer from lasting effects of the disease which presented as lasting COVID-19 symptoms and emerging new symptoms and conditions. This effect was labeled as long COVID or Post-Acute COVID syndrome. Many of these new and ongoing conditions resulted in additional costs to individuals infected with the disease. This report explores the changes to morbidity and health care costs by individuals who were diagnosed with COVID-19, breaking out members into different levels of COVID-19 illness severity, and the existence of prior underlying conditions.

The main takeaway of this report is that individuals with COVID-19 diagnoses saw morbidity and cost increases well in excess of standard medical cost trends once the direct effects of COVID-19 were removed and beyond the recovery period. This is based on commercial health data from January 2019 through July of 2021 provided by our data partner, Wakely. Individuals that were hospitalized due to COVID-19 had higher average costs before their reported diagnosis and they also had significant cost disruptions in the months just before and after the month when they were diagnosed with COVID-19. In fact, these disruptions were evident up to 6 months before and 6 months after their diagnosis. Members with underlying medical conditions who were not hospitalized were also observed to have higher claims activity several months before and after their month of diagnosis. This ramp up and down of claims should be expected due to the major disruption of the health system caused by the effects of the COVID-19 pandemic.


Precise quantification of the impact of a COVID-19 diagnosis on future costs is a challenging exercise due to the claims disruptions cause by various shocks to the system. The deferral of care at the beginning of the pandemic made it more difficult to establish a baseline starting cost in order to compare the impacts of a COVID-19 diagnosis on individuals claims costs. It was necessary to look at how claims developed just prior to the COVID-19 diagnosis in order to determine an appropriate starting point that was not artificially low due to claims deferrals, or artificially high due to resumption of services. At the end of the period, it was also necessary to allow claims to settle back down to new levels that did not include any short term COVID-19 effects.

Based on the data examined, and the assumptions of reasonable measuring period endpoints, overall claims for members with a COVID-19 diagnosis remained at least 20% higher than before the month of diagnosis, even for periods greater than six months after the diagnosis. This was for commercial population with claims running through July of 2021. Future studies could provide the opportunity to examine additional claims development patterns for longer periods. In addition, looking at characteristics of different COVID-19 strains, as well as the general effects of vaccinations on the population could also provide some key insights.



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## Section 1: Introduction and Background

When COVID-19 emerged in early 2020, much of the emphasis was on the characteristics of the disease itself with emphasis on the types of populations most impacted, the different presentations of the disease and the typical disease pathway of acute events. The Society of Actuaries built a Health Care Cost projection model which incorporated the effects of COVID-19 in addition to disruptions in non-COVID related services caused by the onset of the pandemic. With regards to specific COVID-19 related costs, this model took into account different COVID-19 severities and associated medical services and costs related to each one. In addition, the SOA assigned probabilities to each type of COVID severity which were then used to calculate overall costs. Over time, as local surges came and went and more effective treatments emerged, there were significant shifts in terms of hospitalization rates, and cost profiles of new COVID cases.

### 1.1 COVID CLAIMS CHARACTERISTICS

In the SOA's cost projection model<sup>1</sup>, cases were first broken out between hospitalized and non-hospitalized cases. Hospitalizations were defined as an inpatient stay and were further broken out between severe and non-severe cases. Severe hospitalizations included at a minimum an ICU stay and in some cases, use of a ventilator. Less severe hospitalizations did not include ICU, had lower lengths of stay and generally lower daily costs as well.

Non-hospitalized cases included all cases where a diagnosis was identified on a medical record. Typically, these cases included a physician visit and testing costs. More severe non-hospitalized cases often also included an ER visit, or an observation stay at a hospital. Often, there were also lower to moderate cost treatments, including lower cost treatments through repurposed therapeutics, or other higher cost treatments such as monoclonal antibodies or other recently developed therapeutics. Lastly, there were COVID cases where positive tests were rendered, but no treatment within the insurance system was provided. These tended to be the milder cases. Overall, milder cases were the most common, while the most severe cases were relatively rare. The SOA's model estimates were based on COVID cost data provided by participating issuers that were aggregated by Wakely Consulting Group (Wakely).

Wakely broke out their population categories into slightly different buckets listed below:

- Members With Severe COVID IP Admits
- Members With Non-Severe COVID IP Admits
- Non-Admitted Members<sup>2</sup> with COVID Diagnoses<sup>3</sup> and at least one Hierarchical Conditional Category (HCC)<sup>4</sup>
- Non-Admitted Members with COVID Diagnoses and no HCCs

Wakely's hospitalized categories had very similar definitions to those in the Health Care Cost Model, as they were both sourced using Wakely's data and their logic. For HCCs, Wakely relied on the Department of Human and Health Services (HHS) (HCC) risk adjustment model that the Centers for Medicare and Medicaid Services (CMS) used for risk adjusting individual and small group ACA populations. These categories differed from each other quite a bit in terms of average monthly pre-COVID Per Member Per Month (PMPM) costs as well as costs in the calendar month of

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<sup>1</sup> Hall, D, Natsis, A, Weiss, P, 2021 Health Care Cost Model, December 2021, <https://www.soa.org/resources/research-reports/2020/covid-19-cost-model/>, Accessed February 6, 2023.

<sup>2</sup> Non-Admitted members include members with a positive diagnosis who were hospitalized for reasons other than COVID-19.

<sup>3</sup> Individuals flagged as having a COVID-19 diagnosis if they had ICD10 code U071 or B9729 (with B9729 being used almost exclusively in the first few months of 2020).

<sup>4</sup> In order to summarize condition categories, Wakely relied on the Department of Human and Health Services (HHS) Hierarchical Condition Category (HCC) risk adjustment model that CMS used for risk adjusting individual and small group ACA populations.

COVID-19 diagnosis as shown in Table 1 below. Monthly costs are based on calendar months. Costs that took place six or more months prior to the COVID-19 diagnosis are included in the 6+ months prior category as an average cost for all of those months combined.

**Table 1**

**AVERAGE COMPARISON FOR MEMBERS BEFORE AND DURING THE MONTH OF COVID-19 DIAGNOSIS**

| Population                      | Costs of Population 6+ months prior to COVID-19 Diagnosis | Costs During Month of COVID-19 Diagnosis | Ratio of costs during the month of COVID diagnosis to Pre-COVID costs |
|---------------------------------|-----------------------------------------------------------|------------------------------------------|-----------------------------------------------------------------------|
| IP Admits: Severe COVID         | \$1,904                                                   | \$168,095                                | 88.3                                                                  |
| IP Admits: Non-Severe COVID     | \$1,647                                                   | \$43,711                                 | 26.5                                                                  |
| All IP Admits                   | \$1,668                                                   | \$53,811                                 | 32.3                                                                  |
| Non-Admitted COVID with >0 HCCs | \$1,256                                                   | \$7,273                                  | 5.8                                                                   |
| Non-Admitted COVID with no HCCs | \$249                                                     | \$870                                    | 3.5                                                                   |
| All Non-Admitted COVID          | \$603                                                     | \$3,034                                  | 5.0                                                                   |
| All Members                     | \$626                                                     | \$4,229                                  | 6.8                                                                   |

Based on the results of this table, it is clear that there are significant cost differences in COVID related costs depending on the severity of COVID as well as underlying risk characteristics for non-Admitted patients. Also, costs related to COVID-19 were positively correlated with underlying conditions, while hospitalization resulted in higher costs, with or without prior known conditions.

As we progressed from the onset of the COVID pandemic into 2021 and continued to update the SOA cost projection model, we began to further examine the pattern of Post COVID claims for insured individuals that had experienced a COVID-19 diagnosis. The observed patterns generally exhibited a higher level of claims costs after COVID as compared to before COVID. These observations were consistent with the concept of Long-COVID or post-Acute COVID syndrome as it is more commonly known.

## 1.2 POST-ACUTE COVID SYNDROME

Post-Acute COVID syndrome has a general pattern which manifests itself in different symptoms based on the length of time since infection. In general, Post-Acute COVID syndrome several months after initial diagnosis manifests quite differently than it would three weeks after initial diagnosis.

Table 2 below shows list of typical COVID-19 symptoms observed for individuals with Post-Acute COVID syndrome at different points of time since infection.

**Table 2**

**CHARACTERISTICS OF DIFFERENT STAGES OF COVID-19**

| COVID Infection Stage | Period Impacted                        | Common Symptoms                                                                                                                                                                                                 |
|-----------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Phase 1               | Up to two weeks post-Diagnosis         | Fever or chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, diarrhea.  |
| Phase 2               | Two weeks to two months post-Diagnosis | Abdominal pain, muscle aches, and nausea presenting from two weeks to two months after the initial diagnosis plus unresolved symptoms from Phase 1.                                                             |
| Phase 3               | More than 2 months post-Diagnosis      | New symptoms not prevalent during the acute phase starting 2-9 weeks after the COVID diagnosis and ramping up including new allergies, joint pain, brain fog and other unresolved symptoms from earlier phases. |

As the table above shows, there are many symptoms that present well after COVID-19 diagnosis which can cause discomfort and suffering for individuals who have contracted COVID-19. In addition, these conditions can lead to greater claims. Often This is typically manifested through one of the following situations:

- Post-Acute COVID-19 claims leading to higher baseline claims
- Worsening of chronic conditions that existed prior to COVID-19
- Emergence of new chronic conditions subsequent to the COVID-19 diagnosis

Finally, claims also increase due to increased volumes for services that were deferred during the pandemic leading to later claims and possibly worse outcomes. This phenomenon is likely to recur in any future pandemics.

### 1.3 CHANGES IN OBSERVED PATIENT MORBIDITY AND RISK CHARACTERISTICS

Another characteristic that has manifested itself among recovered COVID patients is a change in risk profile. According to Wakely's recently published study, illness with COVID-19 and Risk Characteristics reflected by HCCs tend to amplify and worsen the effects of each other on COVID-19 patients. COVID-19 tends to worsen the effects of previous underlying conditions through higher claims related to HCCs, increases in the number of HCC factors, and increases in claims not directly related to HCCs. Wakely's study has shown that COVID-19 diagnoses resulted in significant increases in HCC prevalence, for the most commonly observable HCCs in the immediate aftermath of a COVID-19 hospitalization<sup>5</sup>. In addition, Wakely looked at individuals with Diabetes and found that a COVID-19 diagnosis corresponded with significantly higher increases in non-COVID disease prevalence for individuals diagnosed with COVID-19 compared to individuals who were not diagnosed.<sup>6</sup>

Overall, COVID-19 has shown to create noticeable and significant issues related to costs and conditions of its recovered patients in the longer term. While Post-Acute COVID syndrome has garnered a lot of attention from the media and with its patients, the impact on health care costs is more due to deterioration in the morbidity of affected individuals resulting in a change in expected new baseline costs. Health Insurance companies and their actuaries are interesting in determining the potential longer-term effects of COVID-19 on future health care costs as they look to project future claims costs for financial forecasting and rate filing purposes. The remaining parts of this report will look to quantify the impact of COVID-19 on the magnitude and composition of Health Care costs that was observed for different populations.

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<sup>5</sup> Cohen, M., Chin, C.Y., Johnson, D. Analyzing Long COVID Using Commercial Claims Data: Table 1 HCC Prevalence Changes. Wakely. March 2022. <https://www.wakely.com/sites/default/files/files/content/analyzinglongcovidusingcommercialclaimsdata.pdf> (Accessed September 6, 2022).

<sup>6</sup> Cohen, M., Chin, C.Y., Johnson, D. Analyzing Long COVID Using Commercial Claims Data: Table 3 Diabetes and No-HCC Cohorts – COVID-19 vs No COVID-19 % Change. Wakely. March 2022. <https://www.wakely.com/sites/default/files/files/content/analyzinglongcovidusingcommercialclaimsdata.pdf> (Accessed September 6, 2022).

## Section 2: Description of Data Sources

The data used for this study was sourced from Wakely’s Denver Office using data aggregated from participating issuers. The data included both Commercial and Medicare Advantage membership from January 2019 – July 2021. However, for the purposes of this analysis, we focused on Commercial data only. Table 3 below shows the total lives by year for both Commercial Populations. The commercial data is broken out between ACA Individual, ACA Small Group and Large Group members. This data was provided by data contributors to Wakely and is considered confidential.

**Table 3**  
**TOTAL ENROLLMENT BY LINE OF BUSINESS (IN MILLIONS)**

| Line of Business | 2019 Lives | 2020 Lives | 2021 Lives |
|------------------|------------|------------|------------|
| ACA Individual   | 4.5        | 5.0        | 4.7        |
| ACA Small Group  | 1.6        | 1.5        | 1.3        |
| Large Group      | 5.4        | 4.8        | 4.2        |
| Total Commercial | 11.5       | 11.3       | 10.2       |

In addition, Wakely relied on others for their data which was gathered from national carriers across a number of different states. It is uncertain the extent to which the issuer population differs materially from the national commercial and Medicare averages in terms of demographics, health status, or location. Any differences from the data collected and market averages may result in material differences.

