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Disruption and Rebound: Healthcare and Telemedicine in Colombia during the COVID-19 Pandemic for Chronic Care Patients

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Abstract

The COVID-19 pandemic led to declines in in-person consultations and substantial increases in telemedicine use in many countries. This paper investigates whether this pattern occurred in Colombia using data for people with particular health conditions prior to the pandemic (rheumatoid arthritis, hemophilia, chronic kidney disease, HIV, and cancer). The study shows that healthcare utilization by people in Colombia with these conditions dropped significantly during the first months of the pandemic relative to the average of the previous two years. However, by the end of 2020, the rate of healthcare utilization had almost reached pre-pandemic levels. While the number of services fell for people in both the contributive and subsidized scheme, the share of people who had any contacts with healthcare providers each month declined substantially for those in the subsidized scheme and by a statistically insignificant amount for those in the contributive scheme. Declines in utilization and contacts for in-person consultations were partially offset by the increased use of telemedicine services which accounted for almost one-fifth of healthcare contacts by December 2020. Of the main explanations for healthcare disruptions, the diversion of healthcare resources to treat COVID-19 patients does not seem to have been as significant as changes in social mobility and government lockdown policies.

These findings have a variety of implications for public policy, including: the need to address the causes of healthcare utilization declines among individuals in the subsidized scheme; the importance of incorporating better social communication and adjustments to lockdown policies when planning for future health emergencies; the value of expanding telemedicine, not only during emergencies but also during normal times; and the potential benefits from improving the quality and availability of administrative data so that future research can contribute more effectively to policies that promote greater equity and effectiveness in Colombian healthcare services.

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Key Words: COVID-19; Pandemic; Healthcare; High-cost diseases; Telemedicine; Digital Health; Colombia; Latin America.

JEL Codes: I10; I11; I18; O14

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1. Introduction

Colombia responded relatively quickly to reports of COVID-19. In March 2020, the same month that WHO declared it a "global pandemic," Colombia declared a state of health emergency and acted to slow the disease through quarantines and mobility restrictions (Ministerio de Salud y Protección Social, 2020). It also boosted healthcare system capacity by creating additional ICU beds, opening provisional hospitals, and promoting telemedicine for a range of health specialties. The disease initially spread more slowly in Colombia than among neighboring countries. Nevertheless, a large wave of infections spread across the country in August 2020, and Colombia continued to experience resurgences, with peaks between December 2020 and February 2021, and again from May to July 2021 (Dong, Du, & Gardner, 2020).

Healthcare services for ailments and conditions other than COVID-19 were reportedly disrupted by the pandemic when resources were diverted to treat COVID-19 patients, health workers fell ill and could not work, and some patients stopped seeking care out of fear of infection. Telemedicine services, allowing patients to consult with medical professionals without risking infection and without requiring professionals to spend time traveling to and from places of work, was a technical strategy for mitigating some of the disruptions in healthcare services. Fortunately for Colombia, the government had been promoting the adoption of telemedicine services prior to the pandemic and was well-placed to pass a series of resolutions that facilitated remote healthcare services, promoted the implementation of digital platforms for telehealth, and implemented other strategies that increased the supply and use of these services (Chavez et al., 2021).

This paper investigates three aspects of how the healthcare system responded to the pandemic. First, it measures how much in-person consultations changed after the arrival of the pandemic. Second, it measures the increasing use of telemedicine and explores whether telemedicine was able to substitute for some of the declines in in-person consultations. Third, it asks whether those changes were similar for different health conditions. Finally, it considers hypotheses regarding the disruption of healthcare services in 2020. In particular, it asks whether those changes are largely a consequence of overwhelmed healthcare facilities, government-mandated restrictions on movements, or social responses to fears of contagion.

2. Background

2.1. Colombian health system

Until 1993, Colombia's health system was like many other Latin American countries. Access to health coverage differed significantly between people with private health insurance, formal sector public insurance, government health insurance, and those with no formal insurance at all. The latter were only able to access services through public provision, managed by federal and local authorities, when it was available.

In the early 1990s, several reforms changed this system dramatically, creating a universal health coverage system with explicit rules for enrollment and coverage. Since then, the new system has undergone further modifications by legislative, executive, and judicial action. Today, enrollment in the national health system is obligatory for all residents and covers 49.1 million people – about 96% of the population.[2] In general terms, formal employees and self-employed individuals who earn more than the minimum salary are expected to contribute payroll taxes and are part of the "contributory scheme;" while those who qualify for social benefits are part of the "subsidized scheme." Therefore, people in the contributory scheme are more likely to have higher incomes than those in the subsidized scheme.[3] Special insurance programs exist for

[2] Cifras de aseguramiento Ministerio de Salud y Protección Social, 2021 (date: October 2021).
[3] Strictly speaking, implementation of all legal provisions would necessarily lead the contributory scheme participants to have higher incomes than those in the subsidized scheme. Nevertheless, for a variety of reasons, this distinction is not exact. For example,

some groups based on schemes that were established before 1993, such as teachers and members of the military. In addition, a small share of the population is not registered at all, as can happen in the case of migrant workers or people who are so poor that they are homeless.

Currently, the risk-adjusted premium paid to insurers in both the contributory and subsidized scheme is expected to cover all services explicitly identified in a single national Health Benefit Plan (*Plan de Beneficios de Salud* or PBS) and is financed through a combination of payroll contributions and public allocations. Services which are not explicitly included in the PBS – but are not statutorily excluded (e.g., cosmetic surgeries) – are financed from a separate public allocation under a capped budget mechanism ("*Presupuestos Máximos*").

In Colombia, Individuals choose their insurer – called Health-Promoting Entities (*Empresas Promotoras de Salud* in Spanish, hereafter "EPS" or "insurers"). The EPSs, in turn, contract with healthcare providers (*Instituciones Prestadores de Servicios de Salud* in Spanish, hereafter "IPS" or "providers"). To address equity, insurers retain a risk-adjusted premium set by the government. Funds in excess of that amount, along with the government's own contributions, are redistributed through financial mechanisms to insurers who have collected less than the risk-adjusted premium.

Colombia has both private and public healthcare provision. Subnational authorities (*distritos, departamentos,* and *municipios*) use their own funds along with transfers from the federal government to operate their healthcare facilities. Well-care visits and treatment for minor ailments take place in doctor's offices or primary healthcare clinics. Secondary and Tertiary hospitals are distributed throughout the country but are concentrated mostly in urban areas. Colombia's geography is quite complex, with mountains and valleys, making access to healthcare in rural areas particularly difficult.

In 2007, Colombia passed legislation to create the High-Cost Fund (*Cuenta de Alto Costo* in Spanish and referred to hereafter as CAC) to improve the quality of care and slow the growth in healthcare spending. CAC is a publicly chartered non-governmental organization whose members are EPSs. CAC focuses its attention on a subset of health conditions which account for significant spending and assists the EPSs in improving the care and management of these conditions. CAC regularly collects data from the EPSs to analyze spending, utilization, and performance.

The country's healthcare system began to face significant stresses in 2016 with the arrival of more than 1.6 million Venezuelan migrants (Bowser et al, 2022). The COVID-19 pandemic generated further stresses on the healthcare system while disrupting all other social and economic activities. Colombia's national income fell 7 percent in 2020. Fortunately, it rebounded in 2021 with an economic growth rate of 10%.

