IDB WORKING PAPER SERIES Nº IDB-WP-1202

On the Demand for Telemedicine:

Evidence from the Covid-19 Pandemic

Matías Busso
María P. González
Carlos Scartascini

Inter-American Development Bank
Department of Research and Chief Economist

April 2021

IDB
Inter-American Development Bank

On the Demand for Telemedicine:

Evidence from the Covid-19 Pandemic

Matías Busso
María P. González
Carlos Scartascini

Inter-American Development Bank

April 2021

Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

Busso, Matías.
On the demand for telemedicine: evidence from the Covid-19 pandemic / Matías Busso, Maria P. Gonzalez, Carlos Scartascini.
p. cm. — (IDB Working Paper Series ; 1202)
Includes bibliographic references.
1. Telecommunication in medicine-Argentina-Econometric models. 2. Coronavirus infections-Argentina-Econometric models. 3. Medical care-Technological innovations-Argentina-Econometric models. I. Gonzalez, Maria P. II. Scartascini, Carlos G., 1971- III. Inter-American Development Bank. Department of Research and Chief Economist. IV. Title. V. Series.
IDB-WP-1202

http://www.iadb.org

Abstract

Telemedicine can expand access to health care at relatively low cost. Historically, however, demand for telemedicine has remained low. Using administrative records and a difference-in-differences methodology, we estimate the change in demand for telemedicine experienced after the onset of the COVID-19 epidemic and the imposition of mobility restrictions. We find a 233 percent increase in the number of telemedicine calls and a 342 percent increase in calls resulting in a medication being prescribed. The effects were mostly driven by older individuals with pre-existing conditions who used the service for internal medicine consultations. The demand for telemedicine remains high even after mobility restrictions were relaxed, which is consistent with telemedicine being an experience good. These results are a proof of concept for policymakers willing to expand access to healthcare using advances in technology.

JEL: I11, I15, P36

Keywords: Coronavirus, COVID-19, Health care demand, Telemedicine, Argentina

* Research Department, Inter-American Development Bank. 1300 New York Ave. NW, Washington, DC, 20577. Corresponding authors: Busso (mbusso@iadb.org) and Scartascini (carlossc@iadb.org).

We are very grateful to Llamando al Doctor for having provided access to their administrative records. The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the Inter-American Development Bank, its Board of Directors, or the countries they represent.

1 Introduction

Telemedicine can be a powerful tool to expand the delivery of health care services at a relatively low cost (Bashshur, 1995; Ekeland et al., 2010). Even though technological innovations have permitted the expansion of telemedicine in recent years (Pandian, 2016), demand has remained low (Wootton, 2008; Zanaboni and Wootton, 2012).[1] In this paper, we exploit the restrictions imposed by the COVID-19 pandemic to show the existence of a large potential demand for telemedicine services in a middle-income developing country.

We rely on administrative records from one of the largest providers of telemedicine in Argentina to build a panel data set that includes the records of all calls received during the first ten months of 2019 and 2020. We use an event study and a difference-in-differences methodology to estimate the change in demand for telemedicine that happened after the onset of the COVID-19 epidemic. We show that the use of telemedicine, as captured by the total number of calls and calls from first-time callers, increased 233 and 226 percent, respectively. The largest effect was observed on calls resulting in prescriptions, which experienced an increase of 342 percent. There was also an increase in resolved consultations (of 244 percent) and in calls referred to another specialist (184 percent). The effects were driven mostly by older individuals with pre-existing conditions who used telemedicine for internal medicine consultations. As mobility started to increase, we find the use of telemedicine declined slightly, but not quickly enough to converge to the pre-pandemic period. A 1 percent increase in mobility resulted in half of a percent decrease in the use of telemedicine. We take this as evidence that the upward shift in demand is likely permanent.[2]

There are several reasons why people may resist the use of new technologies such as telemedicine (Broens et al., 2007). First, there could be a general mistrust or lack of infor-

[1] For example, in the case of one of the main providers of telemedicine in Argentina, in 2019 telemedicine was used by less than 5% of those to whom the provider had granted access.

[2] Our results are consistent with survey evidence from developed countries. A survey of more than 2,700 patients conducted by Accenture across China, France, Germany, Japan, the United Kingdom and the United States showed that about 60 percent said that they want to keep using the technology based on their experience with it during the pandemic (Accenture (2020)).

mation from patients and health professionals about the effectiveness of telemedicine (Mair et al., 2007). In addition, there are real, if small, inconvenience factors, such as having to download and set up the technology, that could discourage or trigger procrastination (Baicker et al., 2012; Bertrand et al., 2004; Kremer et al., 2019; Madrian, 2014; Rice, 2013). Individuals also may not download the applications required to use telemedicine services because of present bias, which makes them undervalue the future gains of having the application ready when they are sick (Kang and Ikeda, 2016; Kremer et al., 2019; Linnemayr and Stecher, 2015; Madrian, 2014; Williams et al., 2018). This can be particularly problematic if they also have optimism bias, which leads them to underestimate the probability that negative events will happen to them, or if they worry that using telemedicine could jeopardize having access to in-person visits later on (loss aversion) (Kahneman et al., 1991). These biases build on a reticence by consumers to move from a known status quo to newer alternatives (Hartman et al., 1991; Kahneman et al., 1991; Rice, 2013; Suri et al., 2013; Tsai et al., 2019; Zhang et al., 2017). Since telemedicine first emerged more than 20 years ago, the rapid evolution and widespread adoption of technological advancements have not been enough to attenuate many of these factors and behavioral constraints. This has been the case in spite of sustained efforts by providers to inform the public and ensure high quality and reliability of the service. This is not unique to telemedicine; it is also the case, for example with sustainable energy technologies (Urpelainen and Yoon, 2017). However, an external shock such as the temporary unavailability of in-person medicine could change the status quo by reducing the incidence of some of these biases and making patients test the service, as is the case with other experience goods (Sunstein, 2019).[3]

By showing that demand increased dramatically after the onset of the COVID-19 epi-