Wakely created claims extracts that isolated monthly claims for all members that included a COVID-19 diagnosis in their records. The claims were then split out into calendar months before, during, and after the COVID-19 diagnosis. Claims records for members 6 months prior to diagnosis were combined into one aggregated sum. Similarly, claims records for members 6 months after diagnosis were also combined. Finally, Wakely’s extracts included breakouts by service category. All services were categorized as one of the following:

- Inpatient Hospital
- Outpatient Hospital (including Emergency Room)
- Ancillary Services
- Professional Services (including physician services)
- Prescription Pharmacy Services

The objective of those particular breakouts was to analyze claims patterns before and after the COVID-19 diagnosis for different populations and to determine what kind of trend factors were present for members following their COVID -19 diagnosis. Presumably, any observed excess trends would likely be attributable to a combination of Post-Acute COVID Syndrome as well as worsening of chronic conditions brought about by COVID-19 or the lack of standard medical care during the early portion of the pandemic.



### Section 3: Changes in Cost Characteristics due to COVID-19

As the COVID-19 data was examined during the development of the SOA's Health Projection Model, some distinctive data patterns related to pre- and post-COVID claims began to emerge. The data was split out between different COVID severity levels and patient morbidity. Table 4 below shows how overall claims differed by severity categories before and after the onset of COVID for Commercial Populations.

**Table 4**

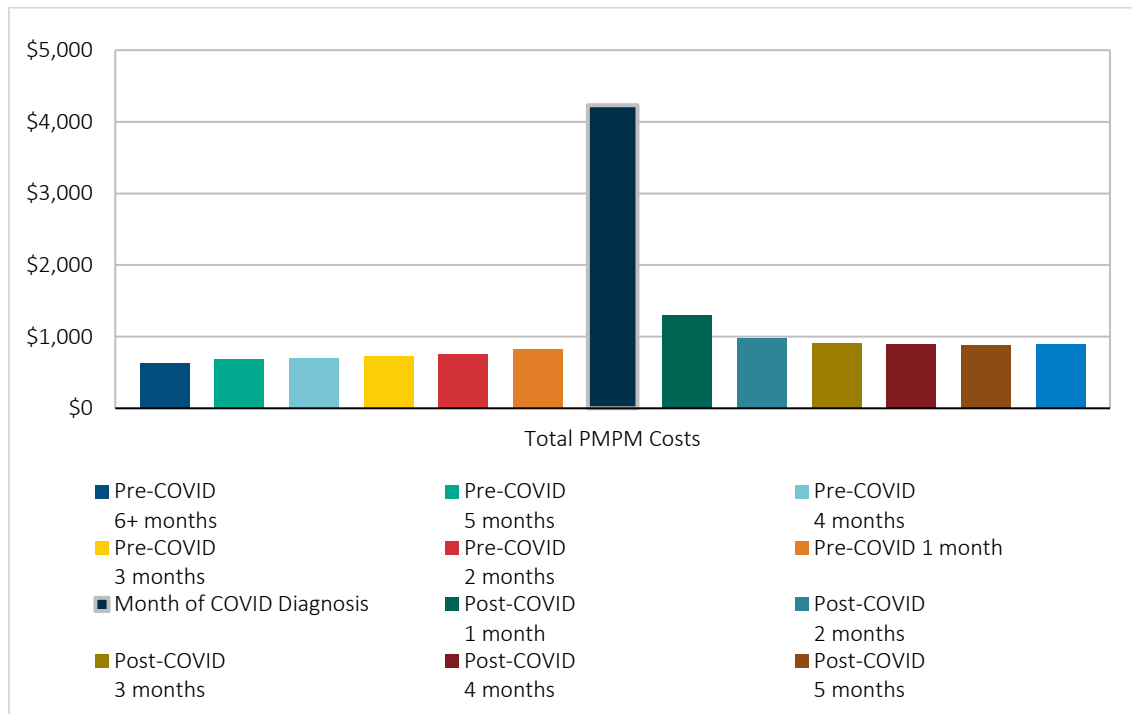
#### COMPARISON OF 6 MONTHS PRE-COVID AND POST-COVID COMMERCIAL PMPM COSTS

| Population                      | Member Count | Average PMPM pre-COVID | Average PMPM - month of COVID diagnosis | Average PMPM post-COVID | Average post-COVID % Increase |
|---------------------------------|--------------|------------------------|-----------------------------------------|-------------------------|-------------------------------|
| IP Admits: Severe COVID         | 1,197        | \$1,904                | \$168,095                               | \$2,824                 | 48%                           |
| IP Admits: Non-Severe COVID     | 13,545       | \$1,647                | \$43,711                                | \$2,015                 | 22%                           |
| All IP Admits                   | 14,742       | \$1,668                | \$53,811                                | \$2,081                 | 25%                           |
| Non-Admitted COVID with >0 HCCs | 207,682      | \$1,256                | \$7,273                                 | \$1,814                 | 44%                           |
| Non-Admitted COVID with no HCCs | 403,718      | \$249                  | \$870                                   | \$322                   | 29%                           |
| All Non-Admitted COVID          | 611,400      | \$591                  | \$3,045                                 | \$829                   | 40%                           |
| All Members                     | 626,142      | \$616                  | \$4,240                                 | \$858                   | 39%                           |

Per the pattern shown, patients with higher COVID costs tended to have higher baseline PMPM costs. Also, post-COVID costs also showed the greatest percentage increases for the most severe cases, although patients with no prior HCCs had a greater increase post-COVID than those with at least one prior HCC. Part of this pattern is better explained by frequent ramp up of costs just before the month of infection, as well as the ramp down of costs just after the initial diagnosis. In particular, members with higher severity COVID cases tended to have a more gradual ramp-down after the month of diagnosis resulting in some skewing of the Table 3 4 Results. Appendix A below demonstrates the differences between ramp ups and ramp downs for different COVID case severities, breaking out PMPM costs by month from 2 months prior, to 2 months after COVID diagnosis. In addition, the tables in this appendix show data 6+ months before and after the month of diagnosis, which overall is a more accurate methodology to evaluate the long term impacts of COVID-19 on healthcare costs.

When we break out the Pre- and Post-COVID costs by months before and after diagnosis, there is a significant delay in ramping down of costs, particularly in COVID cases with Severe and Non-Severe inpatient admissions. While these delays are important in assessing overall costs, they tend to phase out within 6 months of the initial diagnosis. Similarly, there is a lesser, although noticeable increase in costs in the months just prior to COVID diagnosis. Figure 1 below demonstrates a more "Steady State" comparison of pre and post COVID medical expenses by Population.

**Figure 1**  
**CLAIMS COST PMPMS BY MONTH FOR ALL MEMBERS FROM 6+ MONTHS PRE-COVID-19 DIAGNOSIS TO 6+MONTHS POST-COVID-19 DIAGNOSIS**



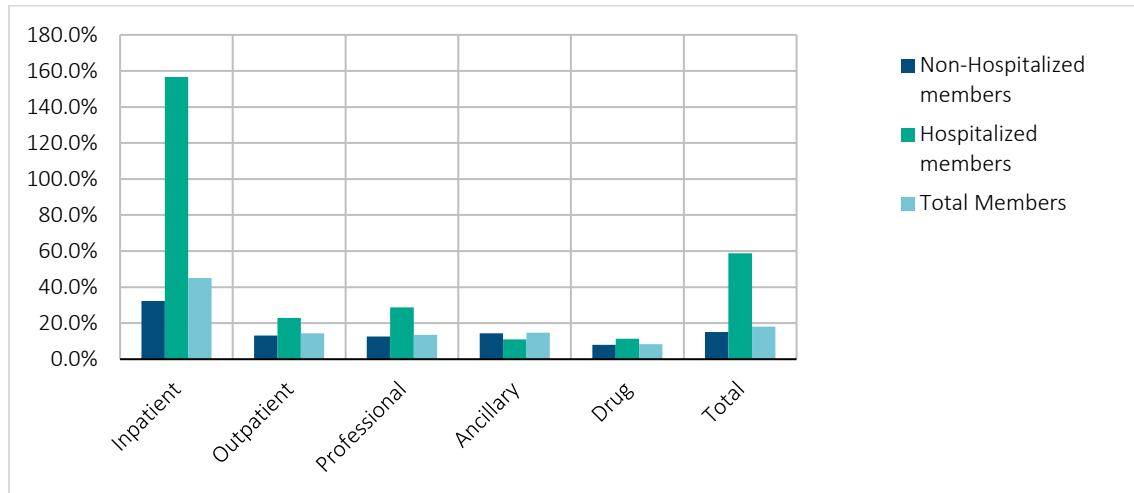
### 3.1 DIFFERENCES IN POST COVID CLAIMS BY SERVICE CATEGORY

As we have shown above, there is clear evidence for overall increased costs post-COVID diagnosis for all categories of impacted members. However, it is also worth exploring what are the characteristics of those costs from a service category perspective.

Wakely provided data split by service categories between different categories of service. By examining this data, we can get a sense of how claims costs are shifting between different categories.

Service categories vary not only by how they drive pre-COVID and post-COVID claims but also how they impact claims ramp up to the levels of the month of COVID diagnosis and ramp down back to more normal levels.

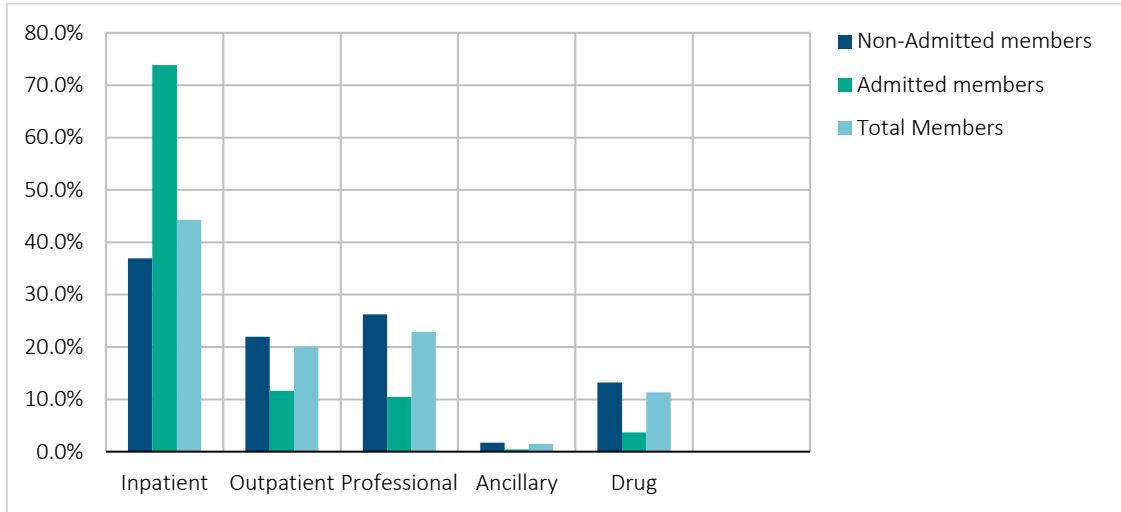
In Figure 2 below, there are significant differences by service category and member type when it comes to the main drivers of cost ramp-ups leading to the month of diagnosis.

**Figure 2****PERCENT CLAIMS INCREASE BY SERVICE CATEGORY FROM MONTHS 6+ PRIOR VS. MONTHS 1-5 PRIOR TO COVID-19 DIAGNOSIS**

The main ramp up driver by service category is Inpatient Hospital. This is the case for the main categories of members including those admitted to hospitals due to COVID-19 and those with milder cases not admitted to hospitals due to COVID-19. The admitted cases saw a ramp up of almost 60% between 6 months and prior to diagnosis and 1-5 months prior to diagnosis. Non-admitted cases saw more modest ramp-ups around 15%. Inpatient Hospital saw by far the highest ramp-ups with almost 160% higher claims in that area during the ramp-up period for admitted COVID-19 cases and over 30% higher inpatient claims levels for non-Admitted COVID-19 cases<sup>7</sup>. Outpatient and Professional services performed more consistently with the overall average, while ancillary and pharmacy claims saw the least degree of ramp-up. In addition, Figure 3 below shows the relative share of each service category as they contributed to the ramp-up on costs. Admitted COVID members had much higher relative contributions from inpatient costs at almost 75%. Non-admitted member ramps up costs had high hospital contributions as well, although with only a 37% share attributable to higher inpatient claims. Outpatient, professional and even pharmacy claims played a bigger role for non-admitted members than for the hospitalized cohorts.