2.2. COVID-19 pandemic

When COVID-19 reached Latin America in early 2020, some governments downplayed the pandemic's seriousness, responding haphazardly, while others took it quite seriously, developing strategies and taking action. Colombia was among the latter countries. The government created a high-level forum, including cabinet officials and international agencies, before the arrival of the virus. It coordinated its strategy development with WHO/PAHO and other international agencies. The President engaged subnational authorities in a range of policies to reduce transmission and communicate with the populace. Starting on March 29, the government began issuing daily situation reports and daily broadcasts, titled "Prevention and

people earning low wages in the formal sector may be enrolled in the contributive scheme while some high-earning self-employed people may benefit from participation in the subsidized scheme if they are in the informal sector and do not accurately report their incomes.

Action." A series of emergency laws were enacted, beginning on March 12, 2020, with the declaration of a health emergency. It facilitated public health measures to slow the spread of the infection. It also included a variety of measures to expand health system capacity, including the encouragement of telemedicine, financial support for the healthcare services, and the procurement of medical supplies and equipment (Ministerio de Salud y Protección Social, 2020). For example, on April 12, the government launched a plan to increase the capacity of ICU beds by 300%. The government also coordinated plans for quarantines with rules to establish when people could go out of their homes (WHO, 2020b). As a result of these efforts, the rate of infection and deaths from COVID-19 did not initially rise as quickly as in other countries of the region. Nevertheless, in July and August of 2020, infections began to surge, just as quarantines were being relaxed or lifted. As of the end of 2021, Colombia had reported over 2.8 million COVID-19 cases and over 80,000 deaths (WHO, 2021). The virus's rapid spread during the first two years of the pandemic put immense pressure on the healthcare system, resulting in shortages of medical personnel, supplies, and beds in hospitals and healthcare facilities (Gomez et al, 2020).

Many articles indicate that the health of patients with chronic conditions worsened as a result of the pandemic. Information on Colombia is limited, but one study by the Colombia Society of Cardiology found that the number of patients with chronic cardiovascular conditions who experienced acute events during the pandemic increased (Cardenas et al, 2020). In Chile, health check-ups for cardiovascular patients declined by 59% (DEIS, 2020), while Ecuador reported a substantial reduction in care for hypertension and diabetes (Mena and Casali, 2020). Other studies showed a reduction in hypertensive disease consultations in Paraguay (Tullo et al, 2020), diabetes and hypertension visits in El Salvador (Bancalari, Bernal, and Garcia, 2021), and cardiology consultations and diagnostic tests in Brazil (Almeida et al, 2020). Hospitalizations for chronic conditions in Brazil, Chile, El Salvador, and Mexico also decreased in 2020 relative to the 2015-2019 average and the mortality rate for these conditions significantly rose in Brazil, Chile, and El Salvador (Savedoff et al., 2022). Overall, the pandemic affected people with non-communicable diseases (NCDs) and those who rely on chronic care management, which is likely to have long-term consequences for population health.

2.3. Telemedicine in Colombia

Telemedicine played a more significant role during the COVID-19 pandemic than in any prior health emergency. The term "telemedicine" - in its most general sense - refers to the use of information and communication technologies (ICT) to share information across distances. It can include consultations between patients and healthcare providers, remote monitoring of patients, and communication among healthcare providers. For many years, attention to telemedicine has been touted for providing better access for rural populations or efficiently exchanging diagnostic information among providers. More recently, telemedicine has been promoted as an opportunity to improve the patient's and doctor's experience of care, attain better population health, and reduce healthcare costs (Tuckson, Edmunds, and Hodgkins 2017). The COVID-19 pandemic showed the benefits of telemedicine in limiting transmission of infectious diseases. It also demonstrated how telemedicine can improve efficiency by, for example, using "forward triage", linking diverse databases to improve diagnosis, monitoring patients remotely, and making it possible for quarantined health personnel to continue to provide healthcare services (Hollander and Carr 2020).

Telemedicine has a relatively short history in Colombia. Prior to the COVID-19 pandemic, telemedicine was promoted for providing remote consultations, diagnosis and follow-up care of patients in rural and remote areas, or for patients with chronic conditions who needed regular monitoring. Between 2006 to 2018, the country started to make progress in regulating telemedicine as a service for patients with limited supply and access due to their place of residence and other barriers (Chavez et al., 2021). In 2019, Resolution 2654 expanded the range of services which could be provided with telemedicine, establishing distinct categories:

interactive, non-interactive, tele-expertise, and telemonitoring. Prior to the introduction of this resolution, the number of telemedicine services was less than 3,000 annually. However, when the government relaxed constraints on telemedicine as part of the emergency response to the COVID-19 pandemic, telemedicine services increased fourfold (Chavez et al, 2021).

Colombia also distinguishes the terms "telemedicine" and "telehealth." The term telemedicine is applied to remote health services for the promotion, prevention, diagnosis, treatment, and rehabilitation of patients. By contrast, the term telehealth is used more broadly to include telemedicine and other remote activities such as tele-education in health. When the COVID-19 pandemic began, the government passed emergency legislation which permitted more healthcare providers to provide a wider range of healthcare services; however, this was enacted as a temporary measure only for the duration of the health emergency (Chavez et al., 2021).

Colombia is not the only country to have experienced a drop in in-person consultations and a surge in telemedicine with the arrival of COVID-19 (WHO 2020a; LeRouge et al. 2019). For example, using commercial insurance claims in the United States, Whaley et al. (2020) found that there were 1,465 fewer in-person consultations per 10,000 enrolled individuals in April 2020 relative to the historical average. In the same month, there were 641.6 more telemedicine consultations per 10,000 enrolled people compared to the previous two years. Other studies in the United States show that in-person consultations fell by almost 50%, while telemedicine increased by a factor of 20 relative to 2019 – particularly for mental health services, among patients in counties with low poverty levels, and for those in metropolitan areas (Cantor et al., 2020; Mehrotra et al, 2021). Telemedicine use also increased in Europe during the first years of the pandemic. The share of adults who received healthcare through telemedicine increased the most in Spain – rising from 48.2% in 2020 to 71.6% in 2021. At the other end of the spectrum, France saw only a modest increase from 22% in 2020 to 23.2% in 2022 (OECD, 2021). In Latin America, telemedicine use before the pandemic was generally quite small but rose rapidly during the pandemic. A study in Argentina reported an increase of 230% in the number of telemedicine calls (Busso et al., 2021); and a study in Brazil showed an increase of 77% in telephone consultations in 2020 relative to 2019 (Silva et al., 2021). Similarly, in the first six months of the pandemic in Chile, the use of telemedicine rose by 900% (Camacho-Leon et al., 2022).

3. Methodology

3.1. Data

To assess the impact of the pandemic on the utilization of healthcare and telemedicine, this study uses administrative data for a group of Colombians who need regular or chronic care because of their health conditions. It included people who used healthcare services at any time between 2018 and 2020 for arthritis, cancer, diabetes, chronic kidney diseases, hemophilia, hepatitis C, HIV/AIDS, hypertension, or pregnancy. CAC, which monitors healthcare for individuals with these conditions, collected the data from 32 of 35 member EPSs.[4] In addition to sex and age of patient, the data includes the place where medical care was provided (municipality and department); principal and secondary diagnosis code and ICD-10 classification[5]; health insurance scheme (i.e., whether *contributive* or *subsidized*); insurer (EPS); and health-care provider (IPS).

