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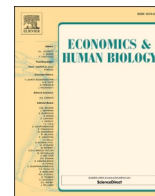
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# How did unmet care needs during the pandemic affect health outcomes of older European individuals?

Julien Bergeot<sup>a,\*</sup>, Florence Jusot<sup>b</sup>

<sup>a</sup> Department of Economics, Ca' Foscari University of Venice, San Giobbe, Cannaregio 873, Venice 30121, Italy

<sup>b</sup> LEDA, CNRS, Université Paris-Dauphine, Université PSL, Paris 75016, France

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## ABSTRACT

The first wave of the COVID-19 pandemic left many people with unmet health care needs, which could have detrimental effects on their health. This paper examines the effects of these unmet needs during the first wave of the pandemic on health outcomes one year later. We combine two waves of the SHARE survey collected during the COVID-19 pandemic (in June/July 2020 and 2021), as well as four waves collected before the pandemic. Our health outcomes are four dummy variables: fatigue, falling, fear of falling and dizziness/faints/blackouts issues. Finally, we use OLS regression with individual and time fixed effects for our difference-in-difference analysis, as well as a doubly robust estimator to condition the parallel trend assumption on pre-pandemic covariates. We find substantial effects of having had unmet healthcare needs during 2020 on the probability of having trouble with fatigue and fear of falling one year later. We particularly find strong effects for general practitioner (GP) and specialist care, and in lower extent of physiotherapist, psychotherapist, and rehabilitation care.

## 1. Introduction

The first wave of the COVID-19 outbreak led to substantial unmet care needs, whose determinants are now well documented (Anderson et al., 2021; Arnault et al., 2021; Davillas and Jones, 2021; González-Touya et al., 2021; Kim et al., 2021; Akobirshoev et al., 2022; Jung et al., 2022; Tavares, 2022; Khattar et al., 2023; Kim and Hwang, 2023; Legge et al., 2023). However, there is still little evidence on the impact of unmet healthcare needs or care restrictions on health occurring during the pandemic, despite their potentially detrimental health effects in the medium to long term, especially for older individuals (Chen and McGeorge, 2020; De Jong et al., 2021). In this paper, we use the COVID-19 pandemic as a natural experiment that led a huge decrease in access to healthcare services to estimate the effect of healthcare use on health outcomes. More precisely, we assess the effect of unmet care needs during the first wave of the COVID-19 pandemic on the health of elderly European individuals and their deterioration one year later.

There is little direct evidence to suggest that, before the Covid-19 pandemic, self-reported unmet health care needs increase the probability of declining health later (Dourgnon et al., 2012; Ko, 2016; Gibson et al., 2019) as well as mortality (Alonso et al., 1997; Zhen et al., 2015,

Lindström et al., 2020), especially for older individuals (Lindström et al., 2020). There is also indirect evidence that health care consumption can result in better health. Finkelstein et al. (2012) find that access to health insurance increases healthcare consumption, which then translates into an improvement in health outcomes. Similar results have been reported by Goldin et al. (2021), who find that an increase in health insurance coverage due to a randomized outreach study resulted in reduced mortality among middle-aged adults. Other papers suggest that improved access to health care at different stages of life due to access to health insurance has beneficial health effects in the short and long term (Card et al., 2009; Goodman-Bacon, 2021). Kim et al. (2019) investigate the association between income and poor health. They find that having unmet care needs is an important mediator explaining the association between low income and poor health: poorer individuals are more likely to have a lower access to health care, which translates into a poorer health. Finally, there is some evidence suggesting that longer waiting times can negatively affect patient outcomes (Moscelli et al., 2016; Reichert and Jacobs, 2018). The literature on waiting times is of particular interest given that many care treatments or appointments have been postponed during the first wave of the COVID-19 pandemic (Arnault et al., 2021), which can be considered to reflect an increase in the duration of waiting times.

\* Corresponding author.

E-mail address: [jul.bergeot@unive.it](mailto:jul.bergeot@unive.it) (J. Bergeot).