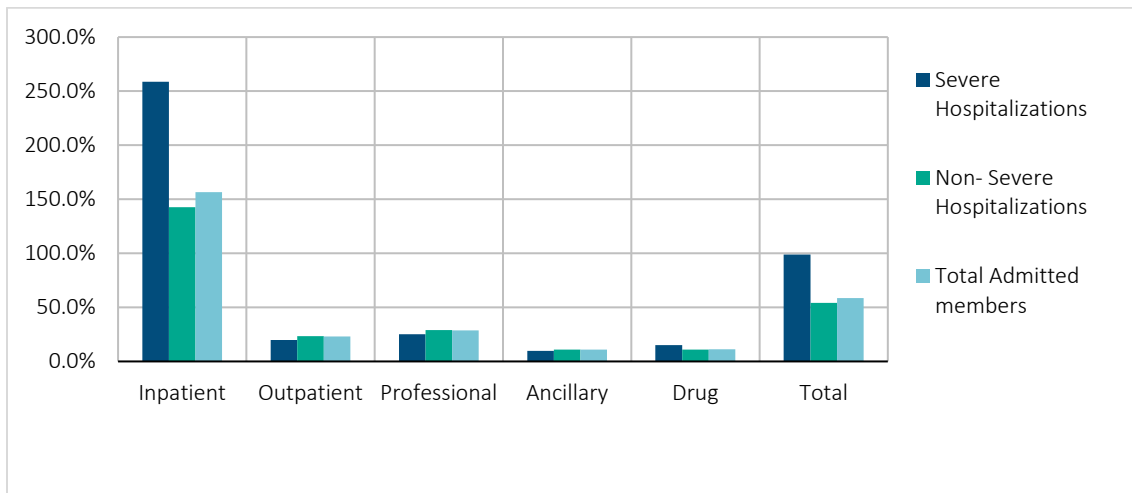
<sup>7</sup> Inpatient Claims for non-admitted patient are for causes other than COVID-19.

**Figure 3**  
**DISTRIBUTION OF TOTAL RAMP-UP COSTS FROM MONTHS 6+ TO MONTHS 1-5 PRIOR TO COVID-19 DIAGNOSIS BY SERVICE CATEGORY**



Figures 4 and 5 show the relative performance of severe and non-severe hospitalizations. Per figure 4, ramp-up values of Severely hospitalized members showed that total costs were almost 100% higher in months 1-5 pre-COVID than they were in months 6+. Non-Hospitalized members also exhibited significantly higher total costs in months 1-5 vs. months 6+ prior to COVID-19 diagnosis at 54%. Inpatient hospital claims were the dominant driver with 86% of the Severely Hospitalized ramp-ups and 71% of the non-severely hospitalized patient ramp up claims coming from inpatient services as shown in Figure 5

**Figure 4**  
**PERCENT CLAIMS INCREASE BY SERVICE CATEGORY FROM MONTHS 6+ VS. MONTHS 1-5 PRIOR TO COVID-19 DIAGNOSIS FOR HOSPITALIZED COVID-19 MEMBERS**



**Figure 5**  
**DISTRIBUTION OF TOTAL RAMP-UP COSTS FROM MONTHS 6+ TO MONTHS 1-5 PRIOR TO COVID-19 DIAGNOSIS BY SERVICE CATEGORY FOR HOSPITALIZED COVID-19 PATIENTS**

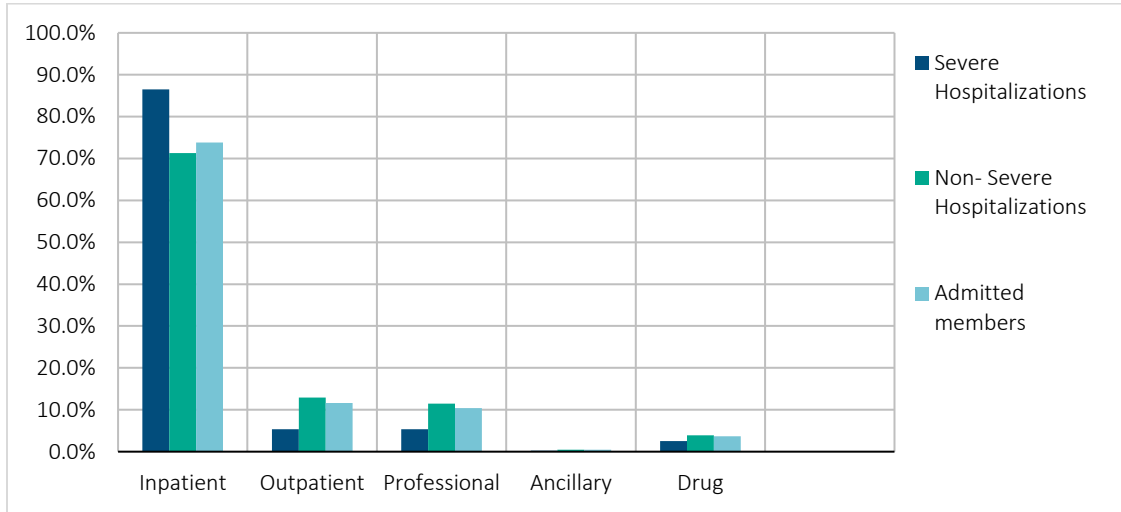
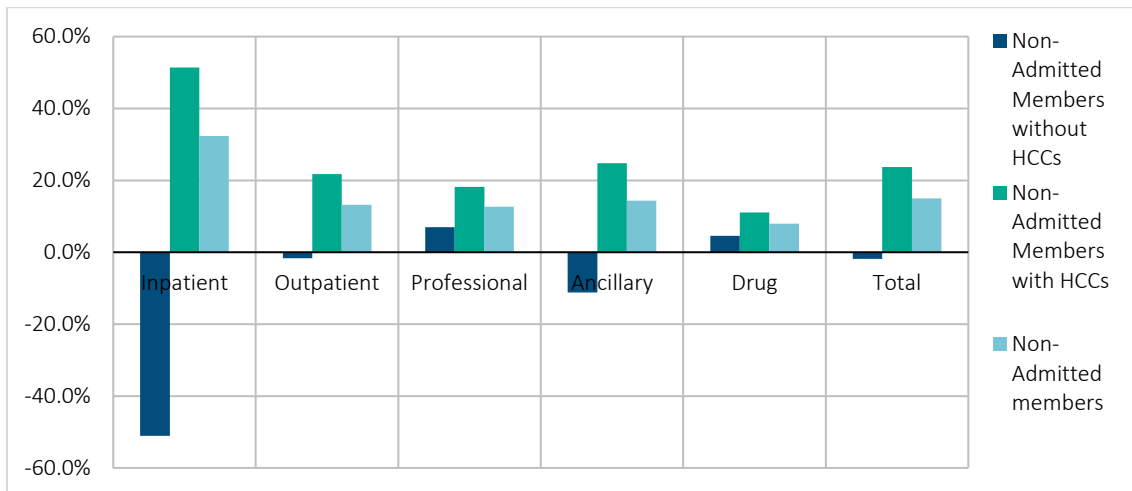


Figure 6 demonstrates the characteristics of two subcategories of non-admitted COVID-19 patients: those with prior HCCs demonstrating the existence of a co-morbidity, and those without prior HCCs.

**Figure 6**  
**PERCENT CLAIMS INCREASE BY SERVICE CATEGORY FROM MONTHS 6+ VS. MONTHS 1-5 PRIOR TO COVID-19 DIAGNOSIS FOR HOSPITALIZED COVID-19 MEMBERS**



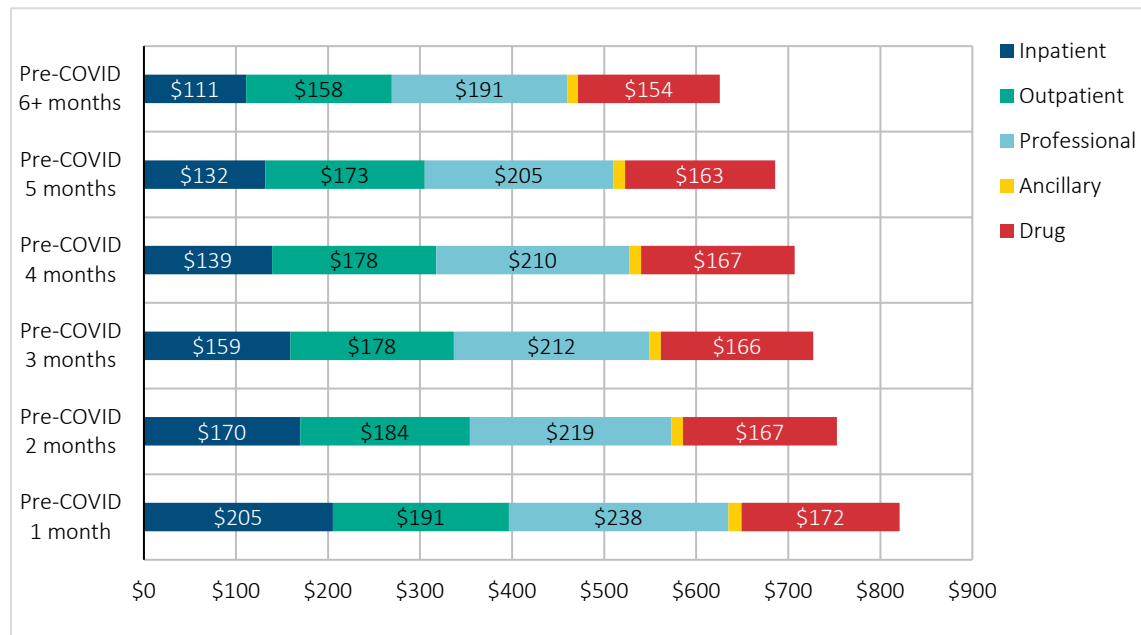
It's worth noting that ramp-up costs are much more evenly distributed in the population that was not hospitalized for COVID-19. Overall cost ramp-ups for the non-hospitalized patients came in at 15% and those with documented pre-COVID HCCs had a 24% ramp-up. Interestingly, non-Hospitalized members who did not have any prior HCCs attributed to them, actually saw a cost decrease of 2% during the ramp-up period driven by decreases in inpatient costs.

Overall, the concept of a ramp-up is a somewhat surprising development. However, there are some potential causes of this include the following:

- Deferral of care caused by COVID-19 hospital shutdowns during the period 6+ months prior to COVID-19 diagnosis since most cases happened later in 2020 and early 2021.
- A general worsening of underlying conditions due to untreated chronic conditions leading to ramping up of costs prior to COVID and potentially worse COVID-19 outcomes.
- Recoupment of deferred costs during the ramp up period (1-5 months prior to COVID diagnosis)

The above analyses show overall average rates of ramp-ups. In addition to these overall factors, there is a clear pattern of cost ramp ups from 6+ months prior to COVID diagnosis all the way through the month of diagnosis. Figure 7 below shows a clear pattern of increasing cost ramp-up up through the month prior to COVID-19 diagnosis.

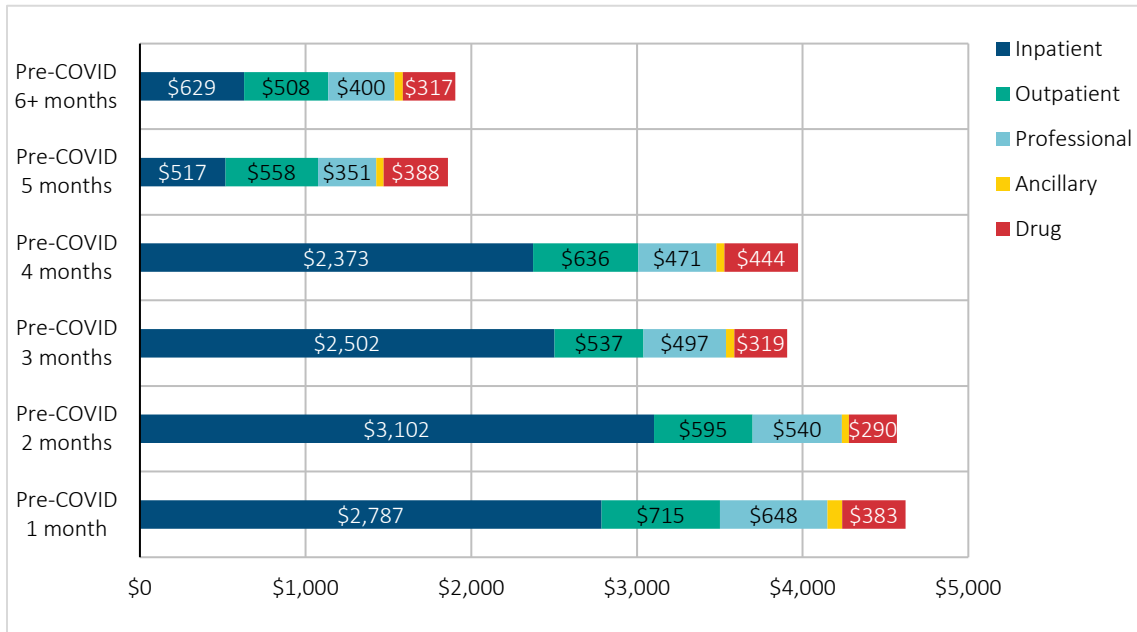
**Figure 7**  
**PRE-COVID CLAIMS COST PMPMS FOR ALL COVID-19 DIAGNOSED MEMBERS**



However, the extent of the ramp-up does vary quite a bit by service category. The main driver of the ramp-up is inpatient cost with professional costs also participating to a lesser extent. These characteristics vary significantly when we look at different COVID-19 severities and underlying conditions.

