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Bando Cariplo - Networking and capacity building on PASC

PROGETTO

“The Post-Covid-19 Syndrome: network building and innovative management to address a new public health emergency”

In the eye of the storm. Long-term impact of the Covid-19 pandemic on healthcare utilization in Lombardy

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Abstract[1]

Covid-19 induced an increase in unmet health needs due to mobility restrictions and social distancing policies, fear of contagion and overload of healthcare facilities. Using administrative data on the Italian provinces of Milan and Lodi in Lombardy and a rigorous empirical strategy, this paper investigates the indirect effects of Covid-19 on outpatient care between January 2018 and June 2021. We find a large and persistent drop in outpatient care, with heterogeneous variations across age groups and chronic status of patients, as well as diagnostic categories of treatments. Results also reveal a significant role played by policy response to Covid-19 and behavioral changes in health-seeking behaviors in shaping the Covid-induced variation in outpatients. Finally, we estimate a cumulative and persistent loss in outpatient care around 25 percent over the period of interest, with an accumulated delay of 4.5 standard months.

Keywords: Covid-19, Outpatient treatments, Health Care System, Lombardy.

JEL Codes: I10, I12, I18

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1 Introduction

The Covid-19 pandemic has wrought profound changes in the lives of individuals across Europe and globally, impacting various facets such as education, economy, and social activities (Baranov et al., 2022; Immordino et al., 2022). In the realm of health, the pandemic has precipitated significant disruptions in healthcare services. A substantial number of European Union citizens reported heightened unmet health needs as countries redirected healthcare resources to address the urgent demands of the pandemic. At the same time, public health directives that reduced physical and social interactions to contain the outbreak further exacerbated the challenges in accessing health care (OECD and Union, 2022). Eurofound's Living, Working, and Covid-19 e-survey (Ahrendt et al., 2022) revealed that more than one in five individuals in EU countries reported forgoing health care within the first 12 months of the pandemic. Moreover, almost 20 percent of individuals reported persisting unmet healthcare needs in the subsequent springs of 2021 and 2022.

This study investigates the consequences of the Covid-19 pandemic on outpatient care, since its outbreak through the early recovery period, with a specific focus on the Italian provinces of Milan and Lodi, in Lombardy, which was the first region outside China hit by the pandemic outbreak.

The disruption in the provision of health care is a multifaceted phenomenon influenced by several factors, including the implementation of restrictive measures, public perceptions of safety, and potential excess mortality. The early studies on the impact of the Covid-19 pandemic on healthcare service utilization in 2020 in China reveal a significant drop in healthcare spending and utilization Zhang et al. (2020), both in preventive care and outpatients (Huang and Liu, 2023) as well as for emergency care and inpatient hospital visits (Xiao et al., 2021). Similar evidence is found in the US for the initial stages of the pandemic both in retrospective cohort studies (Xu et al., 2021) as well as using medical claims and cellphone data to identify the effects of shelter-in-place (SIP) policies (Cantor et al., 2022). Results from the latter study reveal a significant reduction in the use of preventive care, elective services and weekly treatments to physician offices and hospitals associated with Covid-19 outbreak and the introduction of SIP policies. Moreover, systematic and scoping reviews of the impact of Covid-19 on the utilization of healthcare services worldwide provide evidence of an overall reduction in healthcare - across both high- and low-income countries -, with considerable cross-country variation and larger drops

among individuals with less severe illness (Moynihan et al., 2021; Roy et al., 2021).

While existing literature identified a negative effect of Covid-19 on most domains of healthcare services in many countries(Cantor et al., 2022; Lee and You, 2021; Makiyama et al., 2021; Tsai and Yang, 2022; Xu et al., 2021), evidence on Italy is rather scarce and often focusing on specific diagnostic categories of healthcare services (Gualano et al., 2021; Lastrucci et al., 2022; Percudani et al., 2020).

This paper contributes to existing literature in a number of ways. First, we provide novel evidence on the indirect effects of Covid-19 on healthcare utilization in Italy, with a specific focus on the Metropolitan area of Milan, the second largest Italian city, and Lodi. Using rich administrative data from the healthcare system of Lombardy and a rigorous empirical strategy we evaluate the indirect effects of Covid-19 and policy responses on outpatient care over the period from January 2018 to June 2021. Second, with respect to previous studies, we analyze a longer time span, allowing for an additional assessment of possible long-lasting effects of the delays and interruptions in healthcare provision associated with the outbreak of Covid-19. Third, we address concerns about the role of excess mortality in explaining variations in healthcare use. Fourth, we explore possible mechanisms that can shape Covid-related patterns in outpatient care. We investigate the role played by demand and supply-side factors in explaining the variations in outpatient care following the outbreak of Covid-19, exploring the relative importance of variations at the intensive and extensive margin. Moreover, we disentangle the effect of policy response to Covid-19 from that of exposure to the pandemic. We further explore heterogeneous effects of Covid-19 on outpatient care across age groups, different diagnostic categories of treatments, as well as according with the presence of chronic diseases. Finally, we provide an assessment of the cumulative loss in outpatient care due to the pandemic and accumulated delay, along with an estimate of the potential duration for a full recovery under various scenarios.

Our results show a marked and enduring decline in outpatient treatments, with distinct patterns across ordinary, emergency, and screening treatments. We also find heterogeneous effects across age groups, diagnostic categories of treatments and chronic status of patients. A larger impact is found among individuals aged 60 to 84, for outpatients belonging to Diagnostic Imaging and for non-chronic patients, reflecting the disruption in the provision of elective care and a reduced demand for non-essential health care. Mobility restrictions and SIP policies are shown to account for a significant part of the overall reduction in outpatients, especially in the first period after Covid-19 outbreak, and variations at the extensive margin appear to be predom-

inant. These results also suggest that changes in health-seeking behaviors among individuals played a crucial role in determining the level of outpatient care during the pandemic. Finally, the cumulative loss in outpatient care is estimated around 25 percent with an accumulated delay of about 19 weeks.

The paper is structured as follows. Section 2 provides an brief description of the Italian NHS as well as an overview of trends in Covid-19 diffusion and policy responses. The data and methodology are described in Section 3. Section 4 presents the results and concluding remarks are provided in Section 5.

2 Institutional setting

The Italian National Health Service (NHS) is a public (tax-funded) insurance scheme, that provides universal coverage to all citizens and residents largely free of charge, with a small share of co-payments for pharmaceuticals and outpatient care[2]. The level of cost-sharing ranges from total exemption (for people aged 65 and over, children below 6, unemployed or individuals with a gross family income below a given threshold, individuals with severe disabilities) to a coverage of part of the costs. Exemptions also apply to chronic patients and pregnant women as far as the needed treatments are related with their condition. Each individual is assigned to a general practitioner (or pediatrician for children below the age of 14) who provides family medicine free of charge and acts as a gatekeeper to higher levels of care and pharmaceuticals. The central government is responsible for general legislation and financing, while leaving to the regional governments the management and provision of care.

Italy has been the first country outside China to be hit by Covid-19 outbreak, with the first case reported in Codogno (province of Lodi) on February 20th, and recorded the highest number of victims in the first quarter of 2020, with nearly half of the national cases diagnosed in Lombardy. Since January 31st, 2020 Italy started its proactive management of the Covid-19 pandemic, with a six-months state of emergency declared, providing authorities with essential tools to face the alarming epidemic. As the situation intensified, on February 23, 2020 new actions were taken, with the isolation of ten municipalities in Lombardy and one in the province of Padua, including mobility restrictions within and to these areas, along with milder restrictions across the Lombardy region, including school closures and entertainment events suspension.[3].

[2]There is also a co-payment for the "inappropriate" use of emergency care, defined as any access to emergency departments with non-critical or non-urgent conditions.

[3]The municipalities involved were: Codogno, Castiglione d'Adda, Casalpusterlengo, Fombio, Maleo, Somaglia,

On March 9, 2020 SIP policies were introduced[4], with the implementation of the first nationwide lockdown. This unprecedented measure aimed at containing the spread of Covid-19 introduced severe social distancing policies, prohibiting all forms of gatherings in public places and allowing only social interactions to). Meanwhile, elective and non-urgent medical procedures were largely delayed or canceled as a mean to prevent hospital overcrowding, while maintaining the provision of outpatient care for chronic patients. Subsequently, on March 22, 2020, further restrictions were imposed, including the closure of non-essential businesses and mobility restrictions between municipalities. These measures were extended until May 3rd. Starting May 4th a gradual easing of containment measures characterized "Phase Two" of the pandemic management strategy, that lasted until October 2020, when the second pandemic wave struck, leading to a resurgence of Covid-19 cases and the reinstatement of restrictive measures. Figure 1 provides an overview of the time trends for Covid-19 infections and of the timing of the different policy measures. The solid vertical line represents the introduction of the first mobility restrictions in Lombardy and the isolation of the ten most affected municipalities; the two dash-dotted lines delimit the national lockdown; the long-dashed line coincides with the beginning of the second pandemic wave, which was followed by new restrictive measures.