[3]Health care goods in general are characterized as "credence goods" because the consumer does not obtain full information about the quality of the service even after purchase (Dulleck et al., 2011; Emons, 1997). The objective of telemedicine is not to change the course of treatment, but to provide an alternative method of delivering health care. As such, telemedicine can be characterized as an "experience good," i.e., one that can be accurately evaluated -and compared to its substitute, in-person visits- only after the product has been purchased and experienced (Andersen and Philipsen, 1998). As purchases of these goods increase, markets tend to converge to the full information equilibrium (Riordan, 1986).

demic, our results contribute to the large literature that analyzes the determinants of demand for health care. More specifically, this paper contributes to the strand of the literature that studies how demand for new health care services is affected by factors such as service price (Berman and Fenaughty, 2005), beliefs and social norms (Cranen et al., 2011), education and household wealth (Chunara et al., 2020). We conjecture that the epidemic, by restricting access to traditional in-person visits, induced consumers to overcome behavioral constraints and use telemedicine for the first time. This experience with the service seems to have led to a new equilibrium of higher demand, which adds evidence to the literature on experience goods and the adoption of new technologies (Sunstein, 2019).

Our results also contribute to the new and expanding literature on the effects of the COVID-19 crisis on the demand for services including online education (Ikeda and Yamaguchi, 2020), online retailers (Farrell et al., 2020), child care (Ali et al., 2020), and public transportation (Tirachini and Cats, 2020).

From a public health point of view, the importance of telemedicine as "forward triage" to sort patients before they arrive at the hospital has been of paramount importance during the pandemic. Telemedicine allows patients to be efficiently screened and directed to the most suitable health care provider, which effectively increases the capacity of the health care system (Hollander and Carr, 2020), and to isolate those who may be infected by the virus. Our paper also shows that telemedicine, when properly deployed and scaled up, can be relied upon as an important tool for public health management.

This paper is organized as follows. Section 2 reviews the literature on cost and benefits of telemedicine. Section 3 describes the setting in which the increase in the demand for telemedicine services took place. Section 4 shows how mobility declined in Argentina during the COVID-19 crisis. Section 5 specifies the empirical strategy and the data used in the analysis. Section 6 presents the results, and Section 7 concludes.

2 Costs and Benefits of Telemedicine

The term telemedicine is currently used to describe the provision of health care services remotely, by means of a variety of telecommunication tools including telephones, smartphones, and mobile devices, with or without a video connection (Dorsey and Topol, 2016). In recent years, the use of telemedicine has gained momentum, primarily because of the perceived potential to better distribute and control the use of medical services, which would lead to improvements in timeliness of delivery and, hence, in the overall quality of health care.[4] Indeed, telemedicine has been proven to increase the accessibility of health services, as well as reduce travel time and related opportunity costs in the process of obtaining care (Bashshur, 1995). From war veterans to patients in rural areas, telehealth provides an alternative to traditional healthcare that lowers the time and cost of receiving service (Jacobs et al., 2019; Sabesan et al., 2012). In addition, there is evidence that telemedicine is successful in reducing the need for ambulance transport, which could provide relief to the overcrowded healthcare system (Langabeer et al., 2016). Telemedicine can also increase the diversity of care to which an individual has access. As an example, for indigenous groups, telemedicine provides an option that reduces the burden of travel and dislocation from community and family (Caffery et al., 2018).

The effectiveness of telemedicine depends greatly on where it is being deployed. A scoping review of the use of telemedicine concluded that, when comparing the effectiveness of electronic and face-to-face consultations, the evidence shows ambiguous results (Caffery et al., 2016; Roine et al., 2001). Replacing traditional face-to-face patient care can potentially result in a breakdown of the traditional relationship between health professional and patient, caused by the potential depersonalization of the service (Hjelm, 2005). Evidence shows, however, that this idea of service depersonalization might be a misconception. In practice, reported quality and satisfaction levels of patients who use telemedicine are overwhelmingly

[4] As the use of new communication technologies expanded in the late 1990s, telemedicine was implemented for patients with acute traumas and stroke (Levine Steven R. and Gorman Mark, 1999).

positive (Jacobs et al., 2019; Kruse et al., 2017; Polinski et al., 2016). For many patients, electronic consultations were preferred for convenience and travel time (Donelan et al., 2019). In spite of this, there is still a reluctance on the part of patients to increase their use of telemedicine (Wootton, 2008).

It is also important to recognize other practical costs that telemedicine presents. With the adoption of telemedicine as a cheaper and more convenient alternative, there is the potential for excess health care utilization (Ashwood et al., 2017; Bavafa et al., 2018). That is, there is still the open question if the overall increase in demand that could result from the surge of telemedicine would serve a previously unmet need for healthcare or if, on the contrary, it would produce an overuse of health care services. Another concern is the possibility of over-prescription (Sprecher and Finkelstein, 2019). Similarly, legal and reimbursement issues could arise from limited or fragmented health care coverage through telemedicine services (Dorsey and Topol, 2016). The solution to these problems relies on the existence of a legal framework that appropriately regulates the use of telemedicine within the broader healthcare system.

In spite of these limitations, the health care community has encouraged the shift from an in-person care model to a model of virtual care (Duffy and Lee, 2018). The COVID-19 crisis highlighted the need for an easily deployable, mobility-reducing, and low-cost alternative to deliver care, especially to more at-risk populations. The pandemic rapidly increased the perceived benefits of telemedicine and lowered its costs. Moreover, high mobility restrictions imposed by governments pushed individuals to experience telemedicine first-hand, which reduced the barriers associated with experience goods and made more patients find telemedicine a suitable substitute for in-person care (Accenture, 2020).