Related literature exists on the consequences of the COVID-19 pandemic on health outcomes. There are studies exploring the effect of the pressure induced by the pandemic on hospitals on the quality of healthcare delivered by hospitals. [Fetzer and Rauh \(2022\)](#) find that the pressure on hospitals induced, for non-COVID-19 patients, longer waiting times, in particular, a longer time to diagnosis, fewer people seeking care, a longer time to specialist visits for cancer patients, and a longer time to the first visit for urgent treatment due to cancer. Finally, they report an increase in hospitals' excess mortality. They also document that these results are induced by the increase in COVID-19 admissions and an increased staff absence due to infections. Overall, these results highlight a reduction in the quality of healthcare provided in hospitals, which resulted in more deaths among non-COVID-19 patients. It should also be noted that their results related to cancer are in line with more extensive literature on outcomes for cancer patients ([Richards et al., 2020](#); [Macmillan Cancer Support, 2020](#)) and patients with cardiovascular diseases ([Banerjee et al., 2021](#)). Finally, [Quintal et al. \(2023\)](#) estimate logistic regressions to explore the association between unmet care needs during the first wave of the pandemic on health outcome one year later. They particularly focus on self-assessed health, mortality and cancer transitions between the first and the second waves of SHARE Covid. They find a positive association for having any unmet need on the probability of having a diagnosis of cancer. They also find a negative association for mortality.

This paper studies the effect of self-reported unmet health care needs on health outcomes in the Covid-19 pandemic context in Europe. We explore the effect of self-declared unmet needs during the first wave, i.e. between March and June/July 2020, of the pandemic on health outcomes one year later (in June/July 2021). Such self-declared unmet needs have been shown to represent a "meaningful measure of barriers to access" ([Gibson et al., 2019](#)) and are well suited to capture the reduced access to care induced by the pandemic. We analyse several waves of the longitudinal SHARE survey. First, we use the first wave of the SHARE Corona survey, conducted in June and July 2020 and interviewing individuals who participated to SHARE before the pandemic, to identify which individuals have had unmet health care needs during the first wave of the pandemic, as well the type of care needed (GP, specialist, planned care, physiotherapist/psychotherapist/rehabilitation care) and the motives of unmet needs (foregone care because of fear of Covid-19 infection, because medical treatment was postponed, because medical treatment was denied). Second, to explore how health evolved with respect to the initial health trajectory the individual had before experiencing unmet needs, we use waves 5–8 of the regular SHARE survey that were conducted before the COVID-19 outbreak.<sup>1</sup> Finally, we use the second wave of the SHARE Corona survey to obtain health outcomes one year later (June/July 2021). Concerning the health outcomes, we use variables available in all included waves: having issues with fatigue, the fear of falling, falling down and dizziness/faints/blackouts. The methodology we use is a difference-in-difference approach, in which individuals who have had unmet needs in 2020 are the treated group and those who did not have any unmet needs in 2020 are the control group. We particularly use a two-way fixed effects estimator and a doubly robust estimator to condition the parallel trend assumption on observed characteristics ([Callaway and Sant'Anna, 2021](#); [Sant'Anna and Zhao, 2020](#)).

Our results suggest that unmet care needs during the first wave of the pandemic have had significant adverse effects on health outcomes. Postponing care, but also forgoing care due to fear of Covid-19 infection, particularly increase the probability of health problems one year after. Fatigue and fear of falling are the most affected health outcomes by unmet needs, while there is not effects on dizziness issues. We also observe that unmet GP care mainly affects the probability of having trouble with fatigue and fear of falling, although unmet specialist care

also has adverse effects on falls. We also observe some health effects of unmet needs for physiotherapists/psychotherapists/rehabilitation care and planned treatments. Altogether, these results suggest that the shortage of health care during the first wave of the pandemic, and unmet health care needs in general, may have mid-term effects on the occurrence of medical symptoms and can accelerate the process of frailty for old age individuals as well as their entry into a health state with loss of autonomy. Our results appear to hold regardless of the reason for unmet needs, except for denied care for which we obtained unprecise estimates, and regardless of whether the unmet needs are due to supply (because care was postponed) or demand effects (because individuals were afraid of becoming infected).

The contributions of the paper can be summarized as follows. We contribute to the literature on both the effects of unmet health care needs on health outcomes and on the consequence of the COVID-19 pandemic on individuals' health through the reduction in healthcare provision it induced. With respect to the literature about COVID-19, we provide new evidence regarding the consequences of the deterioration in health care access outside of hospital settings. Our results highlight the importance of maintaining the healthcare system to avoid lasting detrimental consequences for older individuals. Given the one-year effects on individuals who have had unmet needs because they were afraid of being infected, maintaining trust in the healthcare system is important to avoid deterioration of the health of older individuals. More generally, our results suggest that ensuring access to health care services for older individuals is a major issue to slow down the depreciation of the health capital.