3 Data and methods

3.1 Data and descriptive statistics

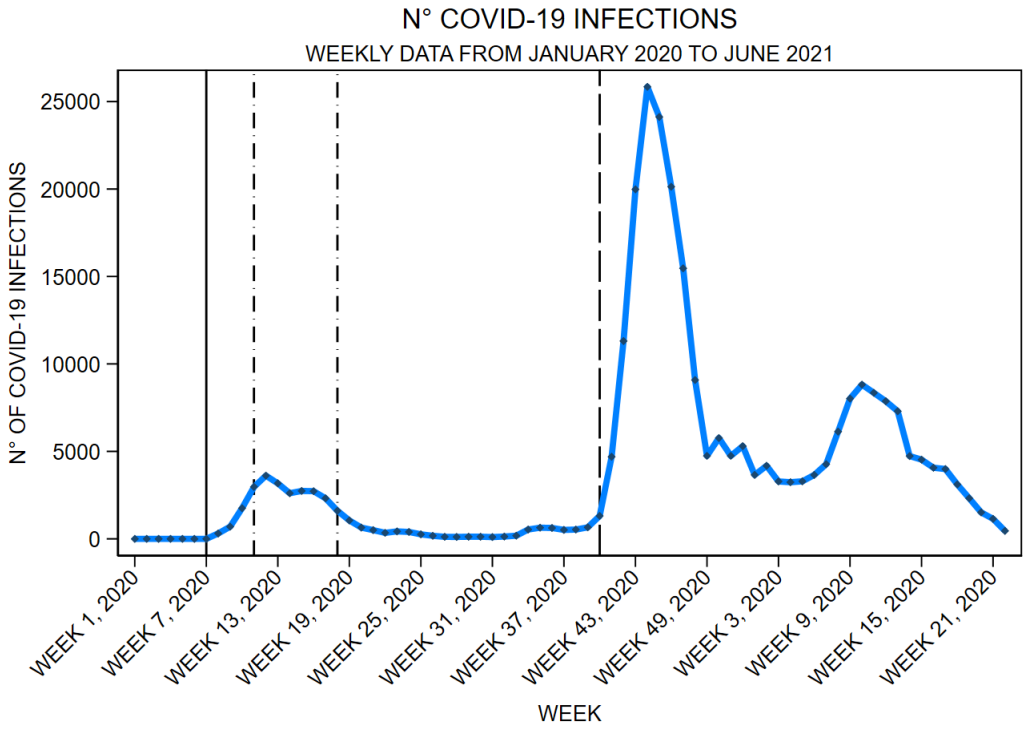
We use administrative data from the Agency for Health Protection (*Agenzia di Tutela della Salute*) of the Milan Metropolitan Area, with information on the universe of healthcare services for the whole population of 193 municipalities in the Lombard provinces of Milan and Lodi (former ASL Milan, Milan 1, Milan 2, and Lodi). In the empirical analysis we focus on outpatient treatments provided between January 2018 and June 2021, aggregated on a weekly basis and by municipality/zip code[5] of residence of patients, combined with data on Covid-19 outbreak. We further exploit information on the age group of patients, the diagnostic category of outpatient

Bertonico, Terranova dei Passerini, Castelgerundo, and San Fiorano in the province of Lodi in Lombardy and Vò in the province of Padua in Veneto.

[4]Shelter-in-place generally means finding a safe indoor location and staying there until the situation outside is safe. SIP orders during the Covid-19 pandemic implied staying at home until further notice, minimizing social interactions.

[5]Each geographic area is defined matching the information on the municipality and zip code, to identify the smallest cell. In most cases municipality and zip code identify the same area, but this is not always the case. For big municipalities characterized by multiple zip codes (like Milan) the unit of observation is at the zip code level, while for some small municipalities sharing the same zip code the identifier is the municipality.

Figure 1: Trends in Covid-19 cases and timing of social distancing policies



treatments (14 categories) and the presence of any diagnosed chronic condition (3 categories) to provide a comprehensive analysis of healthcare utilization patterns during and after the Covid-19 pandemic. Descriptive statistics of our final sample of 42,042 observations are reported in Table 1. On average, more than 1,160 outpatient treatments are provided every week in a single zip code area, 20 percent of which are provided as emergency care and around 1 percent represent screening tests.[6]

Table 1: Descriptive Statistics

	Mean	SD	Max	Min
Total outpatient treatments	1,166	1,423	10,677	0
Ordinary outpatient treatments	913.8	1,143	8,77	0
Emergency outpatient treatments	236.6	290.5	2,666	0
Screening outpatient treatments	16.09	22.53	420	0

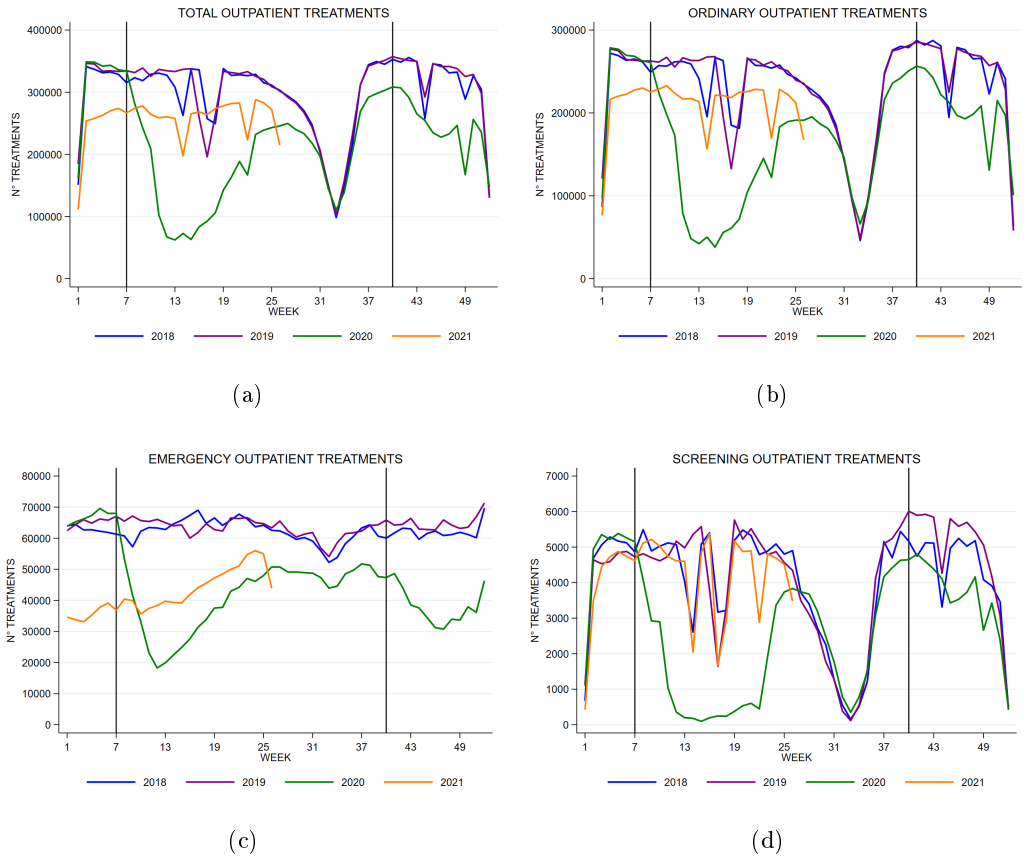
Looking at the distribution of outpatient treatments among age groups (Table A5 in the Appendix) and diagnostic categories (Table A6 in the Appendix), the data show that a substantial portion comes from individuals aged 50 to 84, accounting for more than half of the total number of treatments, especially for screening tests, and that most of the treatments belong to

[6] Additional statistics by age group and diagnostic categories are provided in Table A1, A2, A3 and A4 in the Appendix.

Diagnostic Imaging. Ordinary outpatient treatments are mainly provided to chronic patients (i.e. those with at least one chronic condition diagnosed by a doctor), representing almost 60 percent of the total, while screening tests are more equally distributed between chronic and non-chronic patients (Table A7 in the Appendix).

Figure 2 illustrates the time patterns for weekly outpatient treatments over the period of interest, Jan 2018 - Jun 2021, with overlapping lines for each year. Panel (a) displays the total number of outpatient treatments; panel (b) isolates ordinary outpatient treatments (total minus emergency treatments and screening tests); panel (c) depicts emergency outpatient treatments while panel (d) focuses on screening tests. Vertical lines indicate the week before the introduction of initial restrictive measures in Lombardy (week 7 of 2020) and the week before the beginning of the second pandemic wave (week 40 of 2020).

Figure 2: Trends in outpatient treatments



Overall, outpatient treatments exhibit marked seasonal patterns across all years, with notable drops occurring during holiday periods, such as Christmas (observed in the first and last week of the year), mid-August (during week 33), Easter, and other festive occasions. A substantial drop in outpatient treatments can be identified on the green line for 2020, in the immediate

aftermath of the implementation of restrictive measures introduced on February 23rd in Lombardy, aimed at mitigating the spread of the first wave of Covid-19 (first vertical line). Similarly, a less pronounced reduction in outpatient treatments is found following the second wave of the pandemic, coupled with the subsequent imposition of another set of restrictive measures in early October 2020 (second vertical line). Compared with the reference week (week 7 of 2020), total outpatients fell by up to 80 percent in the first pandemic wave and around 30 percent between October and December 2020. Interestingly, despite a gradual recovery of outpatient treatments during summer 2020, the volumes of outpatient care never fully rebound to pre-Covid levels, even during the first semester of 2021. Such trend is particularly pronounced for outpatient treatments provided as emergency care (panel (c)), which also experienced a more sizable drop after Covid-19 outbreak. Conversely, the decline in screening tests (panel (d)), while substantial, was less enduring, with the numbers eventually converging towards pre-Covid levels. Such preliminary evidence suggests that Covid-19 and policy responses had a non-negligible impact on the provision of outpatient care, with distinct trajectories for different types of services, and a long-lasting effect.

3.2 Empirical Strategy

In the empirical analysis we first investigate the impact of Covid-19 on the provision of outpatient treatments in the 194 municipalities belonging to ATS Metropolitan city of Milan using a standard event study specification:

$$Y_{m,t} = \alpha + \sum_{t \neq 7} \beta \cdot D_t + \mathbf{munzip}_m + \epsilon_{m,t} \tag{1}$$

where $Y_{m,t}$ represents the volume of outpatient treatments (total, ordinary, emergency and screening) provided in week t and municipality/zip code m between January 2019 and June 2021, adjusted for seasonality [7];D_t is a set of dummy variables, equal to one for each specific week t, excluding week 7 of 2020, capturing the variation in the volume of outpatient treatments in week t, relative to the reference week, compared with 2018; munzip$_m$ are municipality/zip code fixed effects and $\epsilon_{m,t}$ is the error term, representing unexplained variation in the model.