3 Telemedicine in Argentina

Before the onset of the COVID-19 pandemic, the government of Argentina had already recognized the use of telemedicine as one of the three main pillars of its strategy to ensure universal health coverage. In 2019, the government launched its digital health strategy, which included among its goals the expansion of telemedicine as a tool to provide health services to geographically remote populations, improving accessibility, reducing the need for medical-related transportation, and compensating for regional differences in access to health care (Gobierno de Argentina, 2019). Naturally, once the COVID-19 pandemic lockdown had begun, the government encouraged private health insurance providers to foster the use of telemedicine (Superintendencia de Servicios de Salud, 2020). At the onset of the pandemic, two providers of telemedicine services covered most of the market. One such providers was "Llamando al Doctor" (or "Call your Doctor") which offered services to health care providers, insurance companies, and individual patients all across the country.[5] At the time, the firm employed 108 doctors covering 11 medical specialties, including general medicine, pediatrics and gynecology, and obstetrics.

Patients access the service primarily through a mobile phone application, where they are asked a series of screening questions: the medical specialty they require, the reason for their consultation, and any previous conditions they may have. Following the screening questions, they proceed to the online consultation with a physician through a video call. Each video call can result in one of three different outcomes. The first and most common is when the doctor is able to resolve the patient's issue during the online consultation (this is the case for 67 percent of the calls in 2019). In some of these calls, patients were prescribed a medicine (9 percent of the overall calls). A second outcome is a recommendation of a follow-up call (8 percent of the calls). A third outcome of the video call could be that the doctor refers the patient to an in-person visit (11 percent of the calls).[6]

[5] The other provider of telemedicine in Argentina is called Doc24.

[6] In about 14 percent of calls, the call is disconnected or the video call does not take place for technical issues.

Each call produces a log that registers the patient's gender, age, and specialty requested as well as a description of the reason for and diagnosis of the call. This article relies on these anonymized administrative data to generate a time series database that tracks the behavior of telemedicine demand for the years 2019 and 2020 (up to October 31). Table 1 provides some descriptive statistics for 2019, when the telemedicine service received a total of 10,340 calls. Patients were relatively young (30 years old on average) and more likely to be women (57%). General medicine leads the share of consultations, followed closely by pediatrics.

Table 1: Telemedicine Service: Descriptive Statistics

		Average	S.D
Call Resolution	Resolved	67%	47%
	Prescription	9%	30%
	Follow-up	8%	28%
	Derived	11%	31%
Medical Specialty	General Medicine	44%	50%
	Ob/Gyn	19%	39%
	Pediatrics	37%	48%
Demographics	Age	30	15
	Male	43%	50%
	Previously Diagnosed	25 %	43 %

Source: Author's calculations using administrative data from "Llamando al Doctor".

4 Mobility during the COVID-19 Crisis

As a consequence of the COVID-19 epidemic, governments around the world enacted policies and measures in an attempt to contain the ongoing pandemic. These extraordinary measures included containment and closure, economic relief, and investment in the health system, in an effort to contain the propagation of the virus and minimize the direct economic losses product of the pandemic and the indirect losses produced by mobility restrictions (Hale et al., 2020*b*). The timing and severity of the policies implemented were summarized in a Stringency Index published by the University of Oxford.[7]

[7]The Stringency Index is a composite index that looks at nine containment, closure, and health system-related policies a government could take in face of the COVID-19 pandemic. This index ranges from 0 to

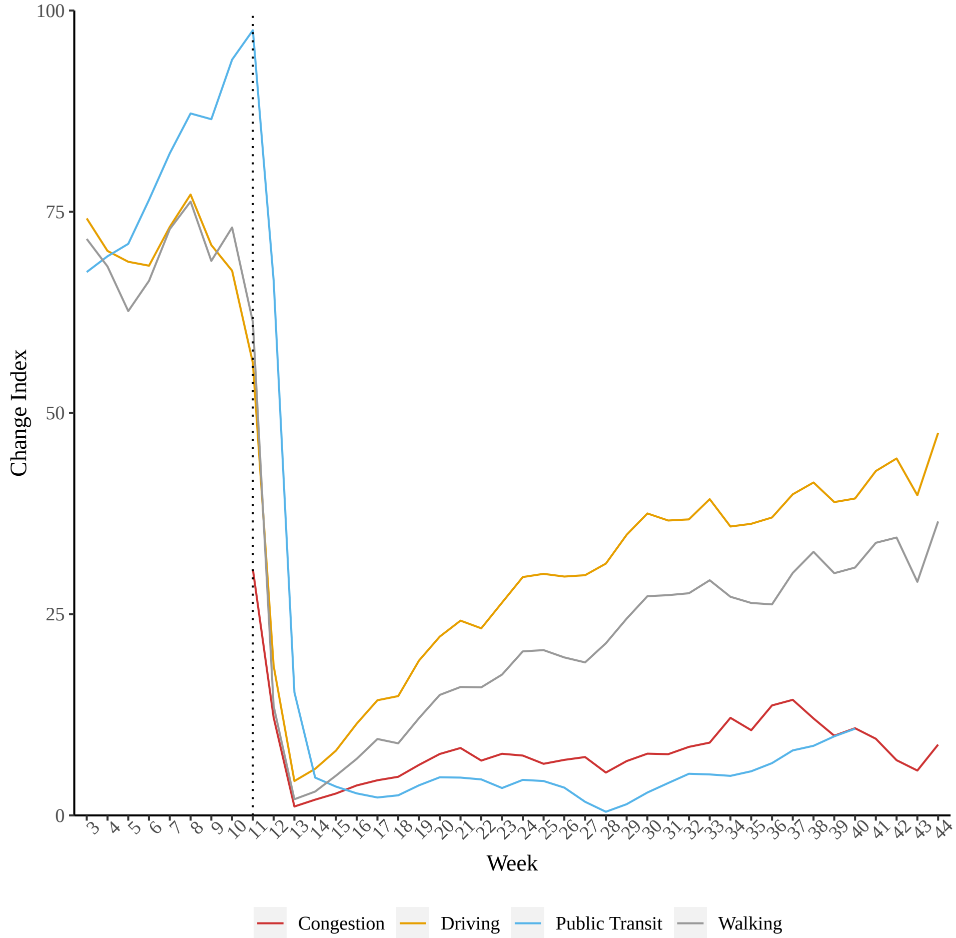
In the case of Argentina, the government started applying containment measures starting March 15, when schools were ordered to close. Three days later the government issued a formal stay-at-home order, which was strictly enforced. By March 22, the government had also placed restrictions on public transportation. The Stringency Index rapidly reached 100 by March 23, when the country reported the first four confirmed deaths by COVID-19 (Hale et al., 2020*a*). The government's fast and stringent response placed Argentina amongst the countries with the strictest lockdowns in the region.[8]