[4] Colombia's Ministry of Health indicated that there were 38 EPSs operating in Colombia during 2021; however, several were close to insolvency and later closed. The number of EPSs in the country has been declining over time. As of January 2023, the Ministry of Health and Social Protection only lists 30 EPSs in operation. (https://www.minsalud.gov.co/sites/rid/Lists/BibliotecaDigital/RIDE/VP/DOA/listado-eps-por-regimen.pdf).
[5] The 2019 version of the ICD-10 classification can be found at: https://icd.who.int/browse10/2019/en

Removing observations which appear to be duplicates, which are neither in-person nor telemedicine visits, or are implausible (e.g., person is listed as more than 100 years old), yielded a database with 70.6 million records of services (see Figure A1 in the Appendix). Service use was then calculated for groups comprising the following patient characteristics: five age categories (i.e., < 20, 20-49, 50-64, 65-80, and 80+ years), two sex categories (male or female), 1,122 geographic categories (municipalities), two insurance schemes (contributive or subsidized), and two service types (i.e., telemedicine or in-person). This led to a total of 1,323,432 cells for which 660,216 had positive observations on service use, while the remainder reported no services (see Figure A1 in the Appendix). The rate of service use (services per insured individual) calculated for each of these cells can be thought of as a monthly flow of services generated by a representative individual of a given age, sex, place of residence, and insurance status.[6]

The population affiliated with the 32 EPS that provided data includes almost 40 million people, about 79% of the Colombian population and 83% of people who are registered for insurance (see Table 1). The characteristics of the people insured by these EPSs is similar to the national insured population, with a slightly higher share of women and somewhat fewer young people (under 20), but significantly more of those in the contributive scheme. Of the people insured by these EPSs, almost 6 million or 12% have one or more of the health conditions monitored by the CAC in 2021. The dataset allowed us to identify 2.6 million individuals who used healthcare services for conditions monitored by the CAC (hereafter "the CAC subgroup"). In contrast to the national population and the EPS affiliates, women in this CAC subgroup are nearly twice as numerous as men. The CAC subgroup is also significantly older, with almost half of the people over 65 years old compared to only 9% of the national population. Almost 70% of the CAC subgroup is in the contributive scheme compared to only 58% of the 32 EPS affiliates generally and 45% of the national insured population. This is somewhat surprising because the contributive scheme population is likely to be healthier than those in the subsidized scheme. Their disproportionate presence in the CAC subgroup suggests, rather, that they may be getting screened, identified and treated at higher rates than those in the subsidized scheme.

Overall, this CAC subgroup should not be seen as representative of Colombia as a whole. It also does not represent everyone affiliated with these EPSs who have the included health conditions because it only includes those whose use of services was observed in the data. Nevertheless, it is reasonably representative of the subpopulation in Colombia that regularly requires healthcare services. Thus, if any subgroup needs to maintain healthcare use through the pandemic, it would be this group. If, instead, their service use declines, it would indicate failure to maintain non-COVID-19 healthcare services.

Table 1. Study population characteristics, 2019

Group	Colombia		EPSs reporting to CAC		EPSs reporting to CAC	
Population	**General population**		**Insured population**		**CAC subgroup**	
Total population	50,374,478	100%				
Total insured	47,962,953	95%	38,166,789	100%	2,649,394	100%
Gender						
Women	25,501,149	51%	19,682,212	52%	1,694,609	64%
Men	24,873,329	49%	18,484,577	48%	955,212	36%
Age range						
< 20 years	17,175,987	34%	11,667,414	31%	50,766	2%
20 to 50 years	21,638,980	43%	17,058,141	45%	518,531	20%

[6] In future analysis, rather than calculating service use by group, it may be possible to use individual data to follow a specific cohort. For example, a study could analyze individuals who used healthcare services associated with hypertension in 2018 and see how their service use changed in 2019 and 2020. However, this requires addressing several biases introduced by collecting the data in 2020, by changes and errors in service coding, and several forms of attrition.

Group	Colombia		EPSs reporting to CAC		EPSs reporting to CAC	
Population	**General population**		**Insured population**		**CAC subgroup**	
50 to 64 years	7,393,706	15%	5,859,993	15%	827,190	31%
65 to 80 years	3,388,887	7%	2,757,553	7%	939,368	35%
80+ years	776,918	2%	823,688	2%	312,675	12%
Health scheme						
Subsidized	22,808,930	45%	16,161,303	42%	820,922	31%
Contributive	22,909,679	45%	22,005,486	58%	1,829,504	69%
Special	2,244,344	4%				

Source: National data on insured population is from the Ministry of Health in Colombia. National population and demographic data is from Colombia's statistical office DANE. Prevalence of high-cost diseases is from the Cuenta de Alto Costo (CAC) HIGIA system and administrative records from the Cuento de Alto Costo (CAC) in Colombia
Note: "Colombia " reports figures for the national population. "CAC subgroup" presents the characteristics of people affiliated with an EPS who used healthcare services related to CAC-monitored conditions in 2019 (see text for more details).

The population in the CAC subgroup is about 6% of the total insured population and about 5% of the national population. This is quite close to the WHO's estimate that 6% of Colombians require treatment for non-transmissible diseases.[7] For comparison, WHO estimates that the number of people requiring treatment for non-transmissible diseases is about 4% in Brazil and 16% in Mexico. If this information is accurate, then Colombia's experience confirms affirmations in recent studies that the key challenge for Latin American countries appears to have shifted from improving access to addressing service quality (Kruk, et al. 2018). A substantial share of Colombians who need care are in contact with the healthcare system; however, the quality of that care and its outcomes are not reaching standards attained elsewhere.[8]

3.2. Empirical strategy

To assess healthcare during the pandemic, we analyzed the rate of healthcare service use to see whether the flow of service volume was affected. Second, we analyzed the share of insured individuals who used at least one healthcare service during any given month to see how much access was affected. Finally, we compared service utilization to changes in COVID infection rates and population mobility to explore possible explanations for changes in utilization.

3.2.1. Use of services per 10,000 affiliates

Following Whaley et al. (2020), we estimated linear regression models (OLS) with fixed effects for three distinct outcome variables: (i) total services (defined as in-person plus telemedicine services), (ii) in-person services, and (iii) telemedicine services.[9] Formally, we estimated:

$$rate_{ismt} = \theta + \beta COVID_{mt} + \rho_i + \partial_i + \gamma_s + \emptyset_i + \alpha_m + \delta_t + \varepsilon_{ismt} \quad (1)$$

where $rate_{ismt}$ is the number of consultations per 10,000 total affiliated individuals that were recorded for each age-sex-health scheme group i in municipality s during month m and year t. The $COVID_{mt}$ term is a dummy variable equal to 0 before the pandemic reached Colombia in March 2020, and 1 from March 2020 to December 2020. In each regression, we included fixed effects for age group (ρ_i), sex (∂_i), health insurance scheme ($\emptyset_i$), municipality (γ_s), month (α_m), and year (δ_t), and we report clustered standard

[7] Authors' calculations using WHO online data and UN population estimates.
[8] For example, IHME's 2016 Health Care Access Quality Index ranks Colombia as 77 of 224 countries in terms of addressing hypertension (Fullman et al, 2018).
[9] Given the size of the database and the high dimensionality of the fixed effects, it would be computationally difficult to include dummy variables for each group. Therefore, we estimated the regressions throughout the study using the *reghdfe* command in Stata which provides a computationally efficient estimator "by first regressing each variable against all the fixed effects, and then regressing the residuals of these variables." (Correia 2017).

errors at the municipality level to control for correlation in errors over time. The coefficient β measures the change in the rate at which services were utilized in the COVID-19 period relative to pre-pandemic periods of time, after controlling for seasonal and compositional changes.