Severely hospitalized COVID-19 patients had a much steeper ramp-up before the month of diagnosis as shown in Figure 8 below. In particular, this increase began 4 months prior to the COVID-19 diagnosis with the significantly higher levels being increased and maintained until the month of diagnosis.

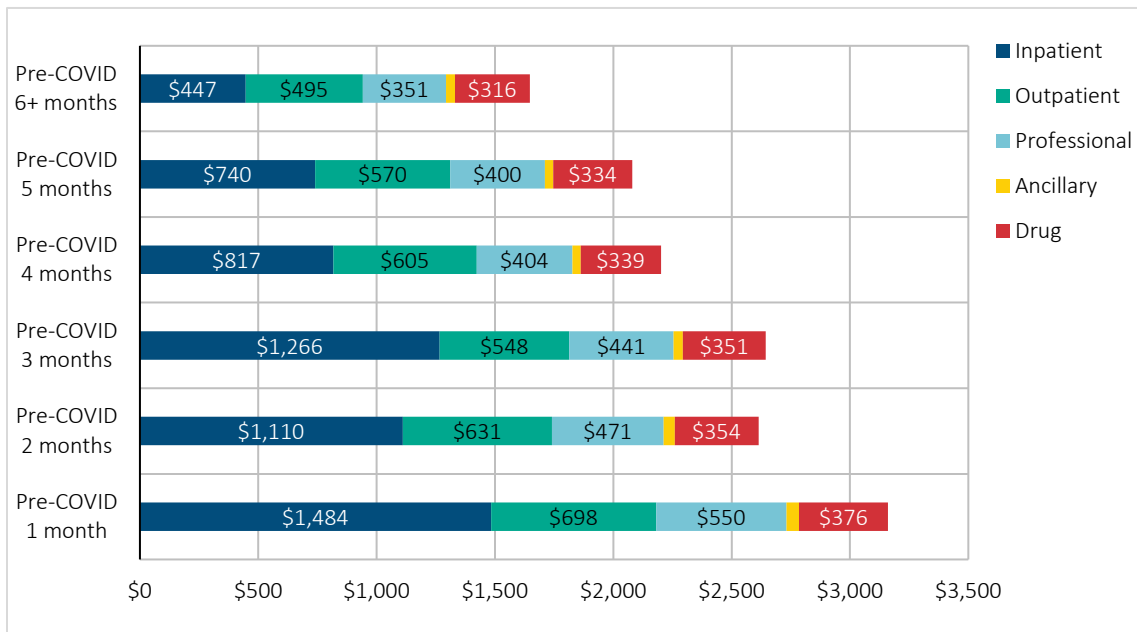
**Figure 8**  
**PRE-COVID CLAIMS COST PMPMS FOR COVID-19 DIAGNOSED MEMBERS WITH SEVERE HOSPITALIZATIONS**



Some of this activity may be related to catch-up of deferred services – especially elective services, as inpatient is a clear driver of those increases. Additionally, the possible existence of comorbidity could indicate that these members had conditions that worsened during the pandemic resulting in unplanned higher costs that may have also contributed to worse COVID-19 outcomes.

Members with non-severe hospitalizations had similar patterns to the severe hospitalizations. These can be seen in Figure 9 below.

**Figure 9**  
**PRE-COVID CLAIMS COST PMPMS FOR COVID-19 DIAGNOSED MEMBERS WITH NON-SEVERE HOSPITALIZATIONS**

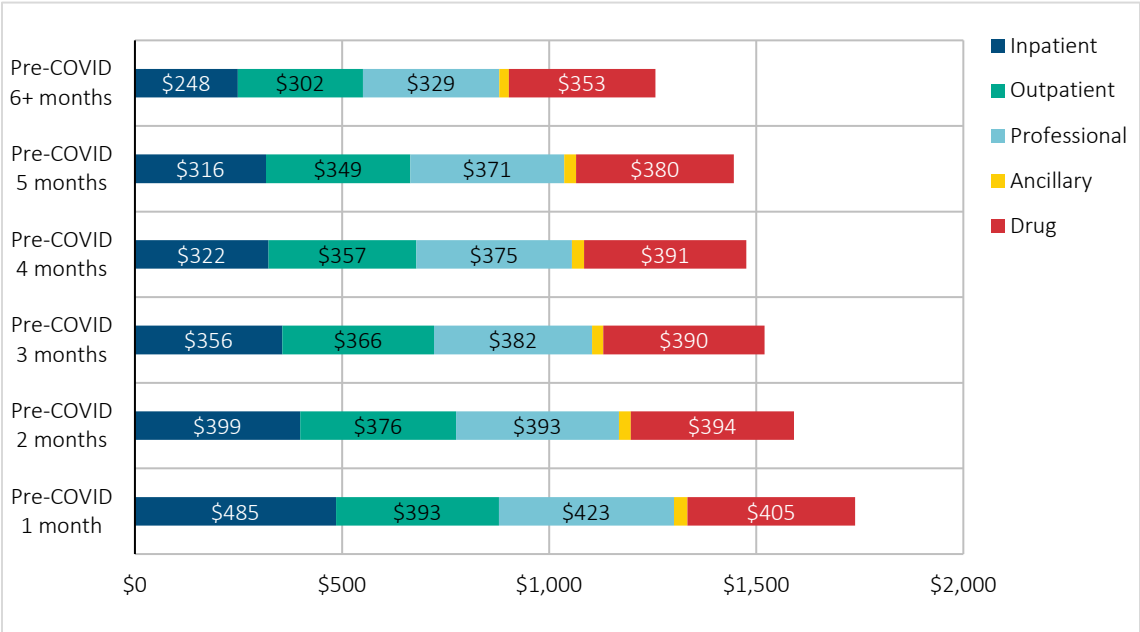


Like the severe cohorts, non-severe hospitalizations had bases costs that doubled from 6+ months prior to one month before diagnosis. Some key differences are a more graded increase in the monthly costs as well as relatively small inpatient increases. However, for all hospitalized members, inpatient costs were the main drivers of cost ramp-ups. Reasons for those increases are likely to be quite similar to what was driving the severely hospitalized cost ramp-ups.

In Figures 10 and 11 below we examine some of the cost ramp-ups of members who did not require hospitalizations. Figure 9 in particular focuses on non-Hospitalized members who had pre-existing conditions or HCCs coded prior to their COVID-19 diagnosis.

Like the hospitalized members these members a consistent pattern of increasing costs leading up to the month of diagnosis, with the main drivers being in the inpatient service category. However, unlike hospitalized members, there is a much gentler ramp-up during the pre-COVID period with the cost increases from 6+ months pre-COVID to 1-month pre-COVID being only 40% higher, instead of 100% higher or more.

**Figure 10**  
**PRE-COVID CLAIMS COST PMPMS FOR NON-HOSPITALIZED COVID-19 DIAGNOSED MEMBERS WITH AT LEAST 1 HCC**



Finally, Figure 11 below shows a break in pre-COVID-19 ramp-up costs prior to the month of diagnosis. For those members, there was a slight decline in claims at the start of the ramp up period followed by a slight uptick one month prior to diagnosis. Some of this decline may be attributable to deferred care for these members during specific outbreaks of the pandemic. Inpatient services played a very minor role for those members, with the main drivers being in professional services. The overall increase from month 6+ pre-diagnosis to 1 month prior to diagnosis was only about 5%.



**Figure 11****PRE-COVID CLAIMS COST PMPMS FOR NON-HOSPITALIZED COVID-19 DIAGNOSED MEMBERS WITH NO HCCS**

Therefore, the figure indicates very little in worsening of conditions and perhaps some of the higher costs that appeared 1 month prior to diagnosis may have been due to an early onset of COVID before the official diagnosis was received.

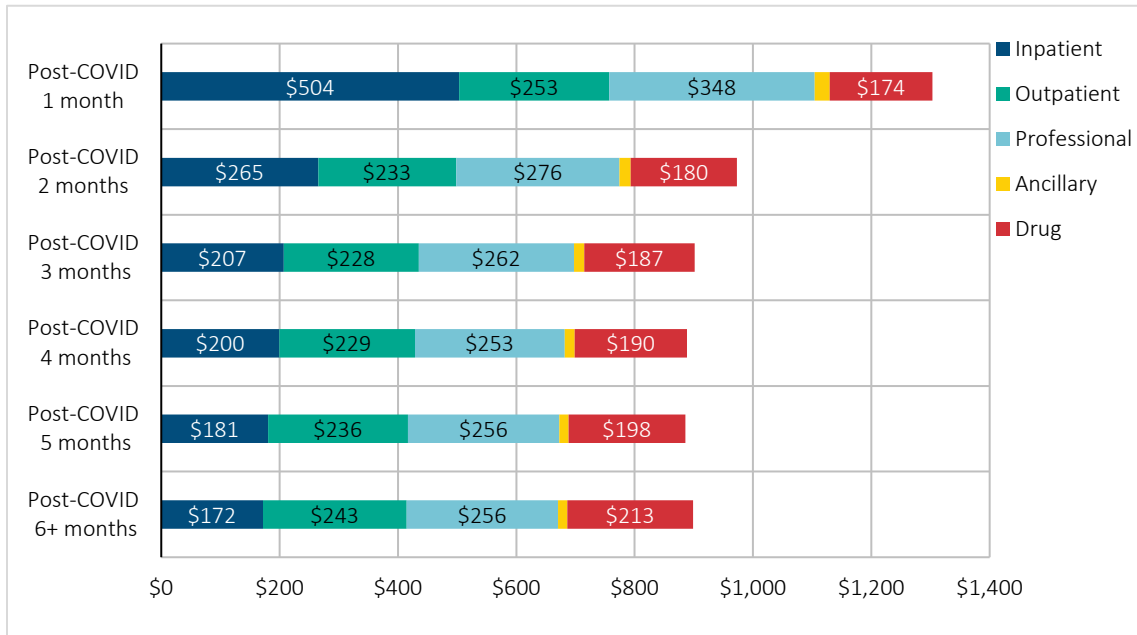
Overall, with the exception of the non-Hospitalized member with no HCCs, the rest of the population experienced significant ramp-ups in costs leading up to the month of COVID-19 diagnosis. This can probably be attributed at least in part to worsening member health as well as deferrals of care during the early parts of the pandemic.

### 3.2 RAMPING DOWN OF HEALTHCARE COSTS POST COVID-19 DIAGNOSIS

In addition to the aforementioned ramp-ups prior to COVID-19 diagnosis, there was a significant ramp down in member costs in the months immediately following the month of diagnosis. These characteristics were examined across service categories and populations to see the extent to which decreased costs were delayed and to estimate a steady state post-COVID level of claims. Ramp-downs were logical and expected due to various degrees of lingering impacts of COVID-19 in members diagnosed with the disease. Some of the delays in ramp-downs may be due to slow recoveries from some of the more severe cases, as well as Long COVID.