To quantify how much the demand for telemedicine changed as a result of the lockdown measures, we need to establish a date on which both the lockdown measures and the pandemic itself (prompting people to self-isolate) actually affected behaviors. We rely on publicly available data to build indicators of mobility. The first two indicators come from the Apple Mobility Trends Report, which keeps track of driving and walking directions requested by Apple users (Apple, 2020). The information shows the relative volume of directions requested to the baseline volume in January 2020. A third indicator comes from Moovit, a company that provides a daily report of the relative use of the Moovit mobile application for public transit compared to the use in the week prior to January 15, 2020 (Moovit, 2020). Fourth, Waze's user base provides information about commuting behavior. By combining information from users in an area, Waze is able to identify whether at any given geographic point traffic is slowing down with respect to a "no congestion scenario." These data are used to calculate the traffic congestion intensity index, which provides an indication of how congested roads are by summarizing the extent of traffic jams in the street network and their duration (Inter-American Development Bank, 2020). This last indicator takes as a baseline the week of March 2-8 (Inter-American Development Bank and IDB Invest, 2020). The congestion data were gathered from the IDB's Coronavirus Impact Dashboard.

100, with 0 being no measures taken and 100 being all nine measures taken in their strictest version (Hale et al., 2020*a*)

[8]For context, other countries in the region like Colombia reached a Stringency Index of 90.74 on March 27 with 243 confirmed deaths; Brazil reached an Index of 81 by May 5 with 7,321 confirmed deaths and Chile reached an Index of 78.24 by May 15 with 358 confirmed deaths. The only other countries in the Latin American region that recorded a Stringency Index of 100 are Honduras and Cuba (Hale et al., 2020*a*).

Figure 1: Mobility Indicators in Argentina



Notes: The figure plots indicators of mobility from different sources (scaled from 0 to 100). Congestion data were gathered from the IDB's Coronavirus Impact Dashboard, driving and walking data were obtained from Apple's mobility trend report, and public transit data were obtained from Moovit public transit indexes.

Figure 1 shows that the four indicators of mobility experienced a sharp decline around March 13-15, 2020. As such, we consider March 13 as the starting date on which mobility dropped. Even though many of the measures limiting mobility remained in place for months to come, walking and driving started to slowly and steadily increase over time, as shown in the figure. The use of public transportation, however, remained depressed throughout the lockdown period. By the end of the year, people were still moving less than in the pre-pandemic months, according to these indicators.[9]

5 Empirical Strategy

We use administrative records from "Llamando al Doctor" to construct a panel data set with the records of all calls received for the period January 1 through October 31, for the years 2019 and 2020. These data allow us to analyze changes in the volume of daily calls received and in the daily number of first-time callers. We are also able to observe the outcome of these telemedicine consultations: whether they were resolved, required a follow-up, or referred to another specialist. In addition, we also observe if calls resulted in the issuance of prescriptions, which is an important outcome in determining whether telemedicine could increase the use of medications.

Given the nature and content of the data, we can estimate the effect of the lockdown associated with the COVID-19 epidemic on the demand for telemedicine using an event study and a difference-in-difference methodology (similar to Leslie and Wilson (2020)). We define the onset of the epidemic (i.e., our "treatment" date) as occcurring in the eleventh week of the year.[10] A simple before and after comparison would not account for possible seasonal changes in demand for telemedicine. Thus, we compare outcome variables before social distancing began relative to their levels on the same date in the previous year of 2019.

We begin by estimating an event study model based on the following equation:

$$Y_{d,year} = \sum_{\tau=0}^{43} \beta_\tau \times (Week_\tau)_d \times Year2020_{year} + \alpha_{year} + \gamma_{week} + \delta_{dow} + \epsilon_{d,year} \tag{1}$$

where $Y_{d,year}$ is the outcome variable measured in day d of each year, $(Week_\tau)_d$ is an

[9]These indicators could be underestimating the true increase in mobility because changes in mobility patterns that have occurred with the pandemic. For example, people have increased their purchases close to their home, which some indicators would not capture (Pan et al., 2020)

[10]Because mobility declined abruptly on March 13-15, we define a week to be a seven-day period starting on each Thursday so that week 11 is the period from March 12 to March 18.

indicator variable for the number of week in the year and $Year2020_{year}$ is an indicator for dates during the year 2020. The coefficient β_τ estimates weekly changes in the outcomes for the period of January 1 to October 31, relative to the outcome variable in 2019. The term α_{year} captures a year fixed effect which controls for possible trends, γ_{week} captures week fixed effects controlling for seasonal trends and δ_{dow} controls for any day-of-week differences in the volume of calls received.

We also estimate average treatment effects according to the following difference-in-differences model:

$$Y_{d,year} = \beta Post_d \times Year2020_{year} + Post_d + \alpha_y + \gamma_{week} + \delta_{dow} + \epsilon_{d,year} \tag{2}$$

where $Post_d$ term is a binary variable that indicates whether the day is during or after week 11 of the year. In this model, the β coefficient captures the average change in the outcome variable after social distancing began, relative to the same period in 2019. One key assumption of our difference-in-difference specification is that, prior to social distancing, the outcome variable in both years followed the same trend.[11]

6 Results

We start by plotting the coefficients β_τ and the 95 percent confidence intervals from our event-study specification described in equation (1). Figure 2 shows the results for two outcomes: the log of the number of daily calls (panel A) and log of first-time callers (panel B). In both figures we overlay the times series of mobility measured as the average of the series shown in Figure (1).