## 2. Data

This study is based on the Survey of Health, Aging and Retirement in Europe (SHARE) which is a longitudinal multidisciplinary database of micro-data on health, socioeconomic status, and intergenerational transfers on individuals aged 50 or more, and conducted in 28 European countries ([Börsch-Supan et al., 2013](#)).

We firstly use the first and second waves of the SHARE Corona survey ([Börsch-Supan et al., 2022e and 2022f](#)). These are special surveys conducted by phone for people who previously participated to the Survey of Health, Aging and Retirement in Europe (SHARE) to study the consequences of the coronavirus on elderly European people. The first wave of the Corona survey was conducted in June and July 2020 and collected information on unmet needs since the beginning of the pandemic, while the second wave was conducted one year later (in June and July 2021). To compare the health of individuals before and after the first wave of the pandemic for both those who had unmet needs during this period (treated group thereafter) and those who did not (control group thereafter), we use the waves 5–8 of the regular SHARE survey, which were conducted before the COVID-19 outbreak to control for previous health trajectory. These last surveys were collected from January to December 2013 for wave 5, from January to December 2015 for wave 6, from March to November 2017 for wave 7 and from October 2019 to March 2020 for wave 8 ([Börsch-Supan et al., 2022a, 2022b, 2022c, 2022d, 2022e, 2020f](#)).

The sample consists of 28,884 individuals who participated to the first and second waves of the SHARE Corona survey, as well as the waves 8 of the regular SHARE survey. Individuals who had unmet health care needs for the first time during the second wave of the SHARE Corona survey (N = 2320) were dropped. Individuals who participated to the wave 8 in March 2020 (N = 2063) were excluded to avoid having individuals whose outcomes were already affected by the pandemic. We don't restrict the sample to individuals who also participated to the wave 5, 6 and 7 for statistical power issues. Our sample consists in a balanced panel for the waves 8 to Corona 2, but is unbalanced for the waves 5 and 7. Finally, to identify a causal effect, the ideal experiment would be to compare two group individuals: those with care needs who were met and those with unmet care needs. Unfortunately, we cannot

<sup>1</sup> The timeline between the survey is presented in Figure A1, in the appendix.

**Table 1**  
Descriptive statistics for unmet needs.

	All groups	
	% of full sample	N
Total sample	100	14,786
No unmet needs	64.6	9556
Unmet needs	35.4	5230
<i>By reason</i>		
Because afraid	12.1	1787
Postponed	26.4	3899
Denied	4.7	688
<i>GP care</i>		
All	8.6	1275
Because afraid	4.4	647
Postponed	4.3	639
Denied	1.2	170
<i>Specialist care</i>		
All	26.2	3867
Because afraid	7.9	1165
Postponed	20.4	3013
Denied	3.0	446
<i>Planned care</i>		
All	3.35	496
Because afraid	0.9	128
Postponed	2.7	399
Denied	0.3	43
<i>Physiotherapist/Psychologist/Rehabilitation care</i>		
All	3.01	448
Because afraid	0.9	135
Postponed	0.3	336
Denied	1.4	38

Data: SHARE Corona Survey 1.

Note: The sample is composed of individuals observed in first and second waves of the SHARE Corona survey, as well as waves 8 of the regular SHARE survey. Individuals who have had unmet health care needs for the first time during the second wave of the SHARE Corona survey are excluded. We also exclude individuals with an excellent and a very good health in wave 8.

identify in the data those with care needs who were met. To circumvent this issue, we drop individuals who reported in wave 8 (i.e before the pandemic) having an excellent or a very good health who are less likely to have care needs. This leaves us with a final sample of 14,786 individuals.

### 2.1. Outcomes

We use different health variables that are available, and with the same wording, in all the different waves we use for the analysis. Our main outcome variables are measured with the following questions:

*For the past six months at least, have you been bothered by any of the following health conditions? Please answer yes or no:*

1. *Falling down*
2. *Fear of falling down*
3. *Dizziness, faints or blackouts*
4. *Fatigue.*

Therefore, the four binary outcomes are equal to one if the individual responded “yes” for the given health outcome and 0 otherwise. One should note that the different variables do not capture the same dimensions of health. The first two variables (falling down and the fear of falling) are determinants of the loss of autonomy and can have long-term impacts on it (Fransé et al., 2017); dizziness/faints/blackouts are medical symptoms (Romero-Ortuno and Soraghan, 2014), while the last variable (fatigue) is a determinant of individuals’ frailty (Fried et al., 2001). Additionally, note that later in the paper, we abbreviate “dizziness, faints or blackouts” to “dizziness”.

Although these outcomes are largely used in the literature, they have not yet been explored in the literature on the health consequences of

unmet needs. Nevertheless, we believe they capture important dimensions of health capital.

Studying the same outcomes as in the literature is difficult when using the panel dimension of SHARE. Many variables capturing health outcomes, such as quality of life scale, are not asked in the Corona surveys. When questions are available, the questions were sometimes asked in a way that prevents comparability throughout time or a panel analysis. Particularly, the question on self-assessed health has been asked in a different manner in the first wave of the Corona survey. Finally, mortality during the pandemic – that studied in exiting studies - cannot be measured with SHARE yet because the end-of-life interviews from the wave 9 are not available yet.

Our main outcomes of interests are those measured in the wave 2 of the SHARE Corona survey, i.e in 2021 or one year after the report of unmet needs during the first wave of the pandemic (measured in the wave 1 of the Corona survey). We do not interpret the estimated effects on health outcomes measured in the first wave of the Corona survey due to a potential simultaneity bias. Indeed, both health outcomes refers to issues that occurred during the last six months, which means that they can have appeared before the reported unmet needs. They could even have been the cause of the needs of care that were unmet later.

### 2.2. Main variables

Our main variable of interest is whether the individuals reported in June and July 2020 they have had unmet care needs since the outbreak of Corona. We will refer to this period as “the first wave of the pandemic”. Three different questions were asked in the first wave of the SHARE Corona survey. Individuals were first asked if they “*forgo some medical treatment because they were afraid of being infected by the coronavirus since the outbreak of Corona*”. Then, they were asked if they “*had a medical appointment scheduled, which the doctor or medical facility decided to postpone due to the coronavirus*”. Finally, they were asked if they “*asked for an appointment for a medical treatment since the outbreak of Corona but did not get one*”. For this latter, we refer to it as denied care. For each of these three questions, the participants could respond “yes” or “no”. We construct four different variables: one binary variable equal to one if the individual responded “yes” to each of the three questions to explore the effect of the three different reasons for unmet health care and one binary variable equal to one if the individual responded “yes” to at least one of the three questions. This last variable captures the effect of having at least one unmet health care need during the first wave of the pandemic. For the first three variables, we refer to them later in the paper as the reasons for forgoing care.

One should note that self-assessed unmet care needs can be criticized because of their subjectivity. In our context, we might think that postponed care is to some extent less subjective and capture unmet needs that have been validated by the health system prior to be postponed. This is particularly true for specialist care for which an appointment is often asked after an appointment with a care professional who recommended to consult a specialist, or as follow up.

To deepen the analysis, for each reason why individuals had unmet needs, people were asked about the type of care they needed. More precisely, individuals could indicate if they forgo due to fear to be infected, have been denied or have postponed i) GP care, ii) specialist care (including dentist), iii) a planned medical treatment (including surgical operation), iv) physiotherapy/psychotherapy/rehabilitation care or v) another type of medical treatment. To explore the effect of unmet needs by the type of care that has been forgone, we construct four dummy variables, which were equal to one if the individual declares having unmet needs for each type of care, irrespective of the reason, and zero otherwise. Note that we did not construct a variable for the category corresponding to “other care” because given the difficulties of interpretation.

Descriptive statistics are provided in Table 1. We can see that our sample consists of 14,786 individuals (observed during four periods),

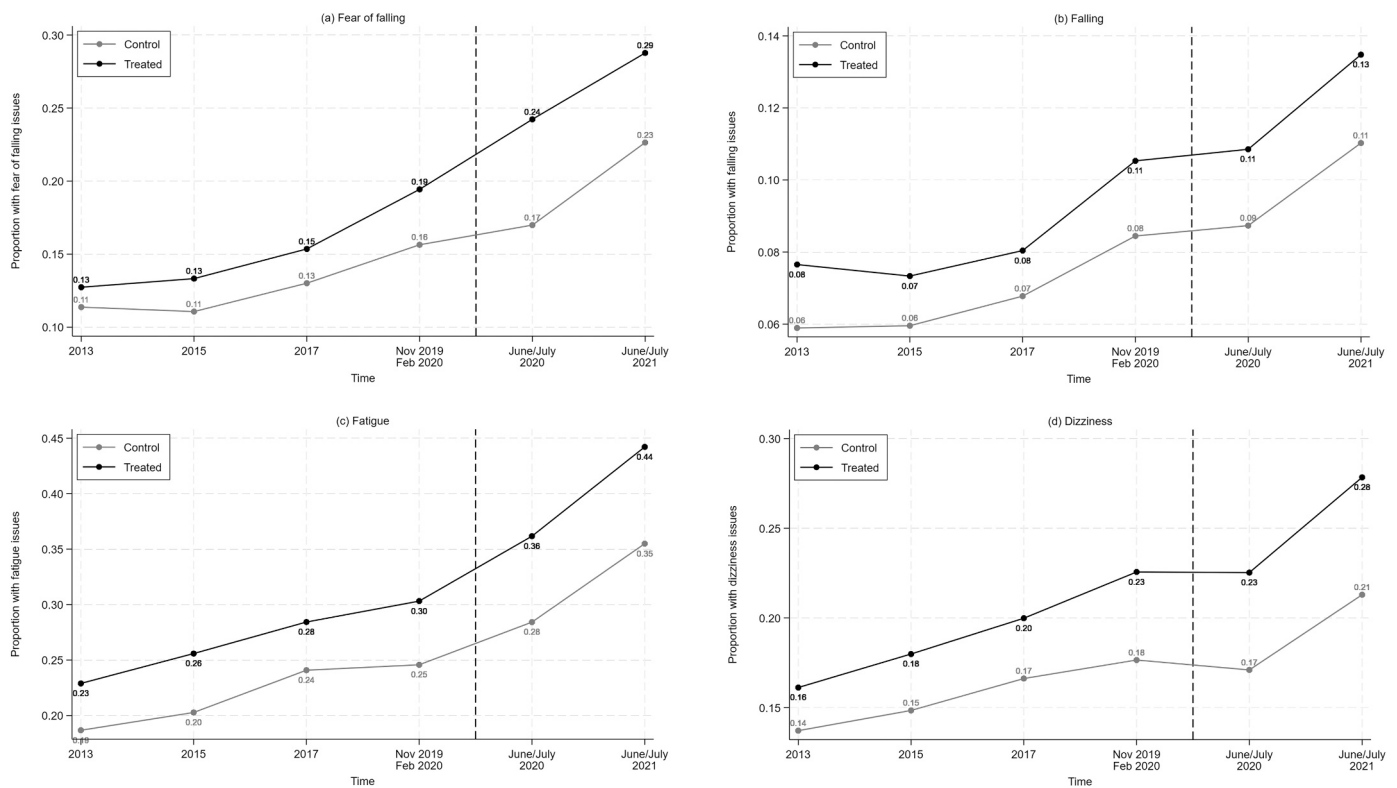


Fig. 1. Evolution of the mean health outcomes over time for treated and untreated individuals. Note: This graph shows the evolution over time of the proportion of individuals with issues with each health outcome in the treated population (i.e., individuals who have had at least one unmet care need during the first wave of the pandemic) and in the control population (i.e., individuals who did not have any unmet care needs). The sample is composed of individuals observed in the first and second waves of the SHARE Corona survey, as well as wave 8 of the regular SHARE survey. Sample is restricted to observations who did not declare excellent or very good health in wave 8.

Table 2  
Descriptive Statistics - Observed characteristics.

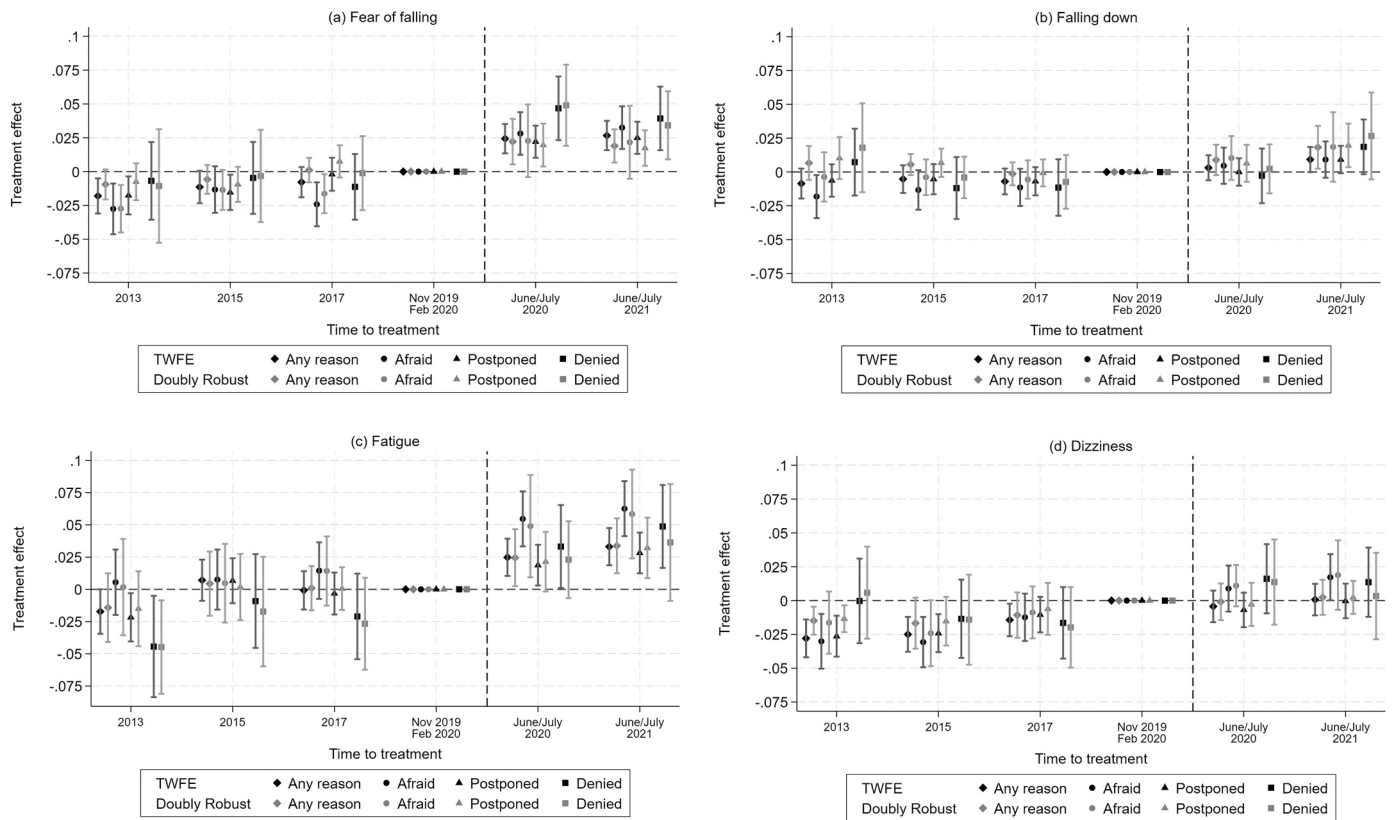
	Without unmet needs	With unmet needs	Test of difference
Age	67.9	68.5	0.000
Nb specialist visits			
0	50.5	28.6	0.000
[1;2]	31.4	35.2	0.000
[3;5]	12.4	22.6	0.000
≥6	5.7	13.6	0.000
Nb generalist visits			
0	22.1	11.7	0.000
[1;2]	38.7	36.6	0.000
[3;5]	27.1	34.7	0.000
≥ 6	12.1	16.9	0.000
Any dentist visit	55.9	71.2	0.000
Forgone care due to lack of availability	4.9	5.7	0.036
Forgone care for financial reasons	3.7	4.7	0.003
Health			
Good	62.4	68.4	0.000
Fair	27.6	25.3	0.002
Poor	10.0	6.3	0.000
Has a chronic condition	74.3	86.3	0.000
Is a woman	54.9	61.0	0.000
Education			
Lower secondary or less	28.3	24.1	0.000
Higher secondary	40.8	39.7	0.199
Higher than secondary	30.9	36.2	0.000
Difficulty to make ends meet	39.9	35.8	0.000

Data: SHARE, wave 8.

with 5230 individuals (i.e., 35% of the sample) who had unmet needs. Thus, many individuals had unmet needs during the first wave of the pandemic, which is in line with the huge reduction in medical treatment during the first wave of the pandemic (Arnault et al., 2021). Another important observation is that if we look at the different reasons for unmet needs, the first is postponed medical treatments (26% of the sample), followed by fear of the coronavirus (12%), and then the denial of a medical treatment or an appointment when attempting to schedule one. Note that the proportion of individuals providing the last reason is potentially smaller due to reasons related to selection; if individuals did not try to make an appointment because they were afraid or because they knew they would not be able to obtain one, they would not report having a medical appointment denied. Note also that not all proportions summed to one because individuals could respond that they have had unmet needs for different reasons and were not constrained to one choice. When we decompose by type of care, we can see that most unmet needs correspond to GP and specialist care, who, respectively represent 9% and 26% of the sample. The control group we use in all regressions corresponds to the remaining 9556 individuals who did not have unmet needs.

### 2.3. Methodology

To explore the effect of unmet needs on health, we use a difference-in-difference methodology with having unmet needs during the first wave of the pandemic as the treatment variable. The control group consists of individuals who did not have any unmet needs during the first wave of the pandemic. Note that the treatment occurs at the same time for everyone in the sample since we focus on the effect of having unmet needs during the first wave of the pandemic. We allow unmet needs to



**Fig. 2.** Effect of any unmet needs on health outcomes by reason. Note: The sample is composed of individuals observed during the first and second waves of the SHARE Corona survey, as well as wave 8 of the regular SHARE survey. Sample is restricted to observations who did not declare excellent or very good health in wave 8. See Table B.1, B.2, B.3 and B.4 for the sample size, the standard errors and the p values for each coefficient of each regression. Bootstrapped standard errors with 100 replications clustered at the country level. Vertical lines are 95% confidence intervals.

have a dynamic effect on health up to one year after the first beginning of the pandemic. We estimate the associations as well between unmet needs during the first wave of the pandemic and all health outcomes measured in the first wave of the Corona survey. However, as our health outcomes refer to health problems occurring during the last 6 months, we don't interpret them causally. Indeed, those associations may be affected by a reverse causality bias, health problems occurring during between January and June 2020 may have generated healthcare appointments that have had been forgone, postponed or denied.

Following the recommendations from Roth et al. (2022), we first estimate the two-way fixed effects (TWFE hereafter) regression:

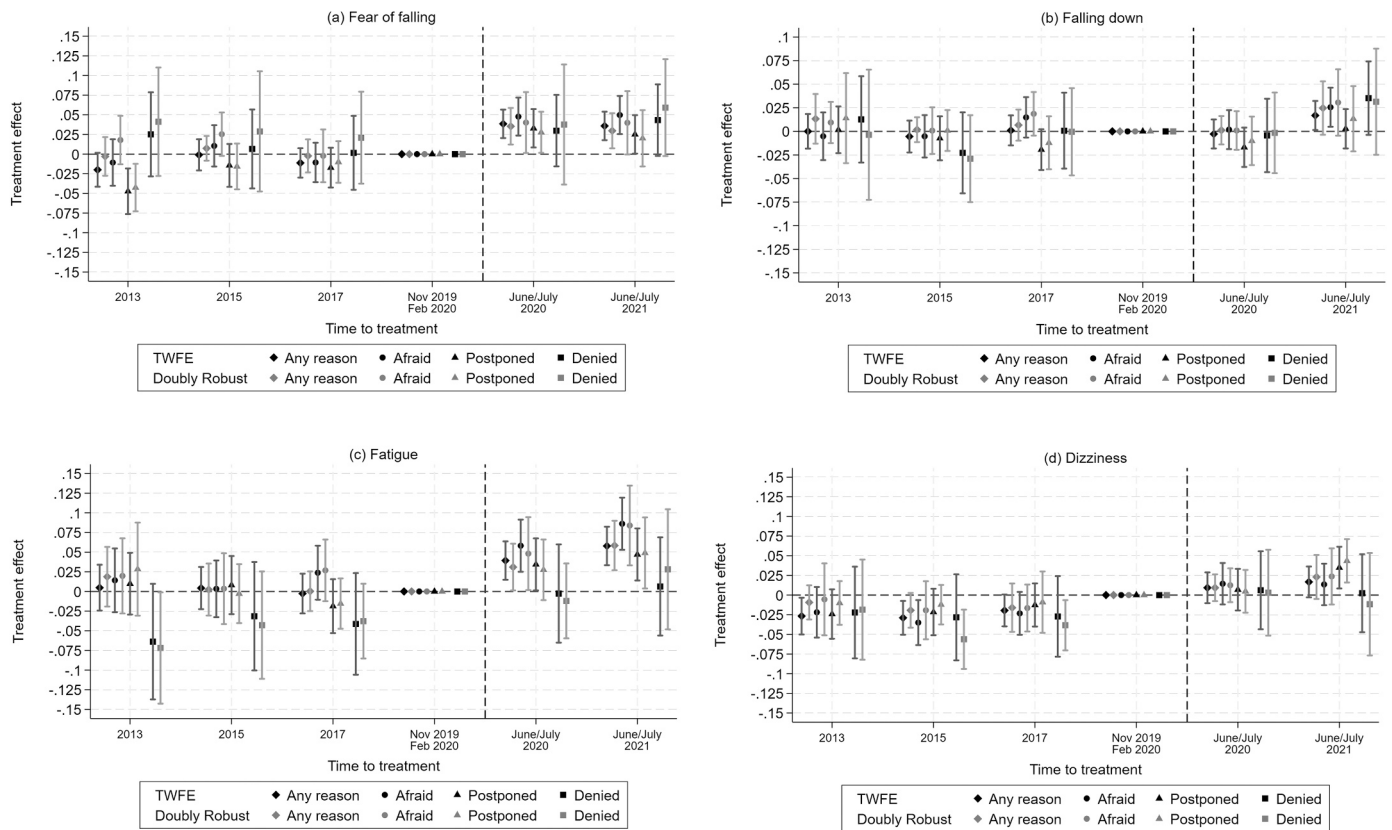
$$y_{it} = \sum_{j=2013, j \neq 2019}^{2021} \beta_j D_i + \mu_t + \nu_i + \epsilon_{it} \quad (1)$$

where  $y_{it}$  is the health variable of individual  $i$  at time  $t = 2013, 2015, 2017, 2019, 2020, 2021$ . Note that 2020 corresponds to the first wave of the SHARE Corona survey (i.e., June/July 2020), which is the time at which the individuals have just had unmet needs. The dates 2013, 2015, 2017 and 2019 respectively represent wave 5, wave 6, wave 7 and wave 8 of the regular SHARE survey, which were conducted before the COVID-19 outbreak, and the date 2020 and 2021 represent the first and second wave of the SHARE Corona survey. See figure A1 in the appendix for a graphic representation with the dates of each interview. In addition,  $\mu_t$  are time fixed effects,  $\nu_i$  are individual fixed effects (that includes a country fixed effect) and  $\epsilon_{it}$  a time-varying unobserved random term.  $D_i$  is a dummy equal to 1 if the individual had unmet needs during the first wave and 0 otherwise. Therefore, the coefficients  $\beta_j$  measure the difference in the evolution of the health outcomes between the treated and control groups at each date with respect to their health

measured before the COVID-19 outbreak (i.e., in wave 8 of the regular SHARE survey, also called  $t = 2019$ ). Indeed, the coefficient  $\beta_{2019}$  is normalized to 0. One should also note that they measure the average treatment effect on the treated (ATT) that is defined as  $E[y_{1j} - y_{0j} | D = 1]$ , where  $y_{1j}$  ( $y_{0j}$ ) is the outcome at time  $j$  when treated (not treated). Hence, it is the expected difference between the observed outcome of treated individuals and the outcome they would have had if they were not treated.

The control group is very important in a difference-in-difference analysis, particularly when we explore unmet needs for a specific reason or specific type of care. Indeed, for example, when we estimate the effect of unmet specialist care need, the control can be composed of individuals with unmet needs for other types of care, which would lead us to underestimate the effect of specialist unmet needs. Therefore, we always include individuals with no unmet needs for any type of healthcare in the control group, which is composed of 9556 individuals. Hence, the remaining individuals with no specialist unmet needs are not included.

Difference in difference relies on two different assumptions to identify the ATT, the parallel trend