[7]Given the marked seasonality in outpatient treatments, we isolate the effects of Covid-related events by transforming the dependent variable as the difference between weekly outpatient treatments for jan 2019-jun 2021 and outpatients for the corresponding week of 2018. As a result of these adjustment, the time period under examination spans from January 2019 to June 2021, encompassing a total of 126 weeks, using 2018 as a reference point for comparative analysis.

Standard errors are clustered at the municipality/zip code level.

As a second step, in order to assess the average weekly variation in the volume of outpatient treatments after Covid-19 outbreak and the implementation of mobility restrictions, we estimate the following regression equation:

$$Y_{m,t} = \alpha + \beta \text{PostCovid}_t + \mathbf{munzip}_m + \mathbf{week}_t + \mathbf{year}_t + \epsilon_{m,t} \tag{2}$$

where $Y_{m,t}$ represents the volume of outpatient treatments (total, ordinary, emergency and screening) provided in week t and municipality/zip code m between January 2018 and June 2021; *PostCovid* is a dummy variable equal to one for all the weeks after the seventh week of 2020, corresponding to the introduction of the first restrictive measures in Lombardy; $\mathbf{munzip}_m$, $\mathbf{week}_t$ and $\mathbf{year}_t$ are municipality/zip code, week and year fixed effects, respectively; $\epsilon_{m,t}$ is the unobservable disturbance. Standard errors are clustered at the municipality/zip code level. In this specification, the coefficient of interest β measures the average weekly change in the number of outpatient treatments due to Covid-19 outbreak and the introduction of mobility restrictions. We further explore the heterogeneous effects of the pandemic on outpatient treatments according to the diagnostic category of medical treatments, chronic status and across different age groups of patients, by estimating equation 2 for each specific subsample.

In order to disentangle the effect of policy responses on the volume of outpatient treatments from that of Covid-19 diffusion, we estimate equation 2 including non-parametric controls for the exposure to Covid-19 ($\text{cases}_{m,t}$ and $\text{deaths}_{m,t}$), calculated as the cumulated number of Covid-19 cases and Covid-related deaths[8] in each municipality/zip code m and week t (rescaled in groups of 100 for Covid-19 cases and 10 for deaths). A set of fixed effects for these measures of exposure are then added to equation 2. Note that within the effect of policy response we also partly capture the disruption in the provision of outpatient care, as on March,16 2020 a memorandum of the Ministry of Health was issued, indicating guidelines for the delay and interruption of a set of elective and non-urgent procedures. However, the application of such guidelines was left to the decision of the single healthcare facility and has been strictly connected with the Covid-related overload, so that non-parametric controls for Covid-19 exposure are also likely to capture a significant part of this supply-side effect, which we are not fully able to isolate. With this specification, our β can be interpreted as the effect of mobility restrictions and SIP

[8]Covid-related deaths refer to deaths occurred within 30 days since a positive PCR test has been recorded.

policies (and part of the supply-side effect) on outpatient care, net of the exposure to Covid-19 cases.

Moreover, in an additional exercise, we split our variable of interest PostCovid_t into four period indicators according with the trajectory of the pandemic and the associated policy responses. The benchmark (omitted category) is the period before Covid-19 outbreak (until week 7 of 2020); the second period indicator ($PR1$) covers week 8 to week 10 of 2020 and refers to the implementation of the first restrictive measures, with the isolation of ten municipalities and the introduction of mobility restrictions within and to these areas, along with milder restrictions across the Lombardy region (school closures and entertainment events suspension); the third period indicator, $PR2$, comprises the lock-down period (week 11 to week 18 of 2020), with the introduction of SIP policies in the whole national territory; the fourth period, $PR3$, is characterized by gradual reopenings and relaxation of mobility restrictions, and basically coincides with the summer (week 19 to week 40 of 2020); the final period, $PR4$, goes from October 2020 to the end of the sample period, and is characterized by the second and successive waves of the pandemic along with the introduction of new restrictive measures.

Finally, we investigate the role of intensive and extensive margins in the Covid-induced variation in outpatient care and try to assess the extent of outpatients lost during the pandemic.

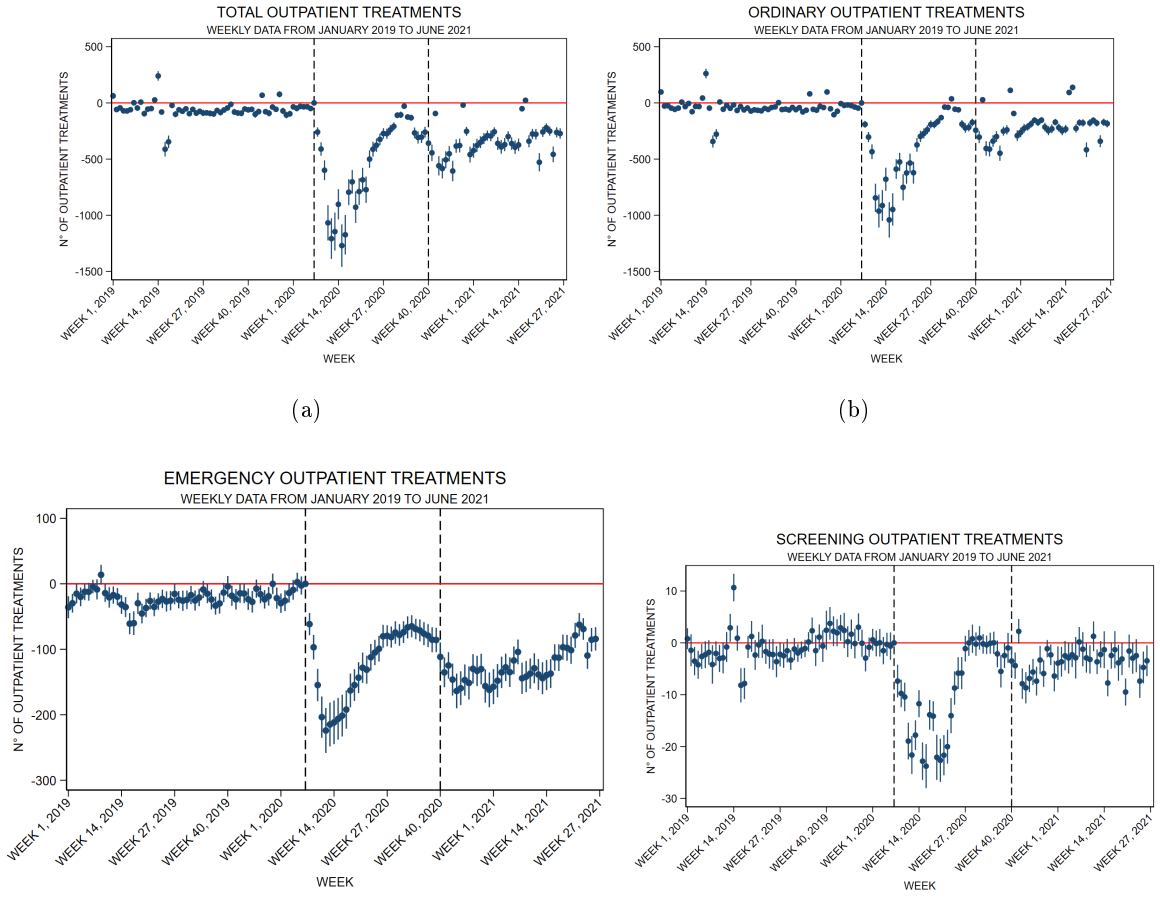
4 Results

4.1 Main Results

Figure 3 presents estimation results from our event study analysis, offering insights into the dynamic shifts in outpatient care throughout our study period. The four panels report the $beta_w$ coefficients (and 95% confidence intervals) of equation 1, estimated separately for total outpatients, ordinary outpatient treatments, outpatients provided as emergency care and screening tests. Vertical lines indicate the week before the introduction of mobility restrictions in Lombardy (week 7 of 2020) and the week before the beginning of the second pandemic wave in October 2020 (week 40).

Overall, looking at the coefficients of the event study for the pre-Covid period, Jan 2019-Jan 2020, no evidence of pre-trends is found, as no significant deviations from typical outpatient treatment patterns are observed. Conversely, a sizable drop in the volumes of outpatients is recorded in each of the four panels after the first Covid-19 outbreak and the implementation

Figure 3: Event study analysis



of mobility restrictions in Lombardy, reflecting both the disruption in the provision of non-urgent care and a drop in the demand for health care. Demand-side drivers of the reduction in outpatient care both include mobility restrictions, social distancing and SIP policies, that encouraged the public to stay at home and avoid healthcare facilities, as well as behavioral responses of individuals who might be afraid of Covid-19 infection while in healthcare facilities. The most notable contraction occurred during the lock-down period, spanning from March 8th to early May 2020, followed by a gradual recovery during summer, when Covid-19 cases shrank and mobility restrictions were cautiously eased. The second wave of the pandemic (October 2020) marks a second significant decline in outpatient treatments, though less severe as compared to the first wave. Interestingly, the volume of total outpatient treatments never fully rebounds to pre-pandemic levels over the period of interest, which might be explained both by supply and demand factors. On the supply-side, the overload on healthcare facilities brought about by Covid-19 patients induced a reallocation of resources from non-urgent outpatient treatments to hospital care, up to a disruption in the provision of the former. The impact of Covid-19 on halthcare provision and resources available was so severe that the volume of outpatient treatments couldn't get back to normal, at least until mid-2021. On the demand-side, patients' behavioral responses to the epidemic and to social distancing policies might have reduced their overall demand for non-urgent care even when the epidemic was less biting.

Although consistent across categories, the decline in outpatient treatments shows different magnitudes. Screening tests experienced a decline of up to 25 treatments (with a pre-pandemic average of 18 treatments per week) immediately after the Covid-19 outbreak and during the extended lockdown, with a gradual recovery back to pre-pandemic levels around summer. The second wave of the pandemic had only a mild effect on outpatient patterns for this category, suggesting possible positive organizational spillovers from the first wave in the provision of preventive care. Conversely, outpatient treatments provided as emergency care show an 87 percent decline at first (approximately -240 treatments with a pre-Covid average around 274 treatments per week) that was only partially recovered over the summer, and set to -100/150 treatments all over the first semester of 2021. Similar trends are shown for the first period after Covid-19 outbreak for ordinary outpatient visits, while the trend in outpatients during the second wave shows a larger reduction, from 25 to 40 percent.