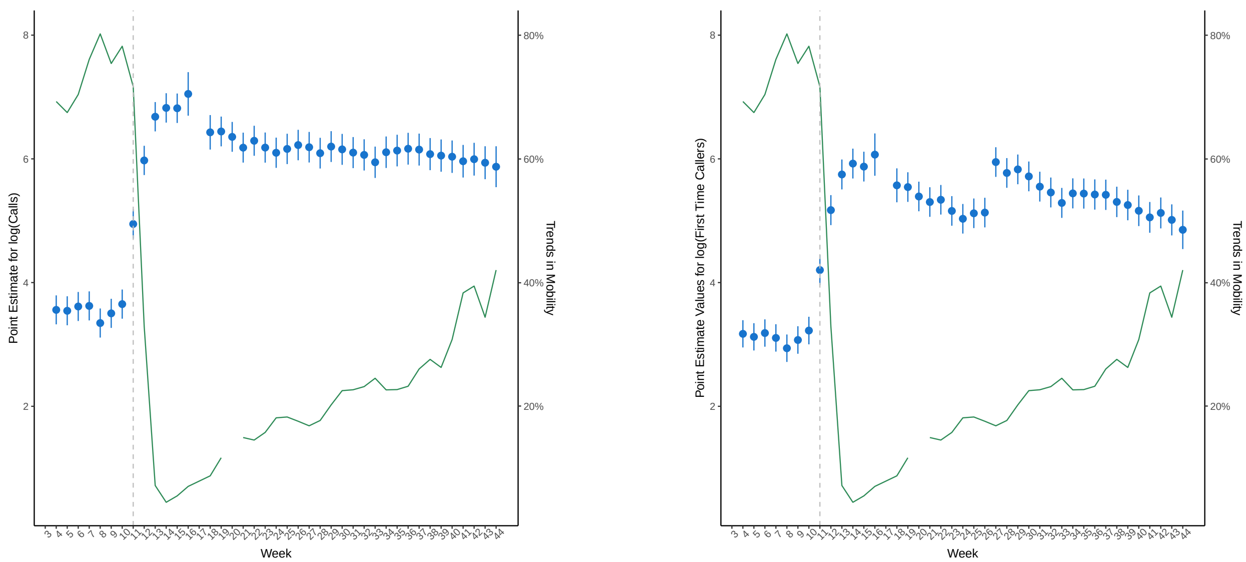
The coefficients for the number of daily calls and first-time callers follow a flat pre-trend before week 11, suggesting that the parallel trend assumption is valid for all our outcomes of interest. Note, however, that the point estimates are positive, which is consistent with a

[11]Notice that the estimated parameters measure the effect of the Covid-19 crisis on the demand for telemedicine from one major provider. They do not capture the effects on other suppliers.

secular increase in the use of telemedicine before the pandemic crisis unfolded. By week 11, when social distancing began and mobility dropped, the estimates for the daily number of calls and first-time callers rises substantially. After that week, there is an upward trend that reaches a maximum by week 16. As mobility slowly started to converge to the pre-lockdown values we observe a mild decrease in the point estimates, which remain persistently higher than before the pandemic. These results point to an increasing demand for telemedicine that extends to the months after social distancing began to fall, which suggests that the effects of the pandemic on the adoption and use of telemedicine could persist in the longer term.

Figure 2: Treatment Effects: Event-study Analysis

(a) Effects on log(number of calls) (b) Effects on log(first time callers)



Notes: The green line graphs the average trend for walking, driving and public transit mobility indicators as described previously. Blue dots correspond to the point estimates and confidence intervals. Source: Authors' calculations using administrative data from "Llamando al Doctor."

Table 2 provides a summary of the results obtained with the difference-in-differences model described in equation 2. The increase in calls and first-time callers in the months after the pandemic was 233 and 226 percent, respectively. The effect of social distancing is not uniform across call resolution outcomes. The largest effect was observed on calls resulting in prescriptions, which experienced an increase of 342 percent. There was also a large increase in calls that required some type of follow-up (314 percent). In addition, the increase in resolved consultations (of 244 percent) was larger than the increase in calls referred to another specialist, which saw an increase of only 184 percent.

Table 2: Impact of Social Distancing in Telemedicine Demand

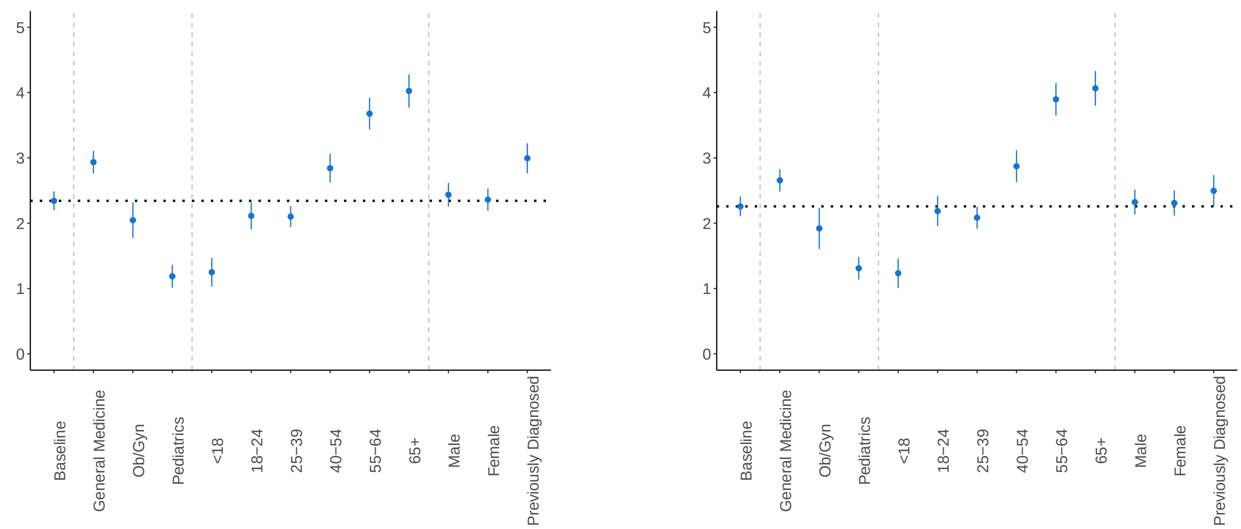
	Main Effects		Call Resolution			
	Calls	First-Time Callers	Resolved	Prescription	Follow-Up	Derived
Post	0.501***	0.503***	0.420***	0.128	0.299**	−0.147
	(0.069)	(0.071)	(0.071)	(0.111)	(0.125)	(0.097)
PostxYear2020	2.327***	2.258***	2.442***	3.422***	3.144***	1.841***
	(0.074)	(0.077)	(0.077)	(0.120)	(0.136)	(0.105)
N	568	568	568	568	568	568
Adjusted R^2	0.995	0.993	0.994	0.981	0.963	0.970