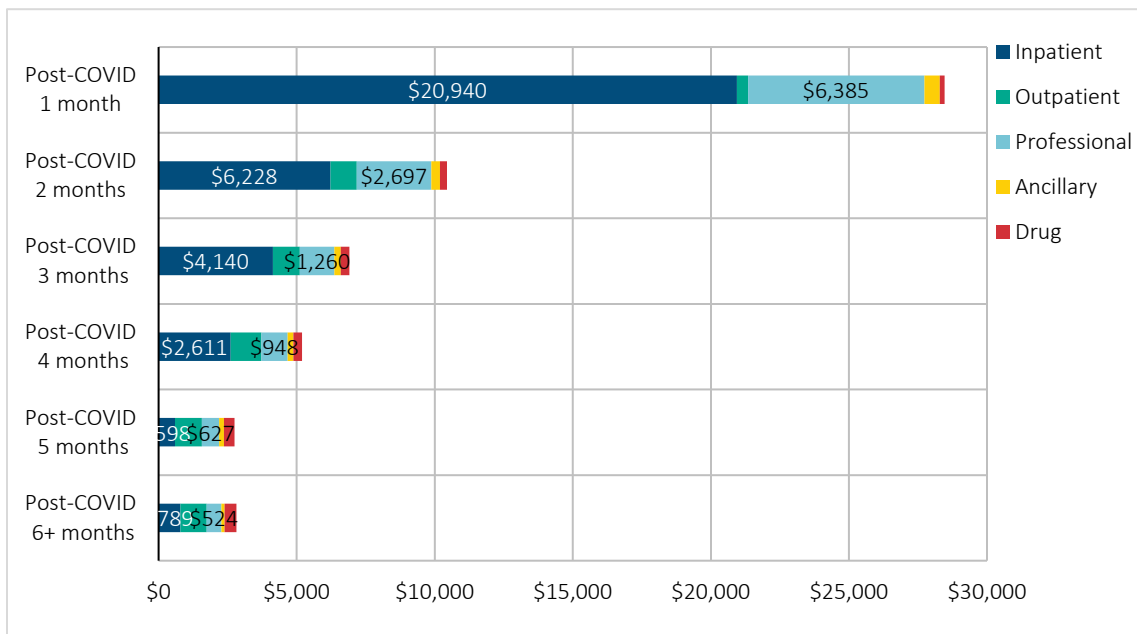
Figure 12 below shows the overall patterns of claims ramp downs for the immediate months following the month of diagnosis. Months 1-5 post diagnosis are split out, while all experience for months 6+ after COVID diagnosis are combined together into an aggregated 6+ month post-COVID-19 period. of cost ramp ups from 6+ months prior to COVID diagnosis all the way through the month of diagnosis. Similar to the ramp downs in pre-COVID diagnosis PMPM costs, the elevated levels of PMPM costs immediately following the month of diagnosis were mainly driven by higher inpatient costs. Unlike Pre-COVID costs which were almost exclusively in inpatient services, the higher post-COVID costs have higher professional costs making a noticeable contribution. Lastly, there is a noticeable pharmacy trend increase as we move from 1 month to 6+ months post-COVID diagnosis.

**Figure 12**  
**POST-COVID CLAIMS COST PMPMS FOR ALL COVID-19 DIAGNOSED MEMBERS**



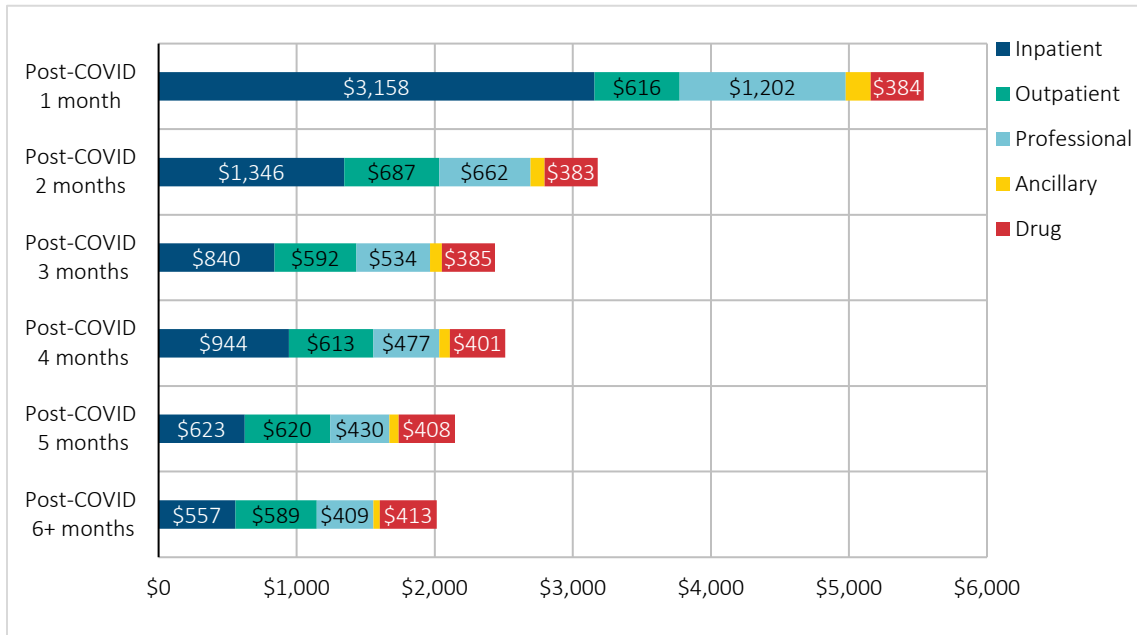
As one would expect, the characteristics vary quite a bit by the different COVID-19 diagnosis categories. Figure 13 below shows the post-COVID ramp-downs for members with severe hospitalization.

**Figure 13**  
**POST-COVID CLAIMS COST PMPMS FOR COVID-19 DIAGNOSED MEMBERS WITH SEVERE HOSPITALIZATION**



The pattern of ramp downs is much more precipitous for this population relative to the overall COVID diagnosed population. The first post-COVID diagnosis month has average PMPM costs of roughly \$28,000. This cost amount drops by 90% 5 months after the diagnosis. This can be seen in Figure 14 below.

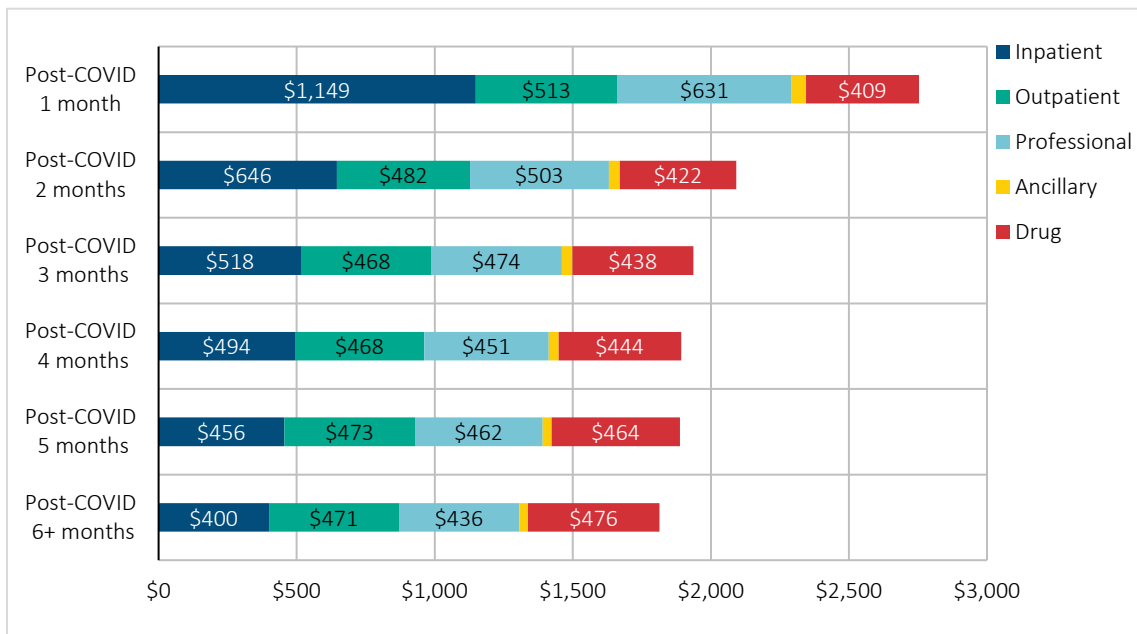
**Figure 14**  
**POST-COVID CLAIMS COST PMPMS FOR COVID-19 DIAGNOSED MEMBERS WITH NON-SEVERE HOSPITALIZATION**



In addition, the main drivers of the higher claims in the immediate months following hospital stays that spill over into the following month, depending on how providers are compensated. Non-severely hospitalized members have a similar, albeit less abrupt pattern. Decreasing inpatient and professional claims lead to a 63% drop in overall claims 6+ months after diagnosis.

Moving on to individuals not hospitalized for COVID-19, we see less of a ramp down, as expenses quickly drop from the month of diagnosis to ‘new normal’ levels. Figure 15 shows that a strong pattern of ramp-downs still exists for that population. Reductions in mostly inpatient and some professional costs driver this 34% decrease.

**Figure 15**  
**POST-COVID CLAIMS COST PMPMS FOR NON-HOSPITALIZED COVID DIAGNOSED MEMBERS WITH AT LEAST 1 HCC**



Lastly, we have non-hospitalized members with a COVID-19 diagnosis but no HCCs indicating underlying conditions. This population had a very small and almost immediate ramp down. By month 2 post-COVID diagnosis, claims already started to manifest positive trends. This is most likely due to the relatively good health of these members along with milder cases of COVID-19. Inpatient, outpatient and professional services all contributed to the 13% claims reduction from month 1 to month 2 post-COVID. This can be observed in Figure 16 below.

**Figure 16**  
**POST-COVID CLAIMS COST PMPMS FOR NON-HOSPITALIZED COVID-19 DIAGNOSED MEMBERS WITH NO HCCS**



Overall, there is a very clear pattern of ramp-downs in PMPM costs following COVID-19 diagnoses. More severe cases and less healthy members tended to have a more significant and slower return to ultimate new costs. In the next section we will examine how claims costs have changed as a result of the COVID-19 diagnosis along with the most appropriate ways to measure those changes.

### 3.3 CHOOSING APPROPRIATE ENDPOINTS FOR PRE- AND POST-COVID-19 CLAIMS

Because of the significant ramp-ups and ramp downs, it can be challenging to come up with an appropriate factor that illustrates long term effects of COVID-19 on different populations.

In order to determine the best estimate, it’s important to choose appropriate starting and ending points. Starting points need to reflect an appropriate base value that represents a true “steady state” claims value. Ideally, this value would be free of any influences relate to COVID such as fluctuations due to timing impacts of deferred care and any actual direct COVID expenses. For the ending point, it is preferable to target claims that are free of any acute and intermediate COVID effects. Rather, the goal is to establish a point in time that includes underlying claims with any increases related to worsening of underlying chronic conditions, emergence of new conditions, and longer term Post-Acute COVID syndrome.

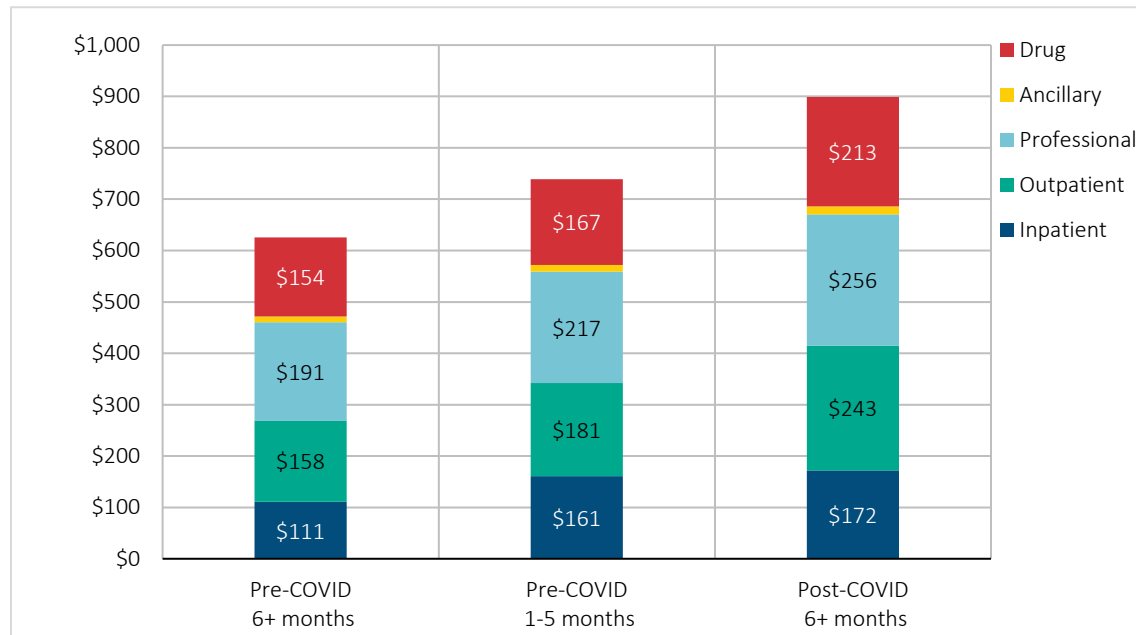
Given the way the available data was structured, using an endpoint of 6+ months post COVID-19 diagnosis makes the most sense. On the other hand, the starting point is less clear. There are some potential disruptions due to factors mentioned above that could impact both the 6+ months pre-COVID period as well as the claims ramp-up

period from months 1-5 pre-COVID. In this section we will examine trends which compare 6+ months Post COVID to both the 6+ month pre-COVID period as well as the period from months 1-5 pre-COVID.