Taken altogether, these results reveal an enduring effect of Covid-19 pandemic on outpatient care and possible mechanisms at play. The significant and persistent drop observed for

all categories of outpatient care until spring 2020 suggests that, beyond supply-side constraints, individuals postponed non-essential health care as a result of both fear of Covid-19 infection while in healthcare facilities and social distancing policies. While this mechanism seems reasonable when it comes to preventive medicine, represented by screening outpatient treatments, the sizable drop in outpatient treatments provided as emergency care might appear puzzling at first. However, around 10 to 20 percent of emergency care admissions in Lombardy before the pandemic were deemed to be inappropriate, identified by a "white" triage code (health is not at risk and no suffering is present so the patient should have addressed the family doctor) and treated after all other more urgent cases. Given the overload of emergency departments over the pandemic period, waiting times for non-urgent cases significantly increased and this might well explain the decline in outpatient treatments provided within this setting. Such hypothesis has been recently confirmed by data on access to emergency departments of the territories of ATS Milan in the first semester of 2023, revealing that up to 20 percent of (plausibly non-critical) patients left the hospital without being visited, due to excess waiting time. Moreover, as Covid-19 has been largely a nosocomial infection, fear of contagion might have discouraged individuals with less urgent situations from resorting to emergency care.

One alternative explanation to the persistent reduction in outpatient treatments, that never fully recover but set to a lower level as compared to the pre-pandemic figures, is Covid-related excess mortality. As we do not observe sample mortality, to address this concern we run several exercises.

We first replicate the event study analysis of equation 1 adding excess mortality as a regressor. To this end we retrieve data from the Italian National Institute of Statistics on week by week cumulative mortality in excess with respect to the years 2018-2019 for each municipality in our sample. Results from this exercise, presented in Figure A1 in the Appendix, are consistent with our baseline event study, suggesting that the drop in outpatient treatments is not entirely attributable to Covid-related mortality[9].

Second, we explore the correlation between excess mortality and the percentage change in total cumulative outpatient treatments between January 2020 and June 2021, relative to the corresponding period in the years 2018-2019, both in overall terms and for people over 65 (the

[9]The unit of observation in this and following exercises exploring the role of mortality is the municipality (not municipality/zip code) as external data on excess mortality are only available at this level of aggregation. Note that with this cell specification we lose significant data variation - as the Milan municipality with 38 zip codes only accounts for one cell -, leading to inflated standard errors (clustered at the municipality level) in the estimated coefficients of the event study specification.

group with the highest exposure to Covid-19). A positive correlation would imply that the observed decrease in the number of outpatient treatments is a consequence of higher-than-average mortality. However, no correlation is found between these two variables, as shown in Figure A2 in the Appendix.

A final exercise, presented in Table A8 in the Appendix, involves a back-of-the-envelope calculation of the volumes of outpatients that would have occurred in the period from January 2020 to June 2021 under different hypothetical scenarios, based on the number of individuals who might have died due to Covid-19. We start considering individuals with a *regular* use of outpatient treatments in the pre-pandemic years 2018-2019 (at least one outpatient treatment in 3 out of 4 semesters) and explore their patterns of participation in outpatient care over the period of interest to make hypothesis about sample mortality. We identify three possible participation patterns that might suggest that the individual left the sample due to death: 1) individuals no longer observed in the 1st semester of 2021 (418,389 individuals); 2) individuals no longer observed in the 2nd semester of 2020 and in the 1st semester of 2021 (236,924 individuals); 3) individuals no longer observed in the 1st semester of 2020, in the 2nd semester of 2020, and in the 1st semester of 2021 (153,779 individuals). We then hypothesize three different scenarios for average outpatient treatments in each semester of the period from January 2020 to June 2021 that would have been associated with these individuals, hadn't they left the sample: 1) an average volume of outpatients equal to the average observed for 2018-2019; 2) an average volume of outpatients equal to 75 percent of the average observed for 2018-2019; 3) an average volume of outpatients equal to 50 percent of the average observed for 2018-2019. By comparing these numbers with the volume of cumulative missed outpatients for the period Jan2020-Jun2021 (5,650,978) - with respect to the corresponding period of 2018-2019 - we can explore the role played by mortality in explaining the drop in outpatient treatments observed after the pandemic outbreak. Results suggest that, even in our upper-bound/worst-case scenario (which considers as dead all those individuals who had *regular* outpatients until the end of 2020 and exit the sample in the first semester of 2021), mortality alone is cannot explain the entire drop in outpatient treatments (in worst-case scenario it accounts for 83 percent of such reduction).

4.2 Overall change in outpatient care, policy response and Covid-19 exposure

In order to assess the overall average weekly change in the volume of outpatient treatments after Covid-19 outbreak we estimate equation 2 separately for each category of outpatients. Results from this exercise, reported in column (1) of Table 2, show an average reduction in total outpatients of about 482 treatments, which represents a 37 percent decrease evaluated at the pre-pandemic sample average. The decrease is -349 (column 5 Panel A) for ordinary outpatients (-35 percent), -123 (column 1 Panel B) for emergency treatments (almost -45 percent) and -9 (column 5 Panel B) for screening treatments (-50 percent).

Table 2: Effect of Covid-19 exposure and policy response on outpatient care

PANEL A	Total outpatient treatments				Ordinary outpatient treatments			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PR1			-403.1***	-399.1***			-287.5***	-283.3***
			(28.79)	(28.03)			(20.29)	(19.71)
PR2			-1,008***	-866.2***			-800.0***	-685.8***
			(75.87)	(61.94)			(60.81)	(49.66)
PR3			-330.0***	-64.83***			-230.0***	-20.16
			(25.35)	(18.96)			(18.32)	(15.79)
PR4			-371.4***	-113.4***			-231.3***	-47.49***
			(28.33)	(19.08)			(18.25)	(12.66)
PostCovid	-481.7***	-305.7***			-349.2***	-215.9***		
	(36.25)	(24.99)			(26.72)	(18.34)		
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Week FE	✓	✓	✓	✓	✓	✓	✓	✓
Municipality/zip code FE	✓	✓	✓	✓	✓	✓	✓	✓
Covid-19 cases FE		✓		✓		✓		✓
Covid-19 deaths FE		✓		✓		✓		✓
N	42,042	42,042	42,042	42,042	42,042	42,042	42,042	42,042
R^2	0.914	0.921	0.920	0.929	0.896	0.902	0.903	0.911
PANEL B	Emergency outpatient treatments				Screening tests			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PR1			-106.3***	-106.7***			-9.306***	-9.101***
			(8.465)	(8.358)			(0.849)	(0.835)
PR2			-189.1***	-164.7***			-18.50***	-15.77***
			(14.36)	(11.91)			(1.379)	(1.152)
PR3			-92.94***	-42.42***			-7.058***	-2.244***
			(6.989)	(4.424)			(0.730)	(0.580)
PR4			-134.0***	-62.61***			-6.136***	-3.303***
			(10.21)	(7.940)			(0.824)	(0.622)
PostCovid	-123.2***	-83.39***			-9.304***	-6.506***		
	(9.271)	(7.786)			(0.837)	(0.630)		
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Week FE	✓	✓	✓	✓	✓	✓	✓	✓
Municipality/zip code FE	✓	✓	✓	✓	✓	✓	✓	✓
Covid-19 cases FE		✓		✓		✓		✓
Covid-19 deaths FE		✓		✓		✓		✓
N	42,042	42,042	42,042	42,042	42,042	42,042	42,042	42,042
R^2	0.919	0.935	0.922	0.940	0.610	0.629	0.617	0.637

* p < 0.1, ** p < 0.05, *** p < 0.01; robust standard errors in parentheses, clustered at the municipality level.

Using equation 2 we also investigate heterogeneous effects across age groups and chronic status of patients, as well as diagnostic categories of treatments. Figures A3, Figure A4 and Figure A5 in the Appendix present a graphical inspection of the β coefficients associated with each group.

Age patterns in the provision of outpatient treatments after Covid-19 outbreak reveal a drop

in ordinary and screening tests mainly attributable to patients aged 65 to 84, while among oldest patients we do not observe a significant reduction with respect to pre-pandemic levels. On the one hand, individuals aged 60 to 84 have been significantly exposed to Covid-19 and account for half of Covid-related hospital admissions, thus receiving most treatments within this setting, but 60 to 79 year-old patients also have significantly relatively low mortality rates and are the youngest are also less likely to develop severe complications (`https://covid19.infn.it/iss/`), so that part of the reduction in outpatients observed within this age groups might be explained by demand-side factors - i.e. reducing unnecessary healthcare use to avoid Covid-19 infection. On the other hand, results for the oldest group are also more likely to be influenced by sample mortality, which might explain the relatively small coefficient. Finally, the effect of Covid-19 on emergency outpatients is more heterogeneous across age groups with respect to ordinary and screening tests.

Looking at differences across diagnostic categories, the most significant drop is observed for Diagnostic Imaging across all types of outpatients, which is likely to be explained by the reallocation of most resources to Covid-19 cases, mainly treated within hospital settings (thus not observed in the outpatients sample) and that generated a large demand of chest-X-rays and assimilated procedures. For screening tests, the drop in the provision of outpatient care in almost exclusively attributable to this category of treatments. The same explanation also applies to the reduction in the provision of ordinary outpatients for Pulmonology and Otorhinolaryngology, as most of Covid-19 symptoms fall in these specialties and often caused patients' hospitalization, particularly for most exposed individuals (who were also likely to have regular patterns in the use of outpatient treatments before the pandemic). Ophtalmology also experienced a large decline after the outbreak of Covid-19 both in ordinary outpatient treatments and among outpatients provided as emergency care, while orthopedics and cytology/microbiology declined by a relatively smaller amount. Overall, heterogeneous patterns across diagnostic categories appear to be reflecting the disruption in the provision of elective care and a reduced demand for non-essential health care. This interpretation is also supported by results obtained from the estimation of our model separately on patients with and without chronic diseases. As expected, the reduction in outpatients following Covid-19 outbreak is significantly smaller among chronic patients, irrespective of the type of treatments.