Note: Each column presents the results of the difference-in-differences specification for a different dependent variable, following equation 2. ***p < .01; **p < .05; *p < .1
Source: Authors' calculations

Heterogeneity.– We next explore which types of patients were more prone to make the shift towards telemedicine. To that end, we calculated the estimates of the coefficients on $Post_d \times Year2020$ from equation (2) for different subgroups. Estimates of effects and confidence intervals are presented in Figure 3. The specialty with the greatest increase in demand was general or family medicine, which experienced an increase of 281 percent in the number of daily calls. Older patients increased the demand for telemedicine more than younger patients: the group 55-65 years old increased the use of telemedicine by 376 percent in the number of daily calls, while the group older than 65 experienced an increase of 404 percent after the social distancing measures were implemented. We also find that calls from patients who reported being previously diagnosed with a disease or illness increased by 297 percent. We additionally find no differences between men and women in the increase of demand for telemedicine.

Figure 3: Treatment Effects: Heterogeneity

(a) Effects on log(Calls) (b) Effects on log(First-Time Callers)



Notes: Panel (a) contains the coefficients estimating increase in number of calls as specified by 2 for the different subgroups. Panel (b) contains the same coefficients estimating increase in number of first-time callers.

Long-run effects.– If telemedicine is an experience good, once people start using telemedicine services they might continue to use them in the future even when the possibility of visiting the doctor in their office again becomes a possibility. Figure 2 shows that mobility steadily increased in the months after the initial lockdown period and, contemporaneously, weekly changes in the number of calls declined slightly throughout the same period. We exploit this variation to approximate an elasticity of demand of telemedicine to mobility by looking at the correlation between mobility and weekly changes in the outcome variables using the following regression:

$$\hat{\beta}_\tau = \alpha_1 Mob_\tau + \alpha_2 Post + \epsilon_\tau \tag{3}$$

where the dependent variable $\hat{\beta}_\tau$ is the weekly changes in outcomes estimated for week τ by equation 1, the independent variable Mob is the average of the four indicators of mobility observed during week τ described in Figure 1, and $Post$ is an indicator variable equal to one for all weeks after week 11 when the lockdown started.

The results of this regression are presented in Table 3. A 1 percent increase in the average mobility results in a 0.5 percent decrease on the estimated weekly difference in the number of calls. The estimates suggest that, despite travelling more, patients do not completely shift back to face-to-face consultations and are still opting for telemedicine as an alternative.[12] Resolved calls decrease by 0.6 percent for a one-unit increase in mobility, but the number of follow-up and referred calls do not experience significant changes. Calls resulting in prescription are the most sensitive to mobility changes. For this group of calls, a one-unit increase in mobility results in a 1 percent decrease. Despite this initial evidence suggesting that the demand for telemedicine did not decline sharply as mobility increased; more time and data are needed to assess how permanent the increase in demand is.

[12] Importantly, the share of first-time callers in the total dropped from 60 percent at the onset of the pandemic to about 30 percent later on, which is also consistent with the evidence regarding experience goods.

Table 3: Effect of Mobility on Weekly Changes

	Main Effects		Call Resolution			
	Calls	First-Time Callers	Resolved	Prescription	Follow-Up	Derived
Mobility Change	-0.005^{***}	-0.005^{***}	-0.006^{***}	-0.010^{***}	-0.003	0.003
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Post	2.390^{***}	2.029^{***}	2.402^{***}	3.004^{***}	3.313^{***}	2.157^{***}
	(0.118)	(0.126)	(0.123)	(0.183)	(0.228)	(0.165)
Constant	3.846^{***}	3.413^{***}	3.461^{***}	2.483^{***}	1.430^{***}	1.366^{***}
	(0.118)	(0.126)	(0.123)	(0.183)	(0.227)	(0.164)
N	43	43	43	43	43	43
Adjusted R^2	0.943	0.917	0.941	0.924	0.884	0.834

Note: Each column presents the results of the difference-in-differences specification for a different dependent variable, following equation 3. $^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$
Source: Authors' calculations

7 Conclusion

Using administrative records from one of the largest providers of telemedicine in Argentina and a difference-in-difference methodology, we find that the demand for telemedicine, as captured by the number of calls and first-time callers, increased 233 and 226 percent, respectively, after the onset of the COVID-19 pandemic. While both increased, first-time callers as a share of the total dropped from 60 percent at the onset of the pandemic to 30 percent later on, which is consistent with telemedicine being an experience good. The largest effect was observed on calls resulting in prescriptions, which experienced an increase of 342 percent. There was also an increase in resolved consultations (of 244 percent) and in calls referred to another specialist (184 percent). The effects were driven mostly by older individuals with pre-existing conditions who used telemedicine for internal medicine consultations. We also show that the increase in the use of telemedicine slightly decreased after mobility restrictions eased but not enough to undo the increase in demand. We interpret this as suggesting that the increase in the demand for telemedicine is likely to be permanent. Importantly, prescriptions dropped along with mobility, which indicates that telemedicine is not being perceived as a gateway to over-prescription.

Prior to the COVID-19 pandemic, many governments as well as the World Health Organization viewed telemedicine as a tool to increase access to healthcare, reduce healthcare costs, and expand service, particularly to geographically remote and underserved populations (WHO, 2016). The COVID-19 pandemic made even more clear the need to adopt innovative solutions that can provide relief to the saturated health care system, helping to meet increasing demand while minimizing the risk of transmission. This paper is a proof of concept that there was a hidden demand for telemedicine and that policymakers have space to foster and accelerate the adoption of technological solutions for health care delivery. Providing patients the ability to experience the service could go a long way toward ensuring sustained use.