3.2.2. Share of affiliates that used at least one service

The service utilization data may be misleading when estimating the impact of the pandemic on healthcare services in several ways. First, some of the in-person visits may have been unnecessary or could at least be replaced by fewer but more intensive consultations. Second, declines in service use would signify very different things if they were concentrated among a small part of the patient population rather than distributed evenly across them. Finally, the data on service utilization may be contaminated by duplications or incorrect entries. Therefore, we analyzed the data by looking just at changes in the share of people who had some contact with the healthcare system. This might be a better measure of access to care during the pandemic for people with chronic conditions than the rate of service utilization, *per se*.

We calculated the outcome variable for this analysis as the share of affiliates with at least one in-person visit or telemedicine service over the total number of affiliates in the given age-sex group, department, health insurance scheme, month, and year. In this case, we used the department rather than municipality because the aggregated affiliation data that we were able to obtain at the department level was more consistent with the service-level information in the database. Formally, we estimated:

$$share_{ismt} = \theta + \beta COVID_{mt} + \rho_i + \partial_i + \gamma_c + \emptyset_i + \alpha_m + \delta_t + \varepsilon_{ismt} \quad (2)$$

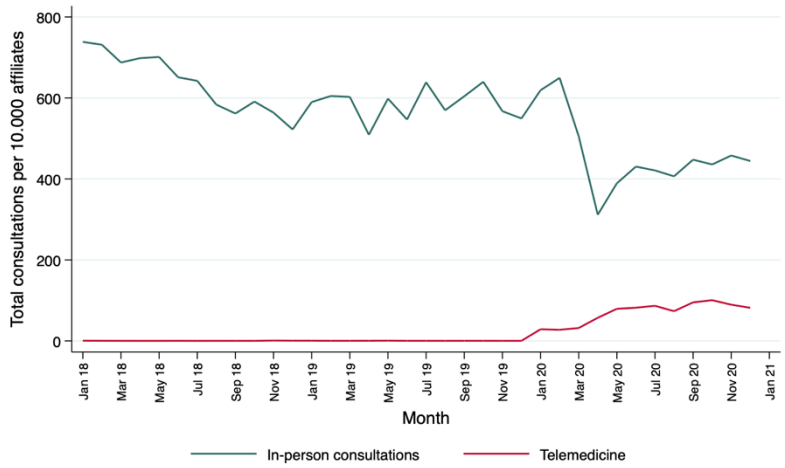
where $share_{ismt}$ is the number of affiliates with at least one in-person visit and/or telemedicine service over the total number of affiliates that were recorded for age-sex group-health insurance scheme i in department c during month m and year t. As before, telemedicine was not in use prior to March 2020 and to capture this effect, the $COVID_{mt}$ term is a dummy variable equal to 0 before March 2020 and 1 from March 2020 to December 2020. In each regression, we included age (ρ_i), health insurance scheme ($\emptyset_i$), sex group (∂_i), department (γ_c), month (α_m), and year 2018 (δ_t) fixed effects, and we cluster standard errors at the municipality level to control for correlation in errors over time. Similar to the first regression, the coefficient β measures the disruption in healthcare services by estimating changes in the share of people with at least one healthcare service contact during a given month relative to the pre-pandemic period, controlling for seasonal and compositional effects.

4. Results and discussion

4.1.1. Service utilization and access - unadjusted data

Without adjusting the data for any seasonal or compositional effects, the rate of service utilization declined through 2018, leveled in 2019, and then dropped sharply in early 2020, before rising again (see Figure 1). In-person visits fell from 619 to 312 per 10,000 affiliates between January and April 2020, and then remained relatively stable from June 2020 onward – with about 400 services per 10,000 affiliates. When considered together, the sum of virtual and in-person visits in December 2020 was almost the same as the previous year's rate of service use. Before the pandemic, in December 2019, about 563 services were provided per 10,000 affiliates, of which very few were remote consultations - less than 1 service per 10,000 affiliates. By contrast, in December 2020, about 526 services were provided per 10,000 affiliates, of which 444 were in-person and 82 were remote.

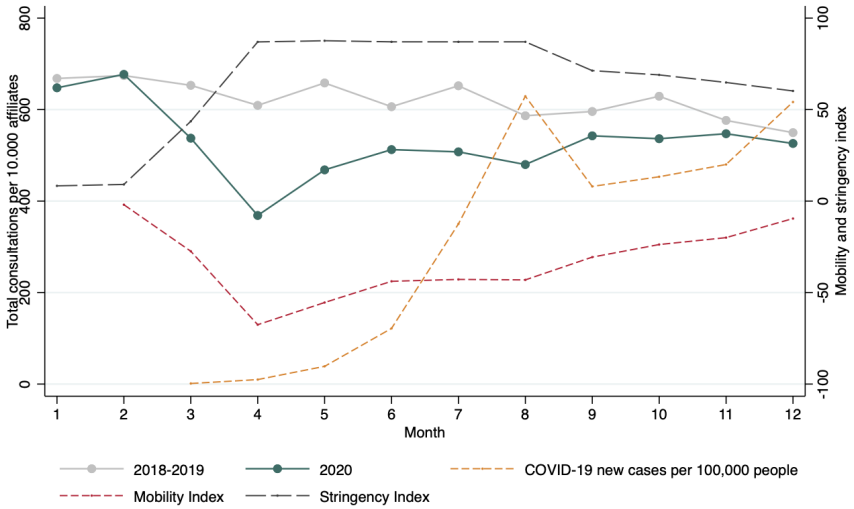
Figure 1. In-person visits and telemedicine consultations per 10,000 affiliates, 2018-2020



Source: Calculated from data provided by the Cuenta de Alto Costo (CAC) in Colombia. See text for description of the database.

The provision of healthcare services to individuals with high-cost conditions in Colombia declined, particularly during months when COVID-19 was spreading, and the government's mobility restrictions were in place (see Figure 2). The sharpest decline occurred in April 2020 just when the pandemic first started spreading throughout Colombia. By the end of the year, however, the total services per 10,000 affiliated appeared to have recovered and reached rates similar to the 2018-2019 average.

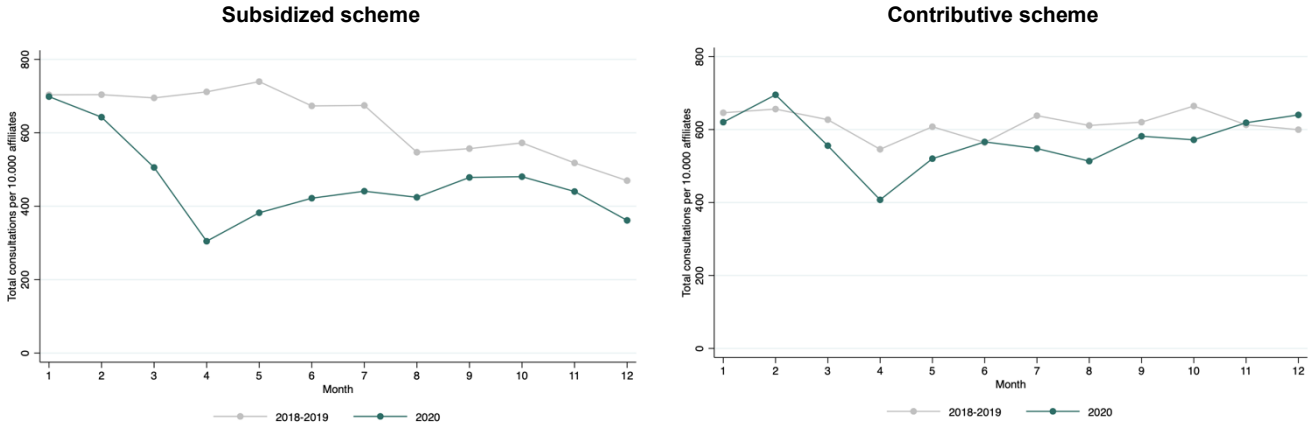
Figure 2. Monthly total services per 10,000 affiliates, 2018-2020



Sources: Consultations calculated from data provided by the Cuenta de Alto Costo (CAC). New confirmed COVID-19 cases are from data reported by Johns Hopkins University. Mobility data uses components of the Google Mobility Index. The stringency index is reported by Oxford University.
Notes: The gray line represents the average rate of service utilization during 2018-2019. The red broken line indicates social mobility and corresponds to the average mobility trends in 2020 from the data collected by Google for grocery and pharmacy, parks, transit stations, retail and recreation and workplaces. The gray dotted line reports the strictness of public policies in 2020 as reported by Oxford University's COVID-19 government response tracker based on 9 containment and closure policy indicators related to school, workplace and public transportation closing, restrictions on gatherings, internal and international travel controls, and public information campaigns.