Finally, we exploit data on the number of Covid-19 cases and deaths recorded in each municipality/zip code and week of the period of interest to disentangle the effect on outpatient care of

policy response to Covid-19 from that of exposure to the evolution of the pandemic. To this end, a set of additional non-parametric controls capturing the cumulated number of Covid-19 cases and Covid-related deaths are added to equation 2. Results obtained from this specification are reported in column (2) of Table 2 and suggest that the introduction of mobility restrictions and social distancing policies are associated with a reduction of almost 306 outpatient treatments, a relative decrease of 24 percent with respect to the pre-pandemic sample average. Thus, controlling for the trajectory of the pandemic (which translates into a behavioral effect associated with fear of infection and avoided care) reduces the impact of mobility restrictions and social distancing measures on outpatient care by 37 percent. This result is consistent across all types of outpatient treatments (columns 2 and 6 of Panels A and B), with a slightly larger (smaller) drop in the coefficient observed among emergency (screening) treatments. These results, and especially the significant reduction observed also on emergency outpatient treatments, might bear significant policy implications. If mobility restrictions implemented to reduce Covid-19 circulation had a negative impact also on the provision on necessary health care, then they might impose some costs in terms of delayed or forgone care (which in turn might translate into higher costs for the NHS due to its detrimental health effects) and lead to additional efforts to restore pre-pandemic levels of health care.

When we split the *PostCovid* dummy into four period indicators according with the trajectory of the pandemic and the associated policy responses, results show that the overall reduction in outpatient treatments (provided in each setting) following Covid-19 outbreak is largest during the lock-down period (columns 3 and 7 of Table 2), but is persistent across all periods. When we control for Covid-19 exposure (cols 4 and 8), we find that the effect of mobility restrictions and SIP policies is much larger in the first period after Covid-19 outbreak, until early may 2020, as the coefficient of $PR1$ is virtually unchanged and $PR2$ is reduced by less than 15 percent across all types of outpatient treatments. However, focusing on the post-lockdown period ($PR3$), controlling for Covid-19 exposure reduces the effect on total outpatients by 80 percent (53 and 46 percent for outpatients provided as emergency care and for screening tests, respectively), and it is not statistically different from zero for ordinary outpatient treatments, suggesting that changes in health-seeking behaviors among individuals are persistent throughout the period of interest. The difference between the coefficients of $PR3$ in the two specifications might also be suggestive of some supply-side effect. During this period, restrictive measures regarding mobility and social distancing were gradually relaxed (explaining the significant reduction in the coefficient of $PR3$,

net of Covid-19 exposure), so that the drop in outpatients can be mostly attributable to the trajectory of the pandemic, which is however characterized by a very low number of Covid-19 cases and deaths. In this setting, the overall effect of the pandemic (coefficient of $PR3$ in column 7) is also likely to capture the differential exposure to Covid-19 in the previous months and the congestion effect on healthcare facilities, with an associated contraction in the provision of non-urgent care.

4.3 Intensive vs. Extensive Margin

In this section, we delve deeper into the mechanisms behind the reduction in outpatient treatments documented in section 4.1, trying to disentangle whether such a decline can be attributed to a decrease in the number of patients (extensive margin) or to a lower demand of outpatients for the same individuals (intensive margin). If the drop in outpatients is mainly observed at the intensive margin, supply-side mechanisms are likely to be at play and the effect of Covid-19 might be interpreted in terms of missed care. On the other hand, extensive margins are more likely to reflect demand-side factors and behavioral responses of individuals in terms of healthcare demand and avoided care.

In order to disentangle the two effects we compare, over six consecutive quarters - spanning from the Q1-2020 to Q2-2021 - the percentage changes with respect to the 2018-2019 mean of various key metrics: the total volume of outpatient treatments, the number of individuals who received at least one treatment, and the average number of treatments. For this exercise four distinct scenarios are set: *i)* actual situation, observed data; *ii)* reduction only on the extensive margin, with an average volume of treatments consistent with the pre-Covid average 2018-2019, and the reduction entirely attributable to the decrease in the number of individuals; *iii)* reduction only on the intensive margin, with an average number of individuals receiving at least one treatment consistent with the 2018-2019 average, and the reduction in outpatients entirely attributable to volumes of treatments; *iv)* "average" scenario, with equal changes in the average volume of outpatients and in the number of individuals receiving at least one treatment.

Comparing actual data with the three hypothetical scenarios we can hypothesize which of the two effects exerted a more significant influence. Results from this exercise are reported in Table 3). Overall, the second quarter of 2020 records the largest drop in outpatient treatments, with an almost 50 percent reduction with respect to the same period before Covid-19 outbreak, followed by a 24 percent decrease during the second wave of the pandemic in the fourth quarter of the

same year. Over the same period, the number of individuals receiving at least one treatments dropped by 45 percent initially and by less than 20 percent in all following quarters.

The data show that the actual scenario closely aligns with that driven by the reduction in the extensive margin, confirming a predominant role for demand-side factors in explaining the reduction in outpatient care.

Table 3: Intensive Margin vs. Extensive Margin

Quarter	Total treatments	Δ% Total treatments	N. of individuals at least one treatment	Δ% N. of individuals at least one treatment	Average n. of treatments	Δ% Average n. of treatments
PANEL A: ACTUAL CASE						
1 - 2020	3,180,459	-22.53	1,036,444	-16.12	3.0686	-7.63
2 - 2020	2,039,131	-49,08	663,203	-45.76	3.0747	-6.12
3 - 2020	2,957,588	-10,66	934,227	-11.33	3.1658	0.75
4 - 2020	3,117,140	-24,18	1,006,488	-18.63	3.0970	-6.82
1 - 2021	3,243,530	-20,99	1,004,540	-18.71	3.2289	-2.81
2 - 2021	3,440,273	-14,08	1,067,579	-12.68	3.2225	-1.60
PANEL B: AVERAGE CASE						
1 - 2020	3,180,459	-22.53	1,087,631	-11.98	2.9242	-11.98
2 - 2020	2,039,131	-49.08	872,514	-28.64	2.3371	-28.64
3 - 2020	2,957,588	-10.66	995,815	-5.48	2.9700	-5.48
4 - 2020	3,117,140	-24.18	1,077,014	-12.92	2.8942	-12.92
1 - 2021	3,243,530	-20.99	1,098,363	-11.11	2.9531	-11.11
2 - 2021	3,440,273	-14.08	1,133,304	-7.31	3.0356	-7.31
PANEL C: REDUCTION ONLY IN THE NUMBER OF treatments						
Quarter	Total treatments	Δ% Total treatments	N. of individuals at least one treatment (2018-2019)	Δ% N. of individuals at least one treatment	Average n. of treatments	Δ% Average n. of treatments
1 - 2020	3,180,459	-22.53	1,235.676	0.00	2.5739	-22.53
2 - 2020	2,039,131	-49.08	1,222,666	0.00	1.6678	-49.08
3 - 2020	2,957,588	-10.66	1,053,557	0.00	2.8072	-10.66
4 - 2020	3,117,140	-24.18	1,236,879	0.00	2.5202	-24.18
1 - 2021	3,243,530	-20.99	1,235,676	0.00	2.6249	-20.99
2 - 2021	3,440,273	-14.08	1,222,666	0.00	2.8137	-14.08
PANEL D: REDUCTION ONLY IN THE NUMBER OF PEOPLE						
Quarter	Total treatments	Δ% Total treatments	N. of individuals at least one treatment (2018-2019)	Δ% N. of individuals at least one treatment	Average n. of treatments	Δ% Average n. of treatments
1 - 2020	3,180,459	-22.53	957,324	-22.53	3.3222	0.00
2 - 2020	2,039,131	-49.08	622,640	-49.08	3.2750	0.00
3 - 2020	2,957,588	-10.66	941,238	-10.66	3.1422	0.00
4 - 2020	3,117,140	-24.18	937,812	-24.18	3.3238	0.00
1 - 2021	3,243,530	-20.99	976,308	-20.99	3.3222	0.00
2 - 2021	3,440,273	-14.08	1,050,473	-14.08	3.2750	0.00

Significance: * p<.1, ** p<.05, *** p<.01. Robust standard errors in parentheses, clustered at the municipality level.