References

Accenture (2020), 'Patients want to continue to use virtual care even after the pandemic ends'.

Ali, U., Herbst, C. M. and Makridis, C. (2020), The impact of covid-19 on the u.s. child care market: Evidence from stay-at-home orders. IZA Discussion Papers 13261, Institute of Labor Economics (IZA).

Andersen, E. S. and Philipsen, K. (1998), The evolution of credence goods in customer markets: exchanging 'pigs in pokes'.

Apple (2020), 'COVID-19 mobility trends reports'. Available at https://covid19.apple.com/mobility.

Ashwood, J. S., Mehrotra, A., Cowling, D. and Uscher-Pines, L. (2017), 'Direct-to-consumer telehealth may increase access to care but does not decrease spending', *Health Affairs* **36**(3), 485–491.

Baicker, K., Congdon, W. J. and Mullainathan, S. (2012), 'Health insurance coverage and take-up: Lessons from behavioral economics', *The Milbank Quarterly* **90**(1), 107–134.

Bashshur, R. L. (1995), 'Telemedicine effects: Cost, quality, and access', *Journal of Medical Systems* **19**(2), 81–91.

Bavafa, H., Hitt, L. M. and Terwiesch, C. (2018), 'The impact of e-visits on visit frequencies and patient health: Evidence from primary care', *Management Science* **64**(12), 5461–5480.

Berman, M. and Fenaughty, A. (2005), 'Technology and managed care: patient benefits of telemedicine in a rural health care network', *Health Economics* **14**(6), 559–573.

Bertrand, M., Mullainathan, S. and Shafir, E. (2004), 'A behavioral-economics view of poverty', *American Economic Review* **94**(2), 419–423.

Broens, T., in't Veid MHA, H. and MMR., V.-H. (2007), 'Determinants of successful telemedicine implementations: a literature study', *Journal of Telemedicine and Telecare* **13**(6), 303–309.

Caffery, L. J., Bradford, N. K., Smith, A. C. and Langbecker, D. (2018), 'How telehealth facilitates the provision of culturally appropriate healthcare for indigenous australians', *Journal of Telemedicine and Telecare* **24**(10), 676–682.

Caffery, L. J., Farjian, M. and Smith, A. C. (2016), 'Telehealth interventions for reducing waiting lists and waiting times for specialist outpatient services: A scoping review', *Journal of Telemedicine and Telecare* **22**(8), 504–512.

Chunara, R., Zhao, Y., Chen, J., Lawrence, K., Testa, P. A., Nov, O. and Mann, D. M. (2020), 'Telemedicine and healthcare disparities: a cohort study in a large healthcare system in new york city during COVID-19', *Journal of the American Medical Informatics Association* .

Cranen, K., Veld, R. H. i., Ijzerman, M. and Vollenbroek-Hutten, M. (2011), 'Change of patients' perceptions of telemedicine after brief use', *Telemedicine and e-Health* **17**(7), 530–535.

Donelan, K., Barreto, E. A., Sossong, S., Michael, C., Estrada, J. J., Cohen, A. B., Wozniak, J. and Schwamm, L. H. (2019), 'Patient and clinician experiences with telehealth for patient follow-up care', *The American Journal of Managed Care* **25**(1), 40–44.

Dorsey, E. R. and Topol, E. J. (2016), 'State of telehealth', *New England Journal of Medicine* **375**(2), 154–161.

Duffy, S. and Lee, T. H. (2018), 'In-person health care as option b', *New England Journal of Medicine* **378**(2), 104–106.

Dulleck, U., Kerschbamer, R. and Sutter, M. (2011), 'The economics of credence goods: An experiment on the role of liability, verifiability, reputation, and competition', *American Economic Review* **101**(2), 526–555.

Ekeland, A. G., Bowes, A. and Flottorp, S. (2010), 'Effectiveness of telemedicine: A systematic review of reviews', *International Journal of Medical Informatics* **79**(11), 736–771.

Emons, W. (1997), 'Credence goods and fraudelent experts', *RAND Journal of Economics* **28**(1), 107–119.

Farrell, D., Wheat, C., Ward, M. and Relihan, L. (2020), The early impact of COVID-19 on local commerce: Changes in spend across neighborhoods and online. SSRN Scholarly Paper.

Gobierno de Argentina (2019), 'Plan nacional de telesalud'.

Hale, T., Webster, S., Petherick, A., Phillips, T. and Kira, B. (2020*a*), 'Oxford COVID-19 government response tracker'. Available at https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker.

Hale, T., Webster, S., Petherick, A., Phillips, T. and Kira, B. (2020*b*), 'Variation in government responses to covid-19'.

Hartman, R. S., Doane, M. J. and Woo, C.-K. (1991), 'Consumer rationality and the status quo', *The Quarterly Journal of Economics* **106**(1), 141—-162.

Hjelm, N. M. (2005), 'Benefits and drawbacks of telemedicine', *Journal of Telemedicine and Telecare* **11**(2), 60–70.

Hollander, J. E. and Carr, B. G. (2020), 'Virtually perfect? telemedicine for covid-19', *New England Journal of Medicine* **382**(18), 1679–1681.

Ikeda, M. and Yamaguchi, S. (2020), 'Online learning during school closure due to COVID-19', *Covid Economics, Vetted and Real-Time Papers* **58**.

Inter-American Development Bank (2020), 'IDB and IDB invest coronavirus impact dashboard methodological note'. Available at https://iadb-comms.org/coronavirus-impact-dashboard-methodological-note.

Inter-American Development Bank and IDB Invest (2020), 'IDB and IDB invest coronavirus impact dashboard', www.iadb.org/coronavirus-impact-dashboard.