Most of the decline shown in Figure 2 can be attributed to a steep decline in services used by people in the subsidized scheme, which only recovered a portion of this loss by the end of 2020 (see Figure 3). Service utilization among those in the contributive scheme also fell during the early months of 2020 when mobility restrictions were in place. However, during the rest of the year, service utilization by those in the contributive scheme were not distinguishable from the 2018-2019 average.

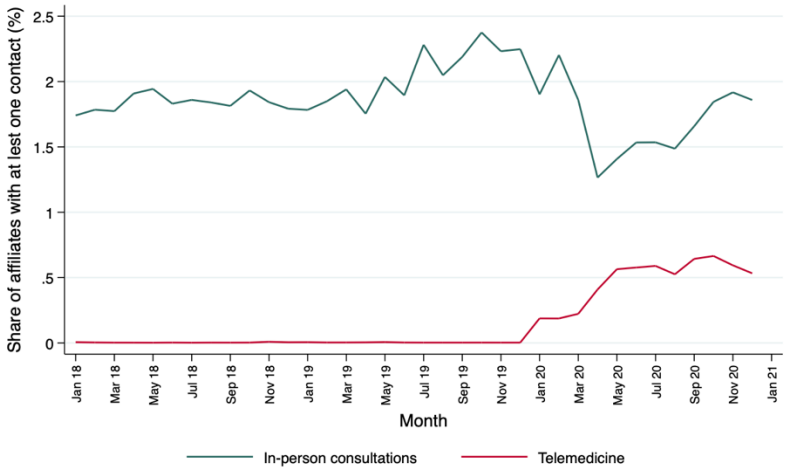
Figure 3. Monthly total services per 10,000 affiliates by health scheme, 2018-2020



Source: Calculations based on data provided by the Cuento de Alto Costo (CAC) in Colombia.
Notes: Gray line represents the average of 2018-2019.

As noted earlier, service usage can be misleading as an indicator of access if utilization is concentrated among a small part of the population. The share of affiliates with at least one consultation tells a different story about service contacts during 2018 and 2019, but confirms that contacts with the health system declined during the pandemic. Each month during 2018, about 1.9% of people insured by the surveyed EPSs (i.e., 620,455) had at least one healthcare service. In 2019, this figure rose above 2%. Then, in the first months of 2020, the share fell from a little bit over 2% to near 1.6%. By December 2020, this rate had rebounded to just over 2% again. As in the service utilization data, the share of affiliates with at least one telemedicine service shows a significant increase at the beginning of 2020 - from close to zero to over 0.5%. That is, more than 240,000 Colombians reported in the CAC subgroup used remote services each month by the end of 2020 (see Figure 4).

Figure 4. Trends in the share of affiliates with at least one in-person visit and/or telemedicine service, 2018-2020



Source: Calculations based on data provided by the Cuento de Alto Costo (CAC) in Colombia.

4.1.2. Statistical analysis of service utilization and access

Controlling for seasonal and compositional effects, the statistical analysis provides more precise measures of the pandemic's impact on utilization and healthcare service contacts (see Tables 2 and 3). During 2020, overall service usage fell by 12.5% and when considering only in-person visits, the decline was 24.1%. This difference is partly due to the significant increase in telemedicine consultations shown in the final columns of the table.[10] As noted earlier, service utilization fell more among those in the subsidized scheme (24.3%) than those in the contributive scheme (13.9%). Again, the larger declines for in-person consultations (37.2% and 22.1%, respectively) along with the statistically significant increase in remote consultations demonstrates that the latter partly offset the overall decline in utilization.

[10]Great care should be taken when interpreting or reporting the extremely high percentages shown for telemedicine which are the result of starting from such a very low base (almost zero). They indicate the rapid adoption of this new technology but, without context, can be misleading.

Table 2. Changes in healthcare service use per 10,000 affiliates, 2018-2020

	Total services		In-person visits		Telemedicine	
	Change in 2020		Change in 2020		Change in 2020	
	Coefficient	*%*	*Coefficient*	*%*	*Coefficient*	*%*
Panel A. Main effect						
Impact of COVID-19	-1.547** (0.503)	-12.5%	-2.951*** (0.829)	-24.1%	1.531*** (0.399)	2631%
Observations	1,324,224		1,324,224		1,324,224	
Adjusted R-squared	0.020		0.020		0.019	
F	4.81		5.50		3.41	
RMSE	222		218		14	
Panel B. Interactive specification						
Impact of COVID on subsidized scheme	-2.394 (1.339)	-24.3%	-3.528** (1.311)	-37.2%	1.297*** (0.312)	1132%
Impact of COVID on contributive scheme	-2.007* (1.001)	-13.9%	-3.201* (1.340)	-22.1%	1.084 (0.642)	8731%
Observations	1,324,224		1,324,224		1,324,224	
Adjusted R-squared	0.002		0.002		0.003	
F	1.38		2.85		9.47	
RMSE	224		220		14.1	

Source: Authors' regressions based on data provided by the Cuenta de Alto Costo (CAC).
Note: This table reports key coefficients from different regressions. They represent changes in utilization per 10,000 affiliates of the total, in-person, and telemedicine services between March 2020 and December 2020 relative to the 2018 and 2019 period. The dependent variable is the monthly number of consultations per 10,000 affiliates. All regressions are estimated by OLS with fixed effects. Regression models include fixed-effect controls for year 2018 and month, municipality, sex, age category, health scheme, and EPS. Clustered errors are reported in parentheses. The percentage change in 2020 is obtained by dividing the coefficient on the relevant dummy variable by the average service rate between January 2019 and February 2020. * p<0.05 ** p<0.01 *** p<0.001.

As expected, the analysis of healthcare contacts indicates that the drop in service utilizations may have overstated the disruption of healthcare for people in the CAC subgroup (see Table 3). The share of people each month who had a healthcare service contact in 2020 was not statistically distinguishable from the historical averages of 2018 and 2019 after controlling for seasonal and compositional effects. Nevertheless, the number of in-person visits did decline, by about 21.3%. Therefore, the rise in remote consultations may have played a role in ensuring that people could at least be in contact with their doctor or healthcare facility. For people in the subsidized scheme, contacts with the healthcare system certainly declined during 2020, with much larger declines in in-person visits. This suggests that, at best, remote consultations partially offset the decline in in-person consultations.