Figure 17 below shows the PMPM values for each of the three periods mentioned above for all COVID-19 diagnosed populations.

**Figure 17**

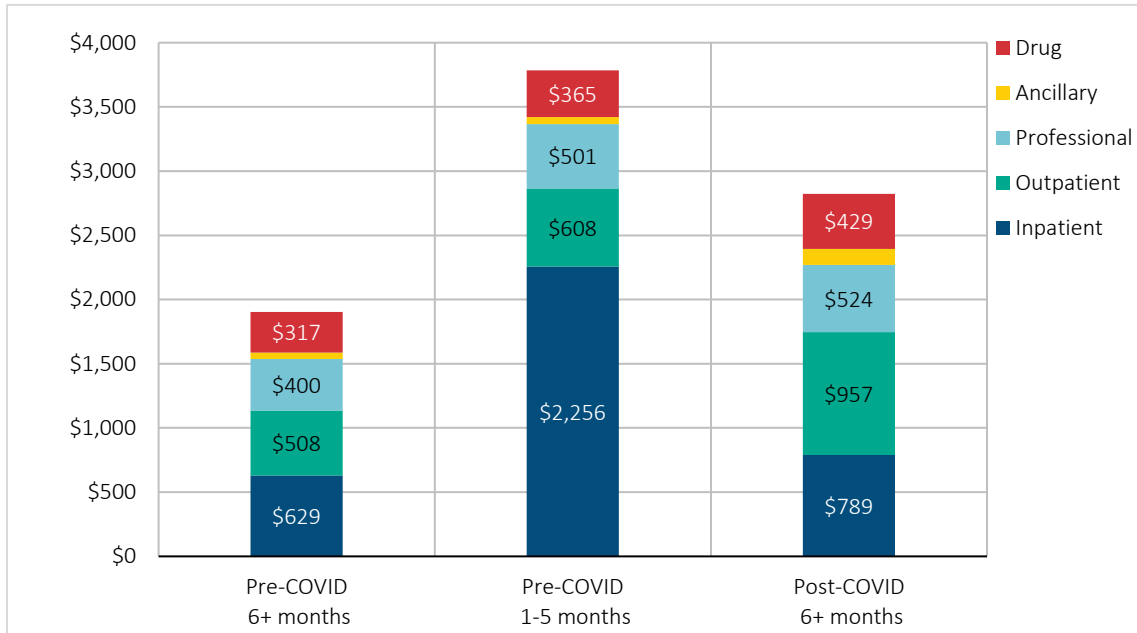
**POST-COVID-19 DIAGNOSIS COST INCREASES BY SERVICE CATEGORY FOR ALL MEMBERS**



As the figure above shows, there are significant PMPM differences between the PMPM costs for the two possible base periods. Inpatient and Outpatient costs are the main causes of higher claims in the 1–5-month pre-COVID period. However, the period 6+ months prior to diagnosis may be artificially low due to deferrals of care, particularly elective surgeries that took place in the early part of the pandemic. In, addition, individuals may have put off some of their regularly scheduled check-up or also seeking care for any less severe medical episodes. Additionally, during the pandemic, fee schedule increases due to inclusion of the COVI-19 diagnosis as well as due to provider contracting changes may have contributed to hiver costs during the 1–5-month period before diagnosis, relative to the 6+ months pre-COVID period. Overall, the calculated range of trends is from 22% when using 1-5 months pre-COVID experience as the base vs. 44% when using the 6+ months period as the base. Based on the factors at play, it is reasonable to expect that true overall trends would likely fall into a range of 22%-44%.

Doing the same comparison for different COVID-19 populations results in significant differences in trends ranges. When we looked at members with severe hospitalizations, we can see that the different bases have significant distortions as shown in Figure 18.

**Figure 18**  
**POST-COVID-19 DIAGNOSIS COST INCREASES BY SERVICE CATEGORY FOR MEMBERS WITH SEVERE HOSPITALIZATIONS**



For the severely hospitalized members, the pre-COVID-19 1-5-month period was actually higher than the 6+ month post-COVID-19 period. Therefore, it is clear that this 1-5-month pre-COVID-19 period has a lot of distortions, particularly in the inpatient setting which are potentially related to either COVID-19 episodes or deferred care / elective surgery that took place just before the COVID-19 diagnosis.

**Figure 19**  
**POST-COVID-19 DIAGNOSIS COST INCREASES BY SERVICE CATEGORY FOR MEMBERS WITH NON-SEVERE HOSPITALIZATIONS**

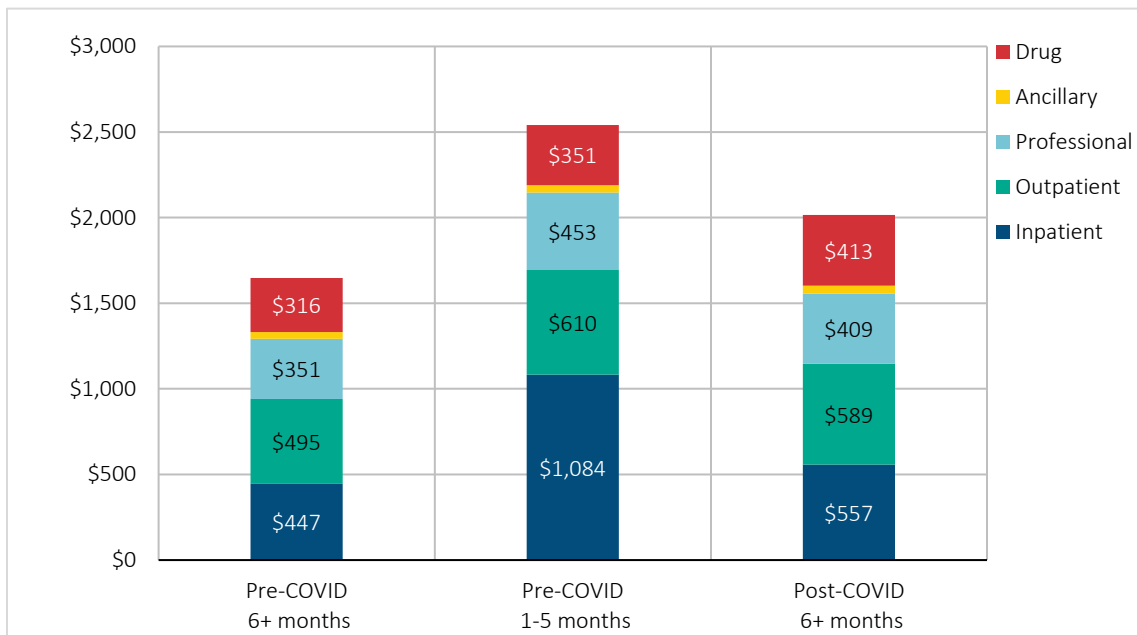
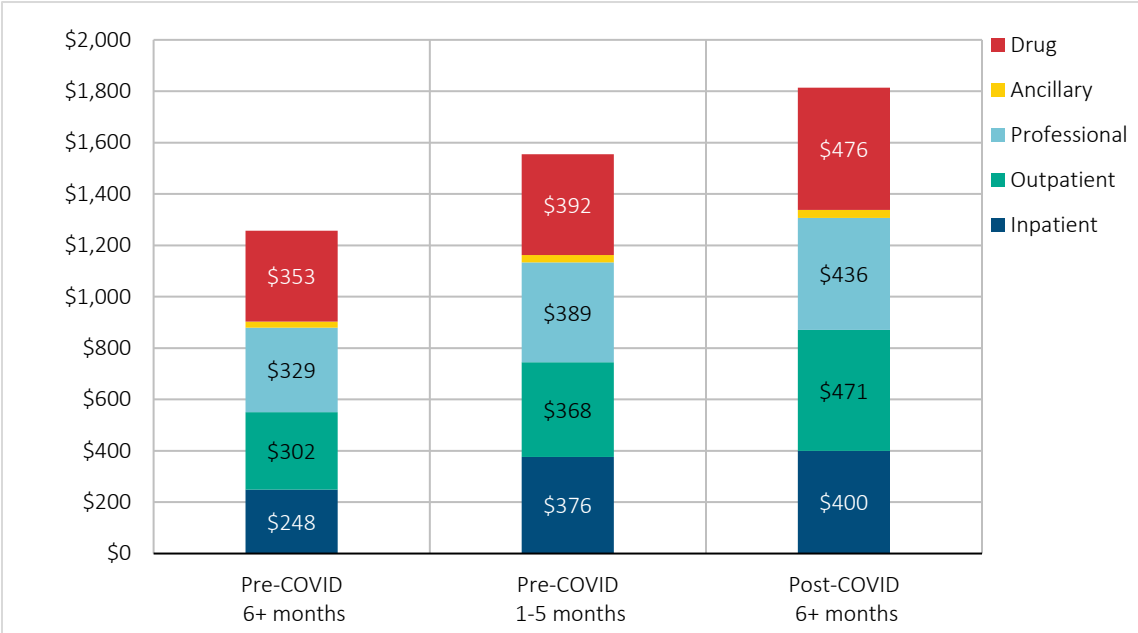


Figure 19 above shows a similar comparison for members with non-severe COVID hospitalizations. In this case as well, the 1–5-month period pre-COVID appears to have a lot of higher inpatient claims, likely related to early onset of COVID-19 or scheduling of elective services during that period.

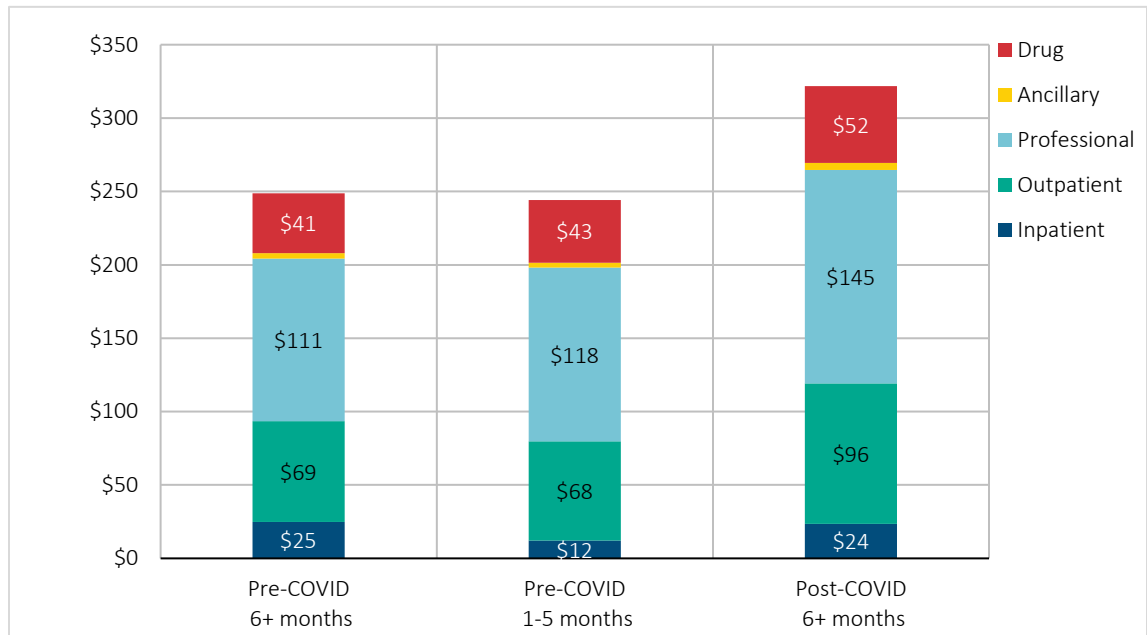
For non-hospitalized members with at least one HCC, the pattern reverts back to more normal levels for 1-5 months pre-COVID diagnosis. This is shown in Figure 20 below. This population group exhibits modestly higher levels of claims for months 1-5 pre-COVID-19 vs. 6+ months pre-COVID-19 diagnosis. Here, there were still some noticeable increases during the ramp up period, resulting in a trend of 17% when using 1-5 months pre-COVID experience as the base vs. 44% when using the 6+ months period as the base. This looks like a reasonable range of values to expect from this group.