4.4 Cumulative Loss of Outpatient treatments

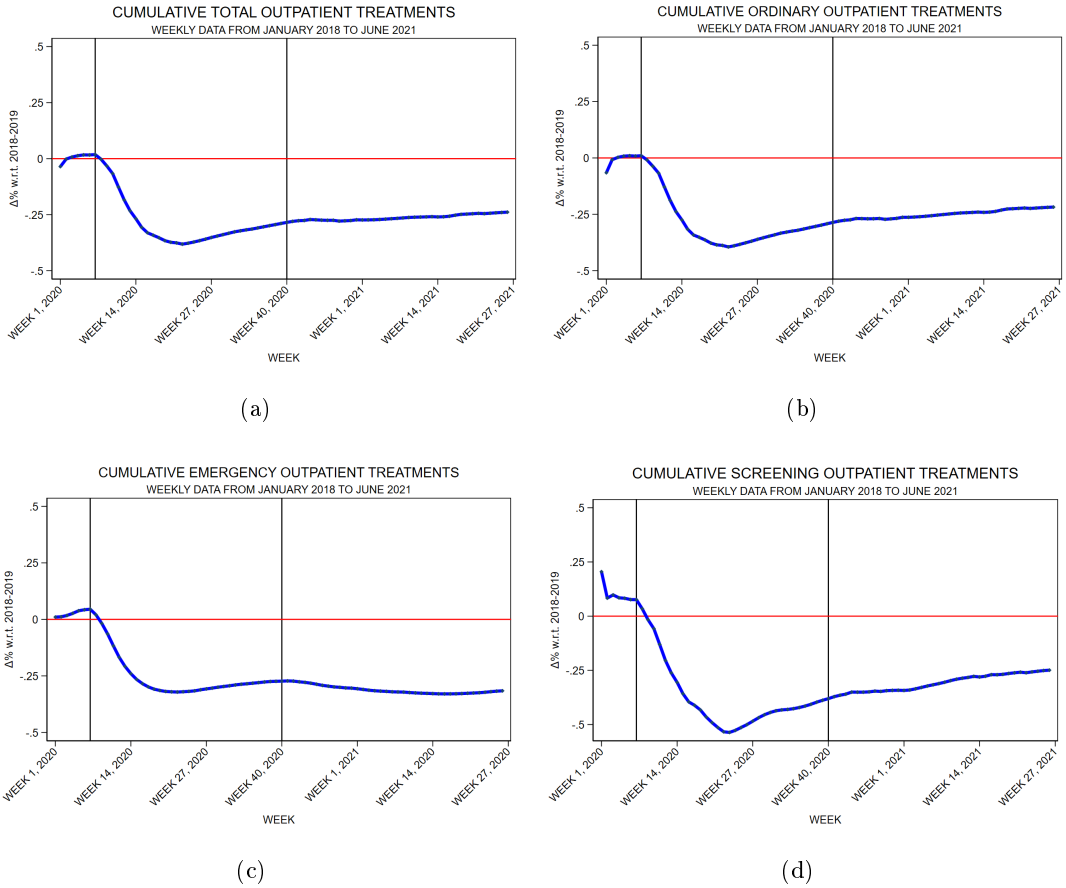
In this final section of the paper we explore the cumulative loss in outpatient care associated with the pandemic as well as the accumulated delay in the provision of these services.

We assess the extent of outpatient treatments lost during the pandemic comparing cumulative treatments provided between January 2020 and June 2021 on a weekly basis with the average weekly number of cumulative treatments provided in the years 2018 and 2019.[10]. The percentage change in cumulative outpatients for the period Jan2020-Jun2021 with respect to average cumulative treatments in the pre-pandemic years is plotted in Figure 4. All outpatient treatments - be they ordinary, emergency, or screening tests - show a consistent decline of approximately 25 percent in cumulative figures by mid-2021, confirming a lasting effect of Covid-19 on outpatient care and a persistent deviation from pre-pandemic figures. Using the same figures we are also able to evaluate the accumulated delay in the provision of outpatient treatments in "standard months", i.e. the number of months of activity that would be necessary to offset the delay if the volume of outpatients provided is comparable with the pre-pandemic period, i.e. the 2018-2019 average number of weekly outpatient treatments ((Mantellini et al., 2020)). The calculation involves a multiplication of the average percentage reduction in the volume of outpatients over a specific period, with the number of months in the time interval. On average, from January 2020 to June 2021 the accumulated delay is around 4.5 standard months. In other words, assuming that starting from June 2021 the provision of outpatient treatments follows a trajectory mirroring "normal times" — the average number of treatments provided in 2018-2019 —, it would take approximately 19 weeks to fully recover all the lost treatments. Alternatively, if we consider more optimistic scenarios where the provision of outpatient care is increased by 10 percent or 20 percent with respect to pre-pandemic levels, the recovery period shrinks approximately 18 and 16 weeks, respectively[11].

[10] Note that for the first 26 weeks of 2021 we keep the cumulative figures by adding the corresponding mean values from the years 2018 and 2019. This adjustment ensures a valid basis for comparison.

[11] These figures are calculated as the ratio between the total number of outpatient visits lost from January 2020 to June 2021 and the average weekly number of visits during the 2018-2019 years, increased by 10 and 20 percent.

Figure 4: Cumulative Outpatient treatments



5 Conclusions

The Covid-19 pandemic has left an indelible mark on global societies, reshaping various facets of daily life. In this paper, we show evidence of a negative and lasting impact of Covid-19 on the provision of outpatient care in the Italian provinces of Milan and Lodi. Using rich administrative data from the Agency for Health Protection of the Milan Metropolitan Area for the period January 2018 and June 2021 and a rigorous empirical strategy, we evaluate the indirect effects of the pandemic on the provision of outpatient treatments, also exploring potential mechanisms that can shape Covid-related patterns in outpatient care.

Our results show a large and persistent drop in outpatient care over the period of interest. The largest drop is observed for preventive care in the immediate aftermath of the pandemic, with a gradual recovery back to pre-pandemic levels around summer 2020, while the reduction in ordinary and emergency outpatients was only partially recovered over the summer, revealing an enduring effect of the pandemic on outpatient care. Such results are robust to the inclusion of excess mortality among the regressors and to a number of additional exercises to address possible concerns related with sample mortality as an alternative explanation to the persistent reduction in outpatient treatments. The overall reduction in outpatient care is found heterogeneous across age groups, diagnostic categories of treatments and chronic status of patients. The drop in ordinary and screening tests is mostly driven by patients aged 65 to 84, outpatient treatments belonging to Diagnostic Imaging and patients without chronic diseases.

When we disentangle the effect of exposure to Covid-19 from that of policy response to the pandemic, we find that mobility restrictions and SIP policies are significant predictors of the overall reduction in outpatient care, especially in the immediate aftermath of the Covid-19 outbreak. However, after the end of the national lockdown the overall reduction in outpatients is mostly attributable to the trajectory of the pandemic and, to some extent, also to supply-side factors.

Moreover, evidence on the intensive vs. extensive margin of Covid-induced variation in outpatients confirms that a relevant role is played by demand-side factors, as the overall reduction appears to be related with a decrease in the number of patients rather than a decrease in the intensity of outpatient care use.

Finally, a consistent decline of approximately 25 percent in cumulative outpatients is observed until the end of the period of interest and the accumulated delay in the provision of outpatient

care is estimated around 4.5 standard months, confirming a lasting effect of the pandemic.

Taken altogether, the above findings suggest that, beyond the disruption in healthcare provision on the supply-side, individuals postponed non-essential health care as a result of both fear of Covid-19 infection while in healthcare facilities and social distancing policies. Although such policy response has been proven effective in the containment of Covid-19 diffusion, our results suggest that it also bears some costs in terms of delayed or forgone care, which in turn might translate into higher costs for the NHS due to the detrimental health effects in the long run. Our findings have implications for the provision of health care, policy formulation, and resource allocation in the aftermath of the pandemic, shedding light on the complex dynamics of healthcare-seeking behavior in the context of unprecedented global public health challenges.

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Appendix

Table A1: Descriptive Statistics by Age Group

PANEL A: Under 14	Mean	SD	Max	Min
Total outpatient treatments	115.17	149.72	2,264	0
Ordinary outpatient treatments	89.16	119.84	1,987	0
Emergency outpatient treatments	26.01	35.59	426	0
Screening outpatient treatments	0.00	0.07	5	0
PANEL B: 15-24				
Total outpatient treatments	64.50	77.47	695	0
Ordinary outpatient treatments	47.14	58.79	538	0
Emergency outpatient treatments	17.36	23.12	271	0
Screening outpatient treatments	0.01	0.11	7	0
PANEL C: 25-34				
Total outpatient treatments	69.15	79.90	560	0
Ordinary outpatient treatments	46.49	54.59	380	0
Emergency outpatient treatments	22.39	29.18	355	0
Screening outpatient treatments	0.28	1.10	46	0
PANEL D: 35-49				
Total outpatient treatments	170.35	198.12	1,514	0
Ordinary outpatient treatments	126.11	149.01	1,189	0
Emergency outpatient treatments	42.16	53.38	559	0
Screening outpatient treatments	2.08	3.88	137	0
PANEL E: 50-64				
Total outpatient treatments	260.17	304.75	2,056	0
Ordinary outpatient treatments	206.76	246.50	1,663	0
Emergency outpatient treatments	44.00	55.61	639	0
Screening outpatient treatments	9.41	13.58	232	0
PANEL F: 65-84				
Total outpatient treatments	417.30	546.96	4,243	0
Ordinary outpatient treatments	350.10	470.55	3,724	0
Emergency outpatient treatments	62.88	85.67	1,081	0
Screening outpatient treatments	4.32	7.50	121	0
PANEL G: Over 85				
Total outpatient treatments	69.83	104.07	868	0
Ordinary outpatient treatments	48.07	75.74	669	0
Emergency outpatient treatments	21.76	34.28	365	0
Screening outpatient treatments	0.00	0.04	4	0

Table A2: Descriptive Statistics by diagnostic category (1)

PANEL A: Cardiology, Vascular Surgery, Angiology	Mean	SD	Max	Min
Total outpatient treatments	134,03	171,58	1.583	0
Ordinary outpatient treatments	120,23	156,86	1.436	0
Emergency outpatient treatments	13,79	17,02	166	0
Screening outpatient treatments	0,00	0,03	2	0
PANEL B: Diagnostic Imaging: Nuclear Medicine, Diagnostic Imaging: Radiology				
Total outpatient treatments	260,39	306,56	2.225	0
Ordinary outpatient treatments	198,46	238,00	1.664	0
Emergency outpatient treatments	48,46	55,99	425	0
Screening outpatient treatments	13,47	19,81	237	0
PANEL C: Cytology and Microbiology				
Total outpatient treatments	143,22	207,46	2.589	0
Ordinary outpatient treatments	75,02	104,14	1.661	0
Emergency outpatient treatments	67,04	128,68	1.948	0
Screening outpatient treatments	1,16	3,24	166	0
PANEL D: Neurosurgery, Neurology, Child Neuropsychiatry, and Psychiatry				
Total outpatient treatments	46,51	59,05	442	0
Ordinary outpatient treatments	43,53	55,89	426	0
Emergency outpatient treatments	2,98	3,95	34	0
Screening outpatient treatments	0,00	0,07	5	0
PANEL E: Pulmonology and Otorhinolaryngology				
Total outpatient treatments	62,90	81,35	681	0
Ordinary outpatient treatments	57,66	77,15	665	0
Emergency outpatient treatments	5,24	8,18	87	0
Screening outpatient treatments	0,00	0,03	3	0
PANEL F: Dermatology, Obstetrics, and Gynecology				
Total outpatient treatments	55,70	68,24	469	0
Ordinary outpatient treatments	50,06	61,74	424	0
Emergency outpatient treatments	5,64	7,90	68	0
Screening outpatient treatments	0,01	0,15	6	0
PANEL G: Anesthesia, General Surgery				
Total outpatient treatments	23,96	31,63	305	0
Ordinary outpatient treatments	19,11	25,44	237	0
Emergency outpatient treatments	4,77	8,47	102	0
Screening outpatient treatments	0,09	0,33	5	0