Table 3. Changes in the share of affiliates with at least one in-person visit and/or telemedicine service, 2018-2020

	Total services		In-person visits		Telemedicine	
	Change in 2020		Change in 2020		Change in 2020	
	Coefficient	*%*	*Coefficient*	*%*	*Coefficient*	*%*
Panel A. Main effect						
Impact of COVID-19	-0.233 (0.138)	-5.5%	-0.872*** (0.131)	-21.3%	1.030*** (0.043)	1794%
Observations	11,880		11,880		11,880	
Adjusted R-squared	0.523		0.522		0.178	
F	246.9		235.5		64.2	
RMSE	5.7		5.5		1.8	
Panel B. Interactive specification						
Impact of COVID on subsidized scheme	-0.891* (0.397)	-34.0%	-1.236** (0.378)	-50.2%	0.407*** (0.103)	1004%
Impact of COVID on contributive scheme	0.043 (0.429)	0.7%	-0.688 (0.408)	-10.7%	1.402*** (0.111)	3896%
Observations	11,880		11,880		11,880	
Adjusted R-squared	0.233		0.232		0.095	
F	287.5		324.5		90.6	
RMSE	7.3		6.9		1.9	

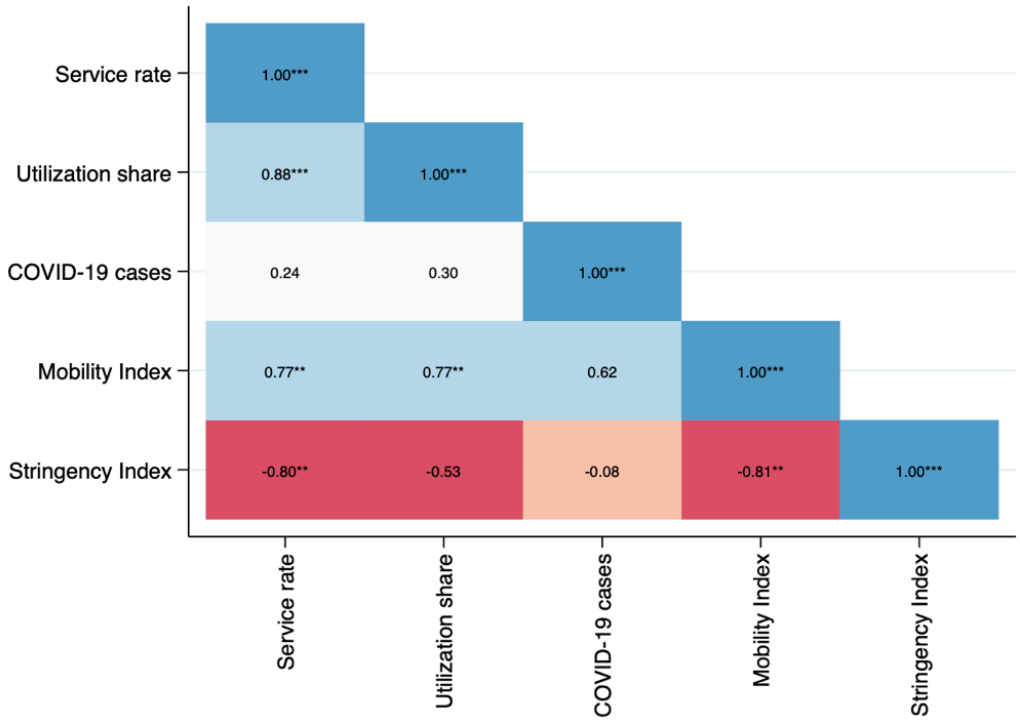
Source: Authors' regressions based on data provided by the Cuenta de Alto Costo (CAC).
Note: This table shows key coefficients from different regressions. They represent changes in the share of affiliates that used at least one in-person and/or remote service between March 2020 and December 2020 relative to the 2018 and 2019 period. The dependent variable is the monthly number of affiliates of the CAC with at least one service over the total monthly number of affiliates. All regressions are estimated by OLS with fixed effects. Regression models include fixed-effect controls for year and month, sex, age category, health scheme, and EPS. Clustered errors are reported in parentheses. The percent change in 2020 is obtained by dividing the coefficient on the relevant dummy variable by average share between January 2019 and February 2020. * p<0.05 ** p<0.01 *** p<0.001.

4.1.3. Explaining healthcare disruptions

The reasons behind the patterns described above are important for guiding future policy during epidemics and pandemic emergencies. If reductions in healthcare services for people with chronic illness are due to disruptions of supply, then declines in contacts would have been correlated with the prevalence of COVID-19 and the implications for future policy would be to assure capacity to maintain normal healthcare services through the emergency.[11] If instead, fewer contacts were due to policies restricting population movements, the declines would be correlated with the strictness of government mandates and would imply a need for some kind of waivers or flexibility to allow patients to attend to their needs. If, however, fewer contacts are primarily driven by fear of contagion or changes in care-seeking behavior, then fewer contacts would be inversely correlated with social mobility and the implications for public policy would focus more on improving communication with the public and providing assurances that services are safe and available.

[11] In some countries, hospital services for non-COVID patients might have been curtailed prior to the surge in infections. However, in Colombia, reports from that period by the government and Reuters indicate that problems with providing services in hospitals did not occur until the surge of infections during July and August of 2020.[see, for example, https://bit.ly/3ZqEt56 ; https://bit.ly/3nwTBRb; and https://bit.ly/3K1aoUq.

Figure 5. Associations between healthcare, COVID-19 infections, mobility, and policy, 2020 (Pearson correlation coefficients)



Sources: Same as Figure 2.
Note: "Service rate" is all healthcare service use per 10,000 insured people in 2020. "Utilization share" corresponds to the share of affiliates with at least one in-person visit and/or telemedicine service in a given month. See notes to Figure 2 for more details. Colors added to highlight direction of causality (reds for negative, blues for positive), with bolder colors for higher magnitudes.
* p<0.05 ** p<0.01 *** p<0.001.

All three of these factors are likely to have contributed to healthcare disruptions in Colombia during 2020. Nevertheless, government policy and social behaviors appear to have been much more significant than healthcare supply issues. Upon inspection, Figure 2 shows that Colombians began to reduce their movements and social interactions between February and March 2020, before the virus had spread widely. Beginning in March 2020, the government also enacted restrictions, such as banning international flights, mandating schooling and work from home, and prohibiting large gatherings. The sharp reduction in healthcare utilization and contacts in early 2020 occurred during this period, before COVID-19 was widespread. In fact, contacts and healthcare service utilization appear to have rebounded during the remainder of 2020, even though Colombia's first large wave of COVID-19 infections occurred during the summer of 2020. This suggests that care-seeking behavior and public policy may have been more significant than supply disruptions in explaining the decline in chronic care.

Using the number of confirmed COVID-19 cases as a proxy for supply disruptions, the government stringency index reported by Oxford University as a proxy for public policy, and population mobility indices reported by Google as a proxy for population movements driven by fear of contagion, it is possible to make this assessment more systematic. For this CAC subgroup, both the rate of healthcare utilization and the share of people with healthcare contacts were significantly and positively correlated with the mobility index and negatively correlated with the stringency index (see Figure 3). By contrast, correlations with the number of COVID-19 cases were much weaker. If our interpretation of these proxies is correct and, in particular, if the number of COVID-19 cases is a good indicator for the difficulties in providing care, then these results

suggest that supply disruptions were not a significant cause of disruptions in healthcare utilization and access for people with high-cost conditions. Rather public policy and changes in care-seeking behavior were more significant. Further research will be needed to determine whether this finding is robust because the short time frame (essentially 9 months) and quality of data (e.g., COVID testing and reporting) could be misleading.