**Figure 20**  
**POST-COVID-19 DIAGNOSIS COST INCREASES BY SERVICE CATEGORY FOR NON-HOSPITALIZED MEMBERS WITH AT LEAST ONE HCC**



Finally, we have the non-hospitalized members with COVID that have no HCCs. The pattern of those individuals is shown in Figure 21 below.

**Figure 21**  
**POST-COVID-19 DIAGNOSIS COST INCREASES BY SERVICE CATEGORY FOR NON-HOSPITALIZED MEMBERS WITH NO HCCS**



This cohort is different from the previous ones in that there is not a demonstrable ramp-up in costs prior to the month of diagnosis. In fact, the average PMPM cost for those members slightly dropped in months 1-5 before COVID relative to their 6+ month pre-COVID costs. The overall difference is very small as costs rose 32% when comparing months 6+ post COVID to months 1-5 pre COVID vs. 29% when using 6+ months pre-COVID as the base. Table 4 below compares all % changes for 6+ month post-COVID-19 costs to the two different sets of pre-COVID-19 costs.

**Table 4**  
**DIFFERENCES IN PRE-COVID VS. POST-COVID CLAIMS TREND BY BASE PERIOD**

| Population                                         | 6+ Months Post vs. 1-5 months pre-COVID-19 Diagnosis Claims Trends | 6+ Months Post vs. 6 months pre-COVID-19 Diagnosis Claims Trends |
|----------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------|
| Severely Hospitalized COVID-19 members             | -25%                                                               | 48%                                                              |
| Non-Severe Hospital Admitted COVID-19 members      | -21%                                                               | 22%                                                              |
| Non-Admitted COVID-19 Patients with at least 1 HCC | 17%                                                                | 44%                                                              |
| Non-Admitted COVID-19 Patients with no HCCS        | 32%                                                                | 29%                                                              |
| <b>All members with COVID-19 Diagnoses</b>         | <b>22%</b>                                                         | <b>44%</b>                                                       |

There are a lot of differences between using the different base periods laid out above. For hospitalized members, the ramp-ups of cost in the months just prior to COVID-19 diagnosis are significant and they effectively prevent the use of months 1-5 pre-COVID-19 as a credible base period. On the other hand, the experience of non-hospitalized members lends credence to the use of months 1-5 pre-COVID as useful to determining the appropriate starting point. Therefore, in examining one’s own data, it is important to establish a baseline that includes appropriate expenses, without artificially lowering the baseline due to missing claims caused by disruptions to services. Therefore, it is reasonable to expect that the effect of COVID-19 should reasonably be expected to fall somewhere



in between the factors calculated using a base of 6+ months pre-COVID-19 and a base using 1-5 months pre-COVID PMPM claims.

When breaking out Pre-COVID and Post-COVID claims by service category, there are evident differences between the level of increases by service category.

## Section 4: Key Takeaways from Pre-COVID and Post-COVID Claims Characteristics

Overall, there are some definitive conclusions that can be drawn about the impact of COVID-19 on PMPM claims experience. Despite some large fluctuations due to sizes of cohorts and disruptions of the timing of historical claims due to the COVID-19 pandemic, there is still validity in what we are seeing.

The main conclusion is that individuals with COVID-19 Diagnoses saw significant increases in their post-Diagnosis costs vs. pre-diagnosis costs. While the amounts by which these increases took place varied, all member cohorts saw some large, indisputable increases over the course of the year spanning their COVID-19 diagnosis.

Members with more severe COVID-19 outcomes and preexisting underlying conditions had higher baseline PMPM costs. Higher expenses in the month of COVID-19 diagnosis correlated with higher starting and ending PMPM costs as shown in the different membership breakouts. In addition to that, hospitalized members had the greatest amounts of claims distortions just before and just after their months of diagnosis, with often up to 6 months of elevated claims being manifested before and after their diagnosis. Non-hospitalized members with HCCs demonstrating underlying medical conditions, also saw ramp-ups and ramp downs of costs, although much more modest than those observed for hospitalized members.

Members with no underlying conditions documented as HCCs had no observable pattern of ramp ups in pre-COVID costs and a very modest ramp down of costs before returning to their post-COVID baseline levels almost immediately.

Generally, comparing PMPM costs from 6+ months before and 6+ months after COVID diagnosis made the most sense in terms of cost ramp-up and ramp downs. However, some of those factors may have been distorted as well due to medical service disruptions early in the pandemic. In addition to this, fee schedule changes that happened during the pandemic also contributed to higher observed trends. As a result, the claims trends demonstrated using this methodology are likely biased to somewhat overstate the longer-term impacts of COVID-19 on member costs.

Claims distortions prior to COVID-19 diagnosis were mainly in the inpatient hospital service category. This might demonstrate the existence of some timing disruptions of elective services or the result of worse outcomes due to untreated conditions at the beginning of the pandemic. Higher average claim costs in the month after diagnosis were mainly concentrated in the inpatient hospital service category as well, but there were also observable bumps in professional services, especially 1-2 months after the COVID-19 diagnosis. More severe COVID-19 outcomes and underlying conditions were more skewed towards higher inpatient costs, as the most severe cases were hospitalized for COVID-19. On the other hand, less severe outcomes with healthier members tended to exhibit a higher bump in professional services.

Overall, once the impacts of acute COVID had tailed off, there were still significantly higher claims observed for members with a COVID-19 diagnosis over six months later. These levels were well in excess of standard trends. As a result, we can conclude that individuals who have recovered from COVID-19 have demonstrated much higher overall claims several months after their diagnosis. The fact that these levels were maintained indicates that the members' claims and risk profiles have permanently change. Some of this is likely due to worsening of underlying conditions or development of new medical conditions. Another possible explanation is centered around lingering Post-Acute COVID Syndrome or Long COVID.

## Section 5: Limitations and Goals of Further Study

When examining the results of this study, it is important to take into account any factors that are either unique or may be influencing the results as well as subsequent changes that might change the trajectory of experience observed up to this point.

While this study shows a large, definitive, and lasting increase in claims PMPMs for members diagnosed with COVID 19, it is important to note that this result cannot necessarily be extrapolated to the future in the same way.

Some factors that have changed since the period that this data measured are as follows:

- Additional runout in future periods
- Emergence of different COVID-19 variants
- Impact of vaccination on claims
- Impact on individuals who did not seek COVID-19 treatment
- Impact of changes in human behavior/government responses (i.e., deferral likely regardless of covid case levels)
- Impact on risk scores and overall population as more individuals got COVID-19

As actuaries continue to track the impact of COVID-19 in their claims experience, the factors above all need to be taken into account. As additional months of runout get included, will discovery of effective treatments for long COVID or other negative effects taper off even more, resulting in some reductions in future claims, or will newly acquired comorbidities continue to cause trends to worsen for populations that recovered from COVID-19.

Similarly, will the Delta variant and the family of Omicron variants of COVID-19 result in different manifestations of long COVID? Will their impact be greater or less than what we observed with the original strain? Will the uptake of vaccination and previous infections help to mitigate the impacts of Long COVID, or will they make long COVID worse and generate additional chronic conditions to members with COVID-19?

Also, how will the impact of health equity and disparities related to network adequacy, access to care, and provider participation affect different populations? As the landscape changes, we would expect the impacts of these changes to be borne out in member costs as well as types of services rendered.

Other changes that took place during the pandemic may also be borne out in experience. The shift to telehealth impacted costs during the pandemic and will likely affect how healthcare is practiced during the post-pandemic or endemic phase of COVID-19. While the total effect of telehealth remains to be seen, it does provide opportunities for some members with geographic and transportation challenges to more easily access care.

Finally, will there be a new baseline for populations with no COVID-19 diagnosis having different trend characteristics than before during the months of the pandemic? There are many individuals who were diagnosed with COVID-19 through testing outside of their insurance carrier. As a result, some of these individuals may experience higher post COVID claims without being identified as having had COVID-19.

In addition, we need to be able to apply what we have learned from COVID-19 to future pandemics. Some key considerations, particularly for new diseases with no known treatment include the potential for deferral of care and a shifting to remote services. This could cause similar disruptions in claims patterns, making it more difficult to track the effects of these diseases on overall claims, as well as to project overall expected claims over the course of future pandemics. This will extend not only to infected populations, but to the uninfected as well. Being able to anticipate

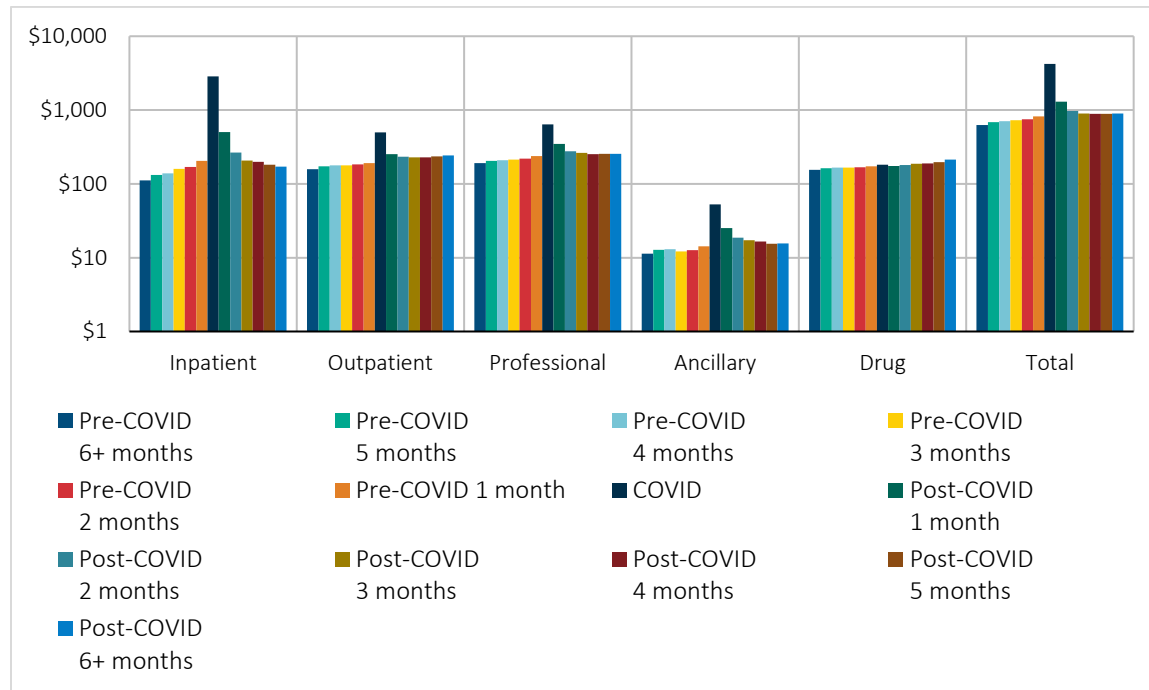
these types of disruptions to access to care and treatments will help actuaries better project the effects of the next pandemic.

## Appendix: Health Care Cost Anomalies Observed Pre and Post COVID-19 Diagnosis

Individuals with a COVID-19 Diagnosis, have a much higher cost during their month of diagnosis. However, there is often a ramp-up of costs just prior to a COVID-19 diagnosis as well as a ramp down following the month of diagnosis back to similar pre-COVID levels. Figure A1 below demonstrates this pattern in a consistent manner for all combined COVID-19 diagnosed members. The overall pattern shows that ramp downs of costs result in higher costs than the ramp up period, as well as a slightly slower decline 1 month after diagnosis and more so on inpatient costs.