Table A3: Descriptive Statistics by diagnostic category (2)

PANEL H: Plastic Surgery, Dentistry, Maxillofacial Surgery	Mean	SD	Max	Min
Total outpatient treatments	26,40	41,26	437	0
Ordinary outpatient treatments	25,03	39,69	423	0
Emergency outpatient treatments	1,36	2,24	28	0
Screening outpatient treatments	0,00	0,01	2	0
PANEL I: Ophthalmology, Other Specialties				
Total outpatient treatments	231,44	286,69	2.510	0
Ordinary outpatient treatments	154,95	204,02	1.872	0
Emergency outpatient treatments	75,63	89,44	892	0
Screening outpatient treatments	0,86	3,02	163	0
PANEL L: Endocrinology				
Total outpatient treatments	24,29	32,76	318	0
Ordinary outpatient treatments	24,27	32,73	318	0
Emergency outpatient treatments	0,02	0,14	3	0
Screening outpatient treatments	0,00	0,01	1	0
PANEL M: Physical Medicine and Rehabilitation, Orthopedics and Traumatology				
Total outpatient treatments	83,56	111,10	922	0
Ordinary outpatient treatments	73,86	100,38	845	0
Emergency outpatient treatments	9,70	13,25	111	0
Screening outpatient treatments	0,00	0,02	1	0
PANEL N: Gastroenterology, Digestive Surgery and Endoscopy				
Total outpatient treatments	15,37	18,52	133	0
Ordinary outpatient treatments	14,72	17,93	131	0
Emergency outpatient treatments	0,15	0,46	7	0
Screening outpatient treatments	0,50	0,97	10	0
PANEL O: Oncology, Radiotherapy				
Total outpatient treatments	24,18	29,46	232	0
Ordinary outpatient treatments	24,01	29,26	230	0
Emergency outpatient treatments	0,17	0,49	9	0
Screening outpatient treatments	0,00	0,01	1	0
PANEL P: Nephrology, Urology				
Total outpatient treatments	34,56	47,37	562	0
Ordinary outpatient treatments	32,95	45,92	557	0
Emergency outpatient treatments	1,61	2,38	22	0
Screening outpatient treatments	0,00	0,00	0	0

Table A4: Descriptive Statistics by chronicity

PANEL A: No chronicity	Mean	S.D.	Max	Min
Total outpatient treatments	512.03	611.56	4,707	0
Ordinary outpatient treatments	373.43	457.23	3,625	0
Emergency outpatient treatments	130.50	159.59	1,325	0
Screening outpatient treatments	8.11	11.46	250	0
PANEL B: One Chronicity				
Total outpatient treatments	247.47	299.25	2,075	0
Ordinary outpatient treatments	200.56	247.96	1,779	0
Emergency outpatient treatments	42.21	54.11	577	0
Screening outpatient treatments	4.70	6.96	101	0
PANEL C: Two or more comorbidities				
Total outpatient treatments	406.97	524.25	4,077	0
Ordinary outpatient treatments	339.84	447.57	3,497	0
Emergency outpatient treatments	63.85	86.52	1,113	0
Screening outpatient treatments	3.28	5.25	76	0

Table A5: Outpatient treatments by age group

PANEL A	Total outpatient treatments		Ordinary outpatient treatments	
	N	**%**	**N**	**%**
Under 14	4,842,031	9.87	3,748,623	9.76
15-24	2,711,818	5.53	1,981,879	5.16
25-34	2,907,261	5.93	1,954,302	5.09
35-49	7,161,942	14.60	5,302,092	13.80
50-64	10,937,987	22.30	8,692,577	22.63
65-84	17,544,013	35.77	14,718,935	38.31
Over 85	2,935,903	5.99	2,020,863	5.26
Total	**49,040,955**	**100.00**	**38,419,271**	**100.00**
PANEL B	Emergency outpatient treatments		Screening tests	
Under 14	1,093,332	10.99	76	0.01
15-24	729,729	7.34	210	0.03
25-34	941,156	9.46	11,803	1.75
35-49	1,772,592	17.82	87,258	12.90
50-64	1,849,993	18.60	395,417	58.46
65-84	2,643,507	26.58	181,571	26.84
Over 85	914,996	9.20	44	0.01
Total	**9,945,305**	**100.00**	**676,379**	**100.00**

Table A6: Outpatient visits by diagnostic category

PANEL A

	Total outpatient treatments		Ordinary outpatient treatments	
	N	**%**	**N**	**%**
Cardiology, Vascular Surgery, Angiology	5,634,776	11.49	5,054,809	13.16
Diagnostic Imaging	10,947,221	22,32	8,343,627	21.72
Cytology and Microbiology	6,021,232	12.28	3,153,811	8,21
Neurosurgery, Neurology, Child Neuropsychiatry and Psychiatry	1,955,288	3.99	1,829,991	4.76
Pulmonology and Otorhinolaryngology	2,644,404	5.39	2,424,183	6.31
Dermatology, Obstetrics and Gynecology	2,341,765	4.78	2,104,409	5.48
Anesthesia, General Surgery	1,007,324	2.05	803,264	2.09
Plastic Surgery, Dentistry and Maxillofacial Surgery	1,109,832	2.26	1,052,494	2.74
Ophthalmology, Other Specialties	9,729,997	19.84	6,514,410	16.96
Endocrinology	1,020,988	2.08	1,020,260	2.66
Physical Medicine and Rehabilitation, Orthopedics and Traumatology	3,512,877	7.16	3,105,071	8.08
Gastroenterology, Digestive Surgery and Endoscopy	646,044	1.32	618,641	1.61
Oncology, Radiotherapy	1,016,444	2.07	1,009,217	2.63
Nephrology, Urology	1,452,763	2.96	1,385,084	3.61
Total	**49,040,955**	**100.00**	**38,419,271**	**100.00**

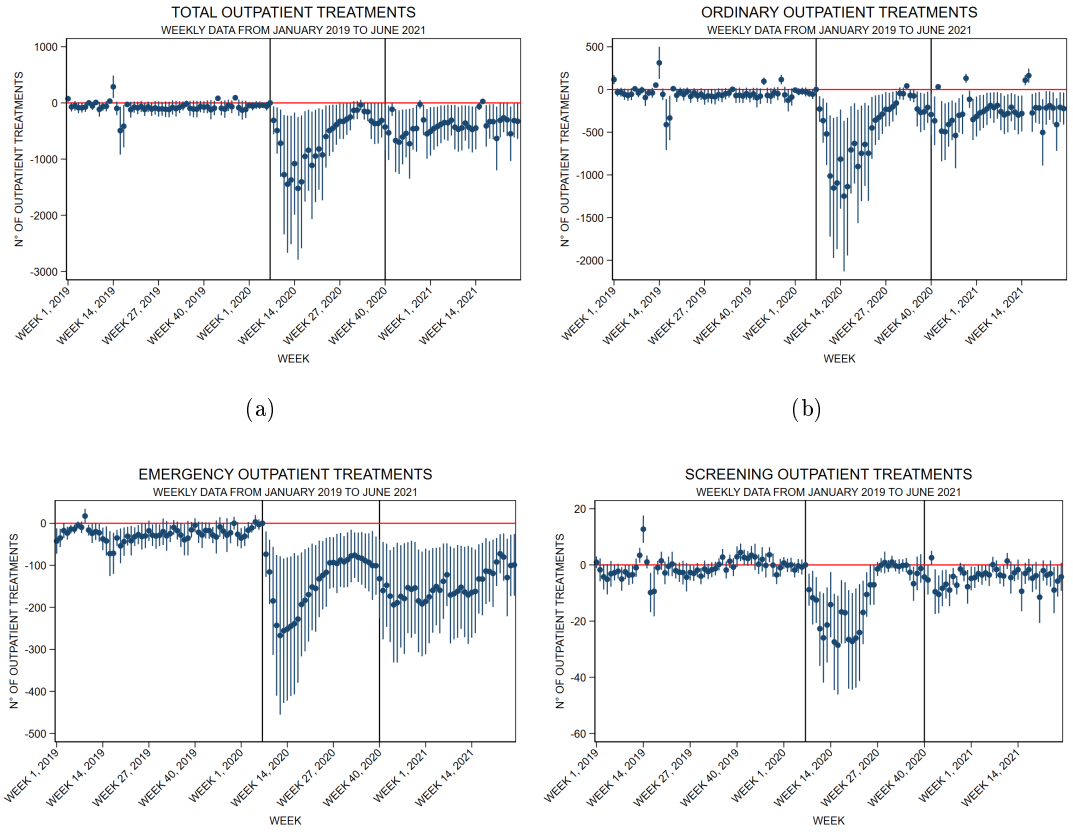
PANEL B

	Total outpatient treatments		Ordinary outpatient treatments	
Cardiology, Vascular Surgery, Angiology	579,933	5.83	34	0.01
Diagnostic Imaging	2,037,433	20.49	566,161	83.70
Cytology and Microbiology	2,818,477	28.34	48,944	7.24
Neurosurgery, Neurology, Child Neuropsychiatry and Psychiatry	125,209	1.26	88	0.01
Pulmonology and Otorhinolaryngology	220,205	2.21	16	0.00
Dermatology, Obstetrics and Gynecology	236,887	2.38	469	0.07
Anesthesia, General Surgery	200,438	2.02	3,622	0.54
Plastic Surgery, Dentistry, Maxillofacial Surgery	57,334	0.58	4	0.00
Ophthalmology, Other Specialties	3,179,638	31.97	35,949	5.31
Endocrinology	726	0.01	2	0.00
Physical Medicine and Rehabilitation, Orthopedics and Traumatology	407,789	4.10	17	0.00
Gastroenterology, Digestive Surgery and Endoscopy	6,337	0.06	21,066	3.11
Oncology, Radiotherapy	7,220	0.07	7	0.00
Nephrology, Urology	67,679	0.68	0	0.00
Total	**9,945,305**	**100.00**	**676,379**	**100.00**