The possibility that Colombia was able to maintain the supply of healthcare for people with high-cost conditions is corroborated by information concerning the government's policies and the dynamics of the pandemic in the country. Initial efforts to slow the spread of COVID-19 appear to have been successful when compared with a neighboring country like Ecuador, although this success was short-lived. Nevertheless, the additional time may have been sufficient to plan for, prepare and expand services. While Colombia experienced serious problems in addressing the volume of COVID-19 patients once the disease became widespread, it still expanded services like telemedicine, at-home delivery of drugs, at-home consultations, and separation of healthcare infrastructure to limit exposure risks - initiatives which may have limited the negative impact on people with chronic conditions.

5. Limitations

This study has several limitations that should be considered when interpreting the results. First, the data in our study is focused on the CAC subgroup - individuals with high-cost conditions - and does not include people with other kinds of conditions and healthcare needs. Second, the study relied on administrative data from 32 EPSs, which may contain errors, omissions, or inconsistencies that affect the reliability and validity of the results. Third, it was difficult to assure the consistency of data because it was a one-time exercise requiring the voluntary participation of the EPSs with limited opportunities for feedback and correction. This led to variations in the way data was reported by the different EPSs. Key variables, such as age, sex, and in-person consultations, appear to be robust. However, inconsistencies in other variables made it difficult to do more detailed analysis. For example, almost 50% of the services reported could not be classified properly (i.e., distinguishing consultations from procedures or hospitalizations) because the codes that were reported varied from the Unified Classification of Health Procedures (CUPS, in its Spanish acronym) used in Colombia.

Although the analysis suggests that telemedicine offset the decline in in-person consultations, it is not possible to infer causality solely from the data. The analysis controls for factors such as seasonality, time, and municipality time-invariant characteristics, but other factors may have also contributed to the discontinuity between 2020 and the previous years. In addition, the calculation of healthcare service utilization per 10,000 affiliates uses data on affiliates at time, age group, and sex level, but not at the municipality level, which introduces a potential bias in municipalities with low population density. Similar qualifications are necessary regarding the assessment of factors that led to healthcare service disruptions. The use of correlation coefficients is only a measure of association, not causality, and does not control for multiple factors or interactive effects.

6. Conclusions

This paper investigated three aspects of how the healthcare system responded to the pandemic: changes in in-person consultations; increases in the use of telemedicine, and factors that contributed to the disruption of healthcare services.

Colombians who had a set of high-cost health conditions monitored by CAC requiring care reduced their service use by about half between January and April 2020. Their rate of utilization rebounded during the

rest of that year and almost reached pre-pandemic levels by December 2020. However, the composition of services at the end of 2020 was substantially different – about one-fifth were provided through telemedicine.

After controlling for seasonal and compositional effects, the rate of in-person consultations for this group of Colombians was 24% below the historical average. The rate of services fell by about 37% for those in the subsidized scheme and 22% for those in the contributive scheme. Contacts with the healthcare system - as measured by the share of people with at least one service in a given month - fell by 21% relative to historical averages. This was almost entirely concentrated among those in the subsidized scheme with a decline of 50%, compared to a statistically insignificant decline among those in the contributive scheme. Together, this evidence suggests that a substantial number of people with serious health conditions in the subsidized scheme did not get the care they needed during the initial months of the pandemic; while others experienced more modest declines in healthcare service use which, in addition, were partially offset by increased use of telemedicine.

Of the main explanations for healthcare disruptions, the diversion of healthcare resources to treat COVID-19 patients does not seem to have been as significant for people with conditions monitored by CAC as changes in social mobility and government lockdown policies. The largest declines in healthcare service use and contacts occurred during the early months of 2020, before the virus had spread widely. Rather, utilization and contacts began to rebound in June 2020 at the same time as Colombia's first major wave of COVID-19 cases but during a period in which government policies were becoming less stringent and social mobility began to increase.

If confirmed by other studies, these findings have a variety of implications for public policy and future research.

- First, they appear to demonstrate important strengths in the way Colombia's healthcare system has detected and managed high-cost conditions for individuals in the contributive scheme. If these strengths can be identified, they could be leveraged to improve healthcare for those in the subsidized scheme.
- Second, further research may be needed to understand how to address factors which led to the greater disruption of care among those in the subsidized scheme. Distinguishing the effects and causes of healthcare service supply and demand for this part of the population is essential for developing appropriate policies to avoid this situation in the future.
- Third, in future health emergencies, Colombian authorities need to find ways to encourage people to seek healthcare through better social communication and through adjustments or exemptions to protective public policies. Maintaining the capacity of healthcare service provision is essential, but does not appear to have been as significant a problem in this recent crisis.
- Fourth, Colombia should clearly incorporate the expanded use of telemedicine in planning for future health emergencies, both to address the pandemic, to provide other forms of healthcare, and to reduce unnecessary risks of disease transmission. But positive experiences with telemedicine - for both providers and patients - also indicates that Colombia should consider relaxing unnecessary legal and regulatory constraints that may be restricting the use of telemedicine.
- Finally, this study has shown the value of analyzing healthcare service data from insurers in Colombia and the potential for more powerful analyses if administrative records could provide better quality and more consistent information to member organizations like CAC, regulatory authorities, and research institutions. In particular, analyzing service use by type of health condition would make it possible to derive much more refined conclusions about the impact of the COVID-19 pandemic on healthcare services, to assist insurers in finding strategies to better manage high-cost healthcare conditions, and to improve the equity and effectiveness of healthcare services for Colombians.

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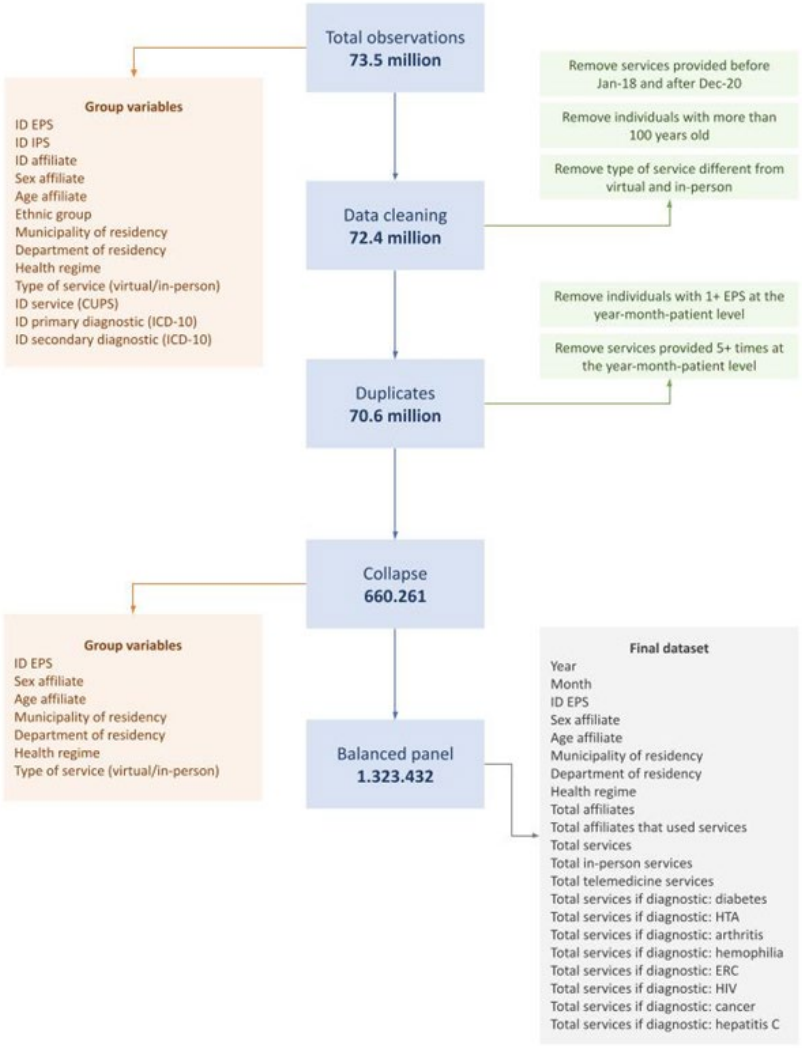
8. Appendix

Figure A1. Generating the Sample from the Survey Data



Source: Authors.