**Figure A1**

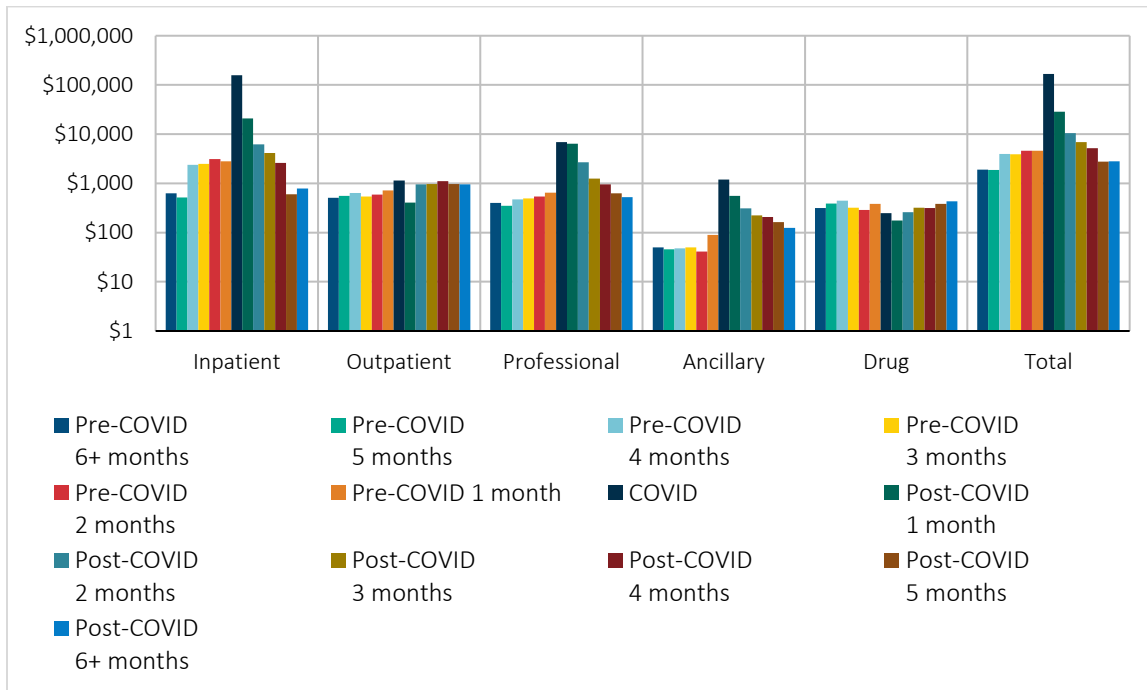
### COMPLETED ALLOWED PMPM OF ALL MEMBERS WITH COVID-19 DIAGNOSES



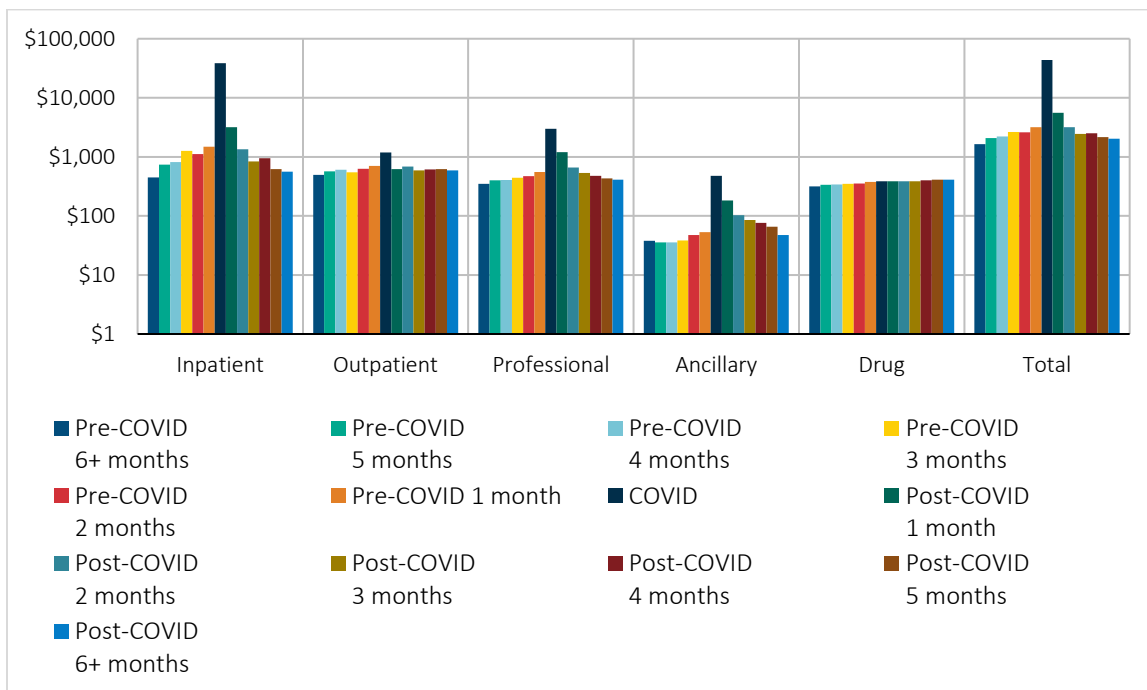
Additional Figures are included below for different levels of COVID-19 severity. These include severe and non-severe admitted cases as well as non-admitted cases with and without HCCs. Patterns that stand out include:

- Severe admitted cases had the slowest ramp downs, particularly for inpatient and professional services.
- Overall pharmacy costs had almost no increase during the month of COVID-19 diagnosis.
- Professional and Outpatient services roughly doubled in the month of COVID-19 diagnosis.
- Inpatient Costs were by far the primary driver of increased costs during the month of COVID-19 diagnosis.

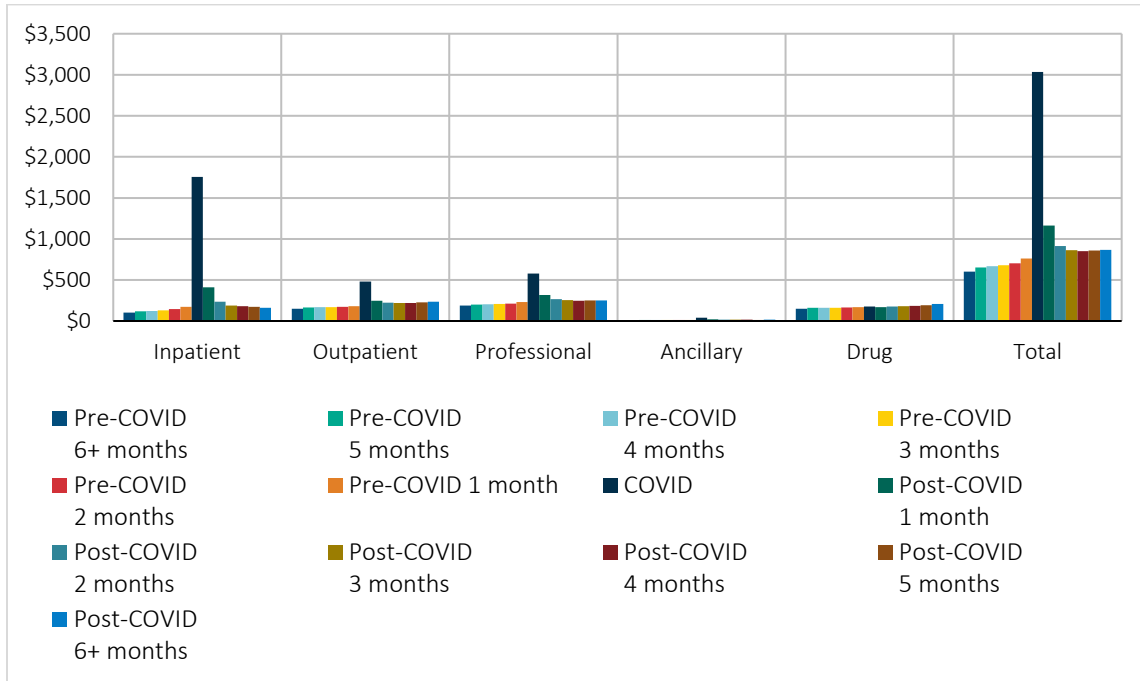
**Figure A2**  
**COMPLETED ALLOWED PMPM OF ALL SEVERE ADMITTED MEMBERS WITH COVID-19 DIAGNOSES**



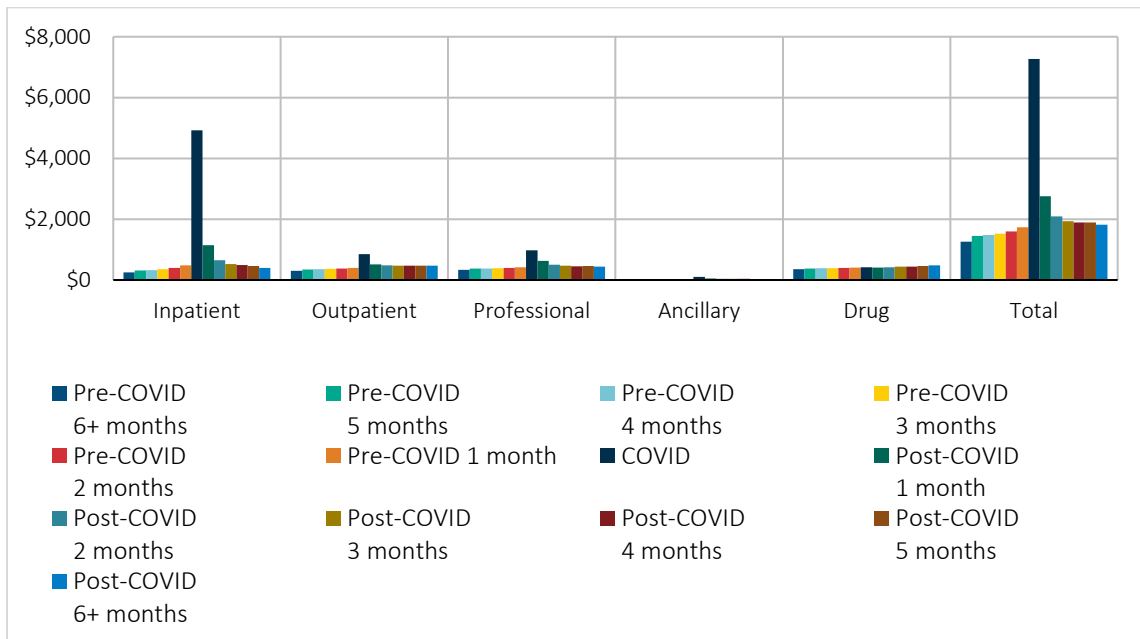
**Figure A3**  
**COMPLETED ALLOWED PMPM OF ALL NON-SEVERE ADMITTED MEMBERS WITH COVID-19 DIAGNOSES**



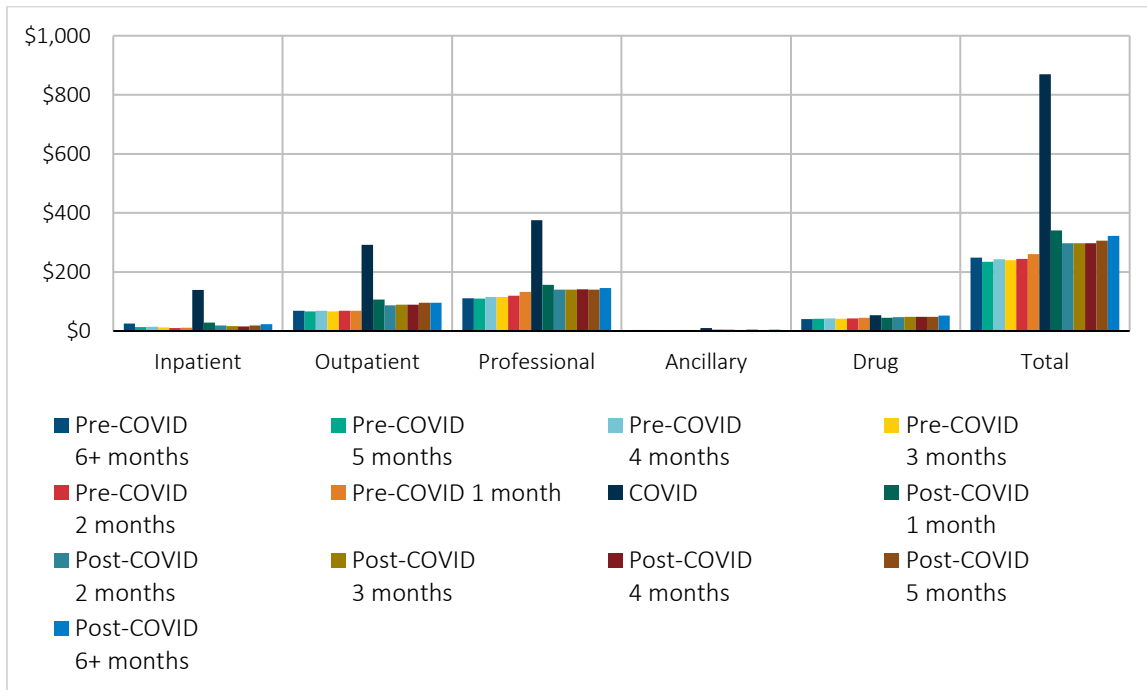
**Figure A4**  
**COMPLETED ALLOWED PMPM OF ALL NON-ADMITTED MEMBERS WITH COVID-19 DIAGNOSES**



**Figure A5**  
**COMPLETED ALLOWED PMPM OF NON-ADMITTED MEMBERS WITH COVID-19 DIAGNOSES AND AT LEAST ONE HCC**



**Figure A6**  
**COMPLETED ALLOWED PMPM OF NON-ADMITTED MEMBERS WITH COVID-19 DIAGNOSES AND NO HCCS**



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## Acknowledgments

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