Table A7: Outpatient treatments by chronicity

PANEL A	Total outpatient treatments		Ordinary outpatient treatments	
	N	**%**	**N**	**%**
No chronicity	21,526,900	43.90	15,699,678	40.86
1 chronicity	10,404,144	21.22	8,432,043	21.95
2+ chronicities	17,109,911	34.89	14,287,550	37.19
Total	**49,040,955**	**100.00**	**38,419,271**	**100.00**
PANEL B	Emergency outpatient treatments		Screening tests	
No chronicity	5,486,270	55.16	340,952	50.41
1 chronicity	1,774,610	17.84	197,491	29.20
2+ chronicities	2,684,425	26.99	137,936	20.39
Total	**9,945,305**	**100.00**	**676,379**	**100.00**

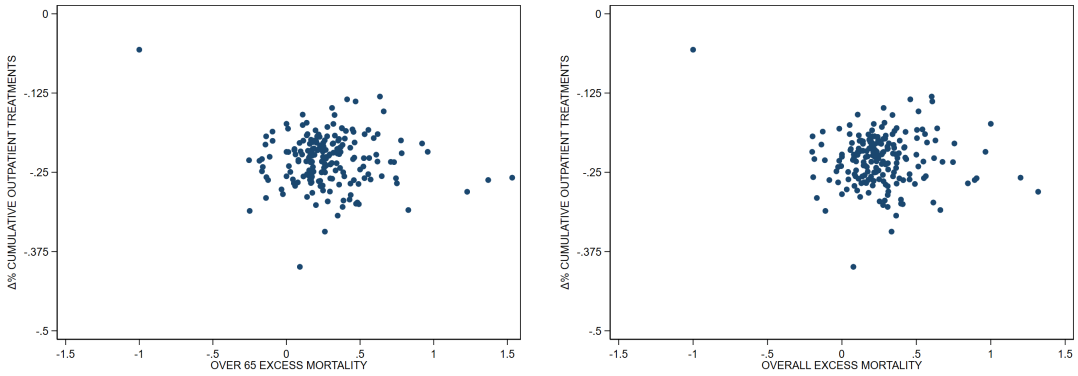
Figure A1: Event study analysis (with excess mortality)



(a) (b)

(c) (d)

Figure A2: Excess Mortality and Cumulative Outpatient Visits

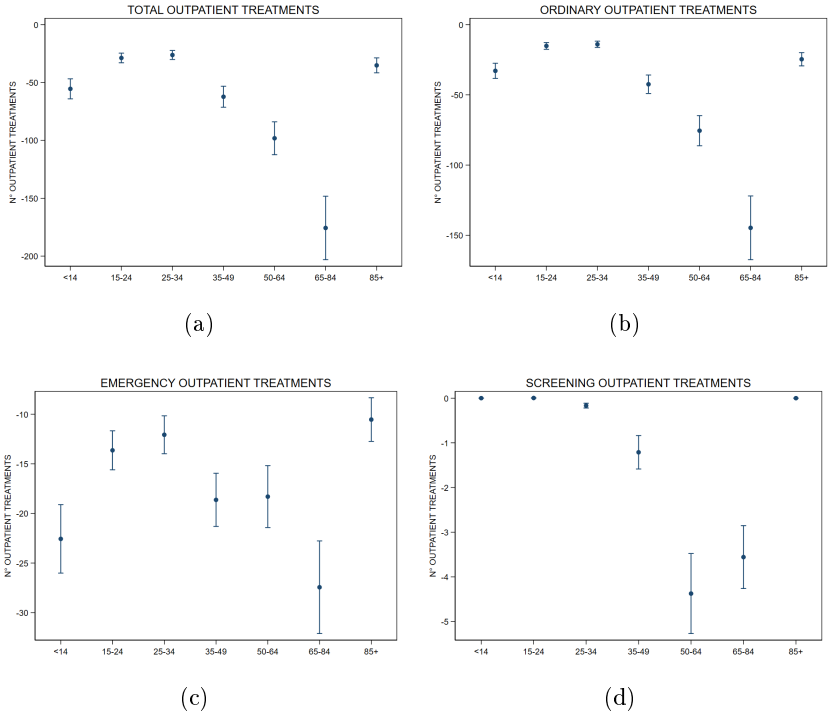


(a) (b)

Table A8: Hypothetical scenarios

Deaths	**Average outpatient treatments per semester**		
	Equal to 2018-2019 average	75% of 2018-2019 average	50% of 2018-2019 average
Individuals not observed in the S1-2021 (418,389)	418,389 · 3.76 = 4,716,287 (83.46%)	418,389 · 2.82 = 3,537,215 (62.59%)	418,389 · 1.88 = 2,358,143 (41.37%)
Individuals not observed in S2-2020 and S1-2021 (236,924)	236,924 · 3.76 = 2,675,615 (47.35%)	236,924 · 2.82 = 2,006,711 (35.51%)	236,924 · 1.88 = 1,337,808 (23.67%)
Individuals not observed in S1-2020, S2-2020 and S1-2021 (153,779)	153,779 · 3.56 = 1,643,744 (29.09%)	153,779 · 2.67 = 1,232,808 (21.82%)	153,779 · 1.78 = 821,872 (14.54%)

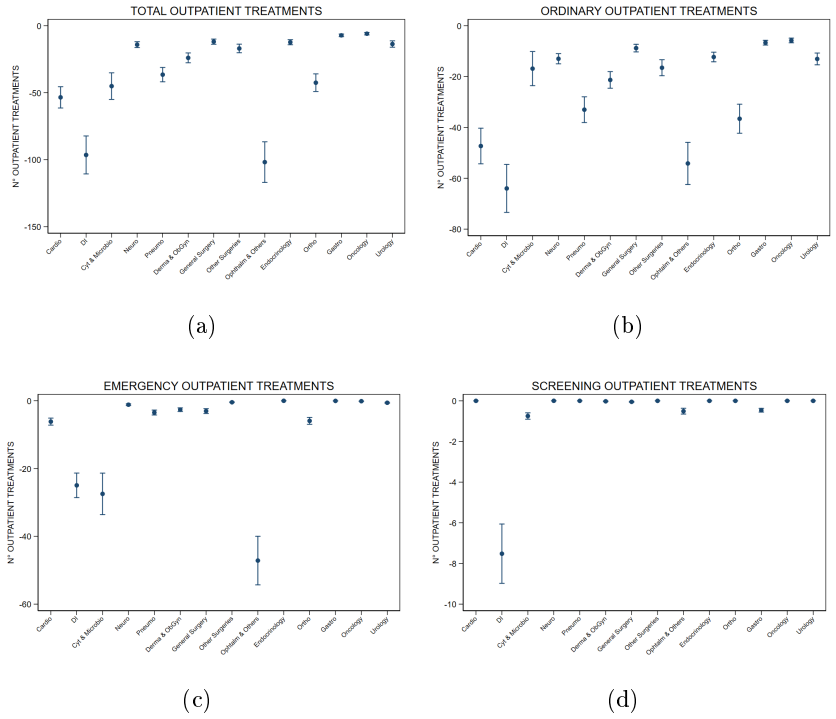
Figure A3: Heterogeneity by age group



(a) (b)

(c) (d)

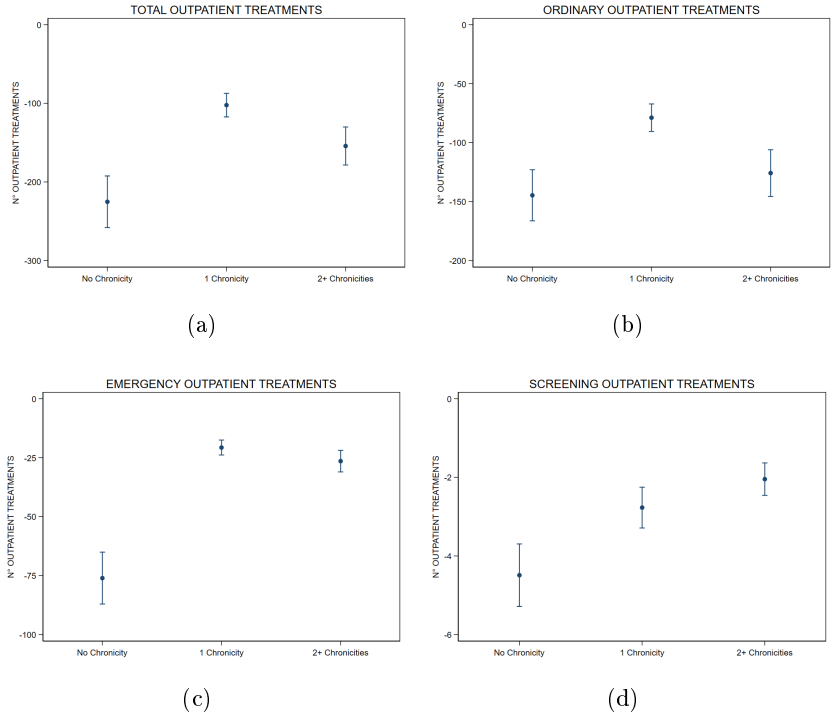
Figure A4: Heterogeneity by diagnostic category



(a) (b)

(c) (d)

Figure A5: Heterogeneity by chronic status of patients



(a) (b)

(c) (d)