Jacobs, J. C., Hu, J., Slightam, C., Gregory, A. and Zulman, D. M. (2019), 'Virtual savings: Patient-reported time and money savings from a VA national telehealth tablet initiative', *Telemedicine and e-Health* **26**(9), 1178–1183.

Kahneman, D., Knetsch, J. L. and Thaler, R. H. (1991), 'The endowment effect, loss aversion, and status quo bias', *The Journal of Economic Perspectives* **5**(1), 193–206.

Kang, M.-I. and Ikeda, S. (2016), 'Time discounting, present biases, and health-related behaviors: Evidence from japan', *Economics & Human Biology* **21**, 122–136.

Kremer, M., Rao, G. and Schilbach, F. (2019), Chapter 5 - behavioral development economics, *in* B. D. Bernheim, S. DellaVigna and D. Laibson, eds, 'Handbook of Behavioral Economics: Applications and Foundations 1', Vol. 2 of *Handbook of Behavioral Economics - Foundations and Applications 2*, North-Holland, pp. 345–458.

Kruse, C. S., Krowski, N., Rodriguez, B., Tran, L., Vela, J. and Brooks, M. (2017), 'Telehealth and patient satisfaction: a systematic review and narrative analysis', *BMJ Open* **7**(8).

Langabeer, J. R., Gonzalez, M., Alqusairi, D., Champagne-Langabeer, T., Jackson, A., Mikhail, J. and Persse, D. (2016), 'Telehealth-enabled emergency medical services program reduces ambulance transport to urban emergency departments', *Western Journal of Emergency Medicine* **17**(6), 713–720.

Leslie, E. and Wilson, R. (2020), 'Sheltering in place and domestic violence: Evidence from calls for service during COVID-19', *Journal of Public Economics, Forthcoming* .

Levine Steven R. and Gorman Mark (1999), 'Telestroke', *Stroke* **30**(2), 464–469.

Linnemayr, S. and Stecher, C. (2015), 'Behavioral economics matters for HIV research: The impact of behavioral biases on adherence to antiretrovirals (ARVs)', *AIDS and Behavior* **19**(11), 2069–2075.

Madrian, B. C. (2014), 'Applying insights from behavioral economics to policy design', *Annual Review of Economics* **6**, 663–688.

Mair, F., Finch, T., May, C., Hiscock, J., Beaton, S., Goldstein, P. and Mcquillan, S. (2007), 'Perceptions of risk as a barrier to the use of telemedicine', *Journal of Telemedicine and Telecare* **13**(1), 38–39.

Moovit (2020), 'Impact of coronavirus (covid-19) on public transit usage'. Available at https://moovitapp.com/insights/en/.

Pan, Y., Darzi, A., Kabiri, A., Zhao, G., Luo, W., Xiong, C. and Zhang, L. (2020), 'Quantifying human mobility behaviour changes during the covid-19 outbreak in the united states', *Nature Scientific Reports* **10**(1).

Pandian, P. S. (2016), 'An overview of telemedicine technologies for healthcare applications', *International Journal of Biomedical and Clinical Engineering (IJBCE)* **5**, 29–52.

Polinski, J. M., Barker, T., Gagliano, N., Sussman, A., Brennan, T. A. and Shrank, W. H. (2016), 'Patients' satisfaction with and preference for telehealth visits', *Journal of General Internal Medicine* **31**(3), 269–275.

Rice, T. (2013), 'The behavioral economics of health and health care', *Annual Review of Public Health* **34**(1), 431–447.

Riordan, M. H. (1986), 'Monopolistic competition with experience goods', *The Quarterly Journal of Economics* **101**(2), 265—279.

Roine, R., Ohinmaa, A. and Hailey, D. (2001), 'Assessing telemedicine: a systematic review of the literature', *CMAJ* **165**(6), 765–771.

Sabesan, S., Simcox, K. and Marr, I. (2012), 'Medical oncology clinics through videoconferencing: an acceptable telehealth model for rural patients and health workers', *Internal Medicine Journal* **42**(7), 780–785.

Sprecher, E. and Finkelstein, J. A. (2019), 'Telemedicine and antibiotic use: One click forward or two steps back?', *Pediatrics* **144**(3).

Sunstein, C. R. (2019), 'Rear visibility and some unresolved problems for economic analysis (with notes on experience goods)', *Journal of Benefit-Cost Analysis* **10**(3), 317 – 350.

Superintendencia de Servicios de Salud (2020), 'Boletín oficial de la república de argentina'.

Suri, G., Sheppes, G., Schwartz, C. and Gross, J. J. (2013), 'Patient inertia and the status quo bias: When an inferior option is preferred', *Psychological Science* **24**(9), 1763–1769.

Tirachini, A. and Cats, O. (2020), 'COVID-19 and public transportation: Current assessment, prospects, and research needs', *Journal of Public Transportation* **22**(1).

Tsai, J.-M., Cheng, M.-J., Tsai, H.-H., Hung, S.-W. and Chen, Y.-L. (2019), 'Acceptance and resistance of telehealth: The perspective of dual-factor concepts in technology adoption', *International Journal of Information Management* **49**, 34–44.

Urpelainen, J. and Yoon, S. (2017), 'Can product demonstrations create markets for sustainable energy technology? a randomized controlled trial in rural india', *Energy Policy* **109**, 666–675.

WHO (2016), *From innovation to implementation – eHealth in the WHO European Region (2016)*, WHO Regional Office for Europe.

Williams, A. M., Liu, P. J., Muir, K. W. and Waxman, E. L. (2018), 'Behavioral economics and diabetic eye exams', *Preventive Medicine* **112**, 76–87.

Wootton, R. (2008), 'Telemedicine support for the developing world', *Journal of Telemedicine and Telecare* **14**(3), 109–114.

Zanaboni, P. and Wootton, R. (2012), 'Adoption of telemedicine: from pilot stage to routine delivery', *BMC Medical Informatics and Decision Making* **12**(1), 1.

Zhang, X., Guo, X., Wu, Y., Lai, K.-h. and Vogel, D. (2017), 'Exploring the inhibitors of online health service use intention: A status quo bias perspective', *Information & Management* **54**(8), 987–997.