Table A1. Changes in healthcare service use per 10,000 affiliates, 2018-2020

	Total services			In-person visits			Telemedicine services		
	Average	*Coefficient*	*%*	*Average*	*Coefficient*	*%*	*Average*	*Coefficient*	*%*
Panel A: Main effects									
March 2020	12.40	-1.547**	-12.5%	12.23	-2.951***	-24.1%	0.06	1.531***	2631%
Sex									
Female	12.63			12.44			0.06		
Male	12.14	-2.160***	-17.1%	12.00	-1.983***	-15.9%	0.05	-0.123***	-191.9%
Age range									
< 20 years	0.39			0.38			0.00		
20-49 years	1.46	4.541*	1167%	1.44	4.292*	1117.2%	0.01	0.185***	18091%
50-64 years	8.09	15.834*	4069%	7.96	15.052*	3918.1%	0.04	0.629***	61510%
65-80 years	20.58	25.924*	6662%	20.28	24.683*	6425.1%	0.15	1.073***	104929%
80+	31.20	-2.051***	-527%	30.82	-1.833***	-477.1%	0.00	-0.151***	-14766%
Year									
2018	11.88	-0.360	-3.0%	11.75	-0.335	-2.8%	0.00	-0.039***	-779.8%
2019	12.17			12.04			0.01		
Month									
January	12.25			11.98			0.20		
February	13.68	0.816*	6.7%	13.43	0.819*	6.8%	0.18	-0.013*	-6.5%
March	13.39	0.341	2.8%	13.26	0.781*	6.5%	0.00	-0.493***	-244.9%
April	11.22	-1.722	-14.1%	11.07	-1.574	-13.1%	0.01	-0.211***	-104.8%
May	13.27	-0.188	-1.5%	13.11	-0.183	-1.5%	0.01	-0.061	-30.3%
June	11.71	-0.755	-6.2%	11.59	-0.726	-6.1%	0.00	-0.083**	-41.2%
July	13.12	-0.631	-5.2%	12.98	-0.570	-4.8%	0.00	-0.120***	-59.6%
August	11.98	-1.419	-11.6%	11.85	-1.279	-10.7%	0.00	-0.186***	-92.4%
September	12.71	-0.998	-8.1%	12.59	-1.006	-8.4%	0.00	-0.048	-23.8%
October	13.19	-0.376	-3.1%	13.06	-0.435	-3.6%	0.00	0.001	0.5%
November	11.13	-1.010	-8.2%	11.01	-1.058	-8.8%	0.00	0.005	2.5%
December	10.08	-2.565	-20.9%	9.91	-2.572	-21.5%	0.00	-0.058	-28.8%

Source: Own estimations based on administrative records from the Cuenta de Alto Costo (CAC) in Colombia.
Note: This table shows the key coefficients from different regressions. They represent changes in utilization per 10,000 affiliates of the total, in-person, and remote services between March 2020 and December 2020 relative to the 2018 and 2019 period. The dependent variable is the monthly number of consultations per 10,000 affiliates. All regressions are estimated by OLS with fixed effects. Regression models include fixed-effect controls for year 2018 and month, municipality, sex, age category, health scheme, and EPS. Clustered errors are reported in parentheses. The percentage change in 2020 is obtained by dividing the coefficient on the relevant dummy variable by the average service rate between January 2019 and February 2020. For the coefficients of the fixed effects controls we calculated the percentage change in 2020 by dividing the coefficient by the average service rate between January 2019 and February 2020 for the reference category. Reference categories are highlighted in yellow. * p<0.05 ** p<0.01 *** p<0.001.

Table A2. Changes in the share of affiliates with at least one in-person visit and/or telemedicine service, 2018-2020

	Total services			In-person visits			Telemedicine services		
	Average	*Coefficient*	*%*	*Average*	*Coefficient*	*%*	*Average*	*Coefficient*	*%*
Panel A: Main effects									
March 2020	4.21	-0.233	-5.5%	4.10	-0.872***	-21.3%	0.06	1.030***	1794%
Sex									
Female	4.77			4.63			0.06		
Male	3.45	-1.021***	-21.4%	3.37	-0.922***	-19.9%	0.04	-0.069*	-107.0%
Age range									
< 20 years	0.11			0.11			0.01		
20-49 years	0.73	2.457***	2246%	0.71	2.287***	2141%	0.01	0.157**	2193%
50-64 years	3.35	6.740***	6161%	3.25	6.250***	5852%	0.04	0.509***	7111%
65-80 years	7.92	7.943***	7260%	7.69	7.365***	6896%	0.09	0.759***	10603%
80+	8.94	-0.582***	-532%	8.72	-0.545***	-510%	0.14	-0.035	-489%
Year									
2018	3.76	-0.455***	-10.9%	3.67	-0.439***	-10.7%	0.02	-0.030	-167.4%
2019	4.18			4.09			0.02		
Month									
January	3.89			3.72			0.16		
February	4.38	0.370	9.5%	4.21	0.359	9.6%	0.15	-0.003	-1.9%
March	4.23	0.286	7.3%	4.14	0.489	13.1%	0.02	-0.323***	-203.3%
April	3.91	-0.045	-1.2%	3.82	0.072	1.9%	0.02	-0.127	-79.9%
May	4.39	0.359	9.2%	4.29	0.383	10.3%	0.02	-0.038	-23.9%
June	4.05	0.222	5.7%	3.97	0.253	6.8%	0.02	-0.062	-39.0%
July	4.54	0.328	8.4%	4.44	0.360	9.7%	0.02	-0.095	-59.8%
August	4.24	0.173	4.4%	4.15	0.221	5.9%	0.02	-0.127	-79.9%
September	4.39	0.306	7.9%	4.31	0.309	8.3%	0.02	-0.055	-34.6%
October	4.54	0.553*	14.2%	4.45	0.534*	14.3%	0.02	-0.027	-17.0%
November	4.14	0.408	10.5%	4.05	0.376	10.1%	0.02	0.004	2.5%
December	3.96	0.011	0.3%	3.85	0.009	0.2%	0.02	-0.052	-32.7%

Source: Own estimations based on administrative records from the Cuenta de Alto Costo (CAC) in Colombia.
Note: This table shows the key coefficients from different regressions. They represent changes in the share of affiliates that use at least one in-person, and/or remote service between March 2020 and December 2020 relative to the 2018 and 2019 period. The dependent variable is the monthly number of affiliates of the CAC with at least one service over the total monthly number of affiliates. All regressions are estimated by OLS with fixed effects. Regression models include fixed-effect controls for year and month, sex, age category, health scheme, and EPS. Clustered errors are reported in parentheses. The percentage change in 2020 is obtained by dividing the coefficient on the relevant dummy variable by average share between January 2019 and February 2020. For the coefficients of the fixed effects controls we calculated the percentage change in 2020 by dividing the coefficient by the average share between January 2019 and February 2020 for the reference category. Reference categories are highlighted in yellow. * p<0.05 ** p<0.01 *** p<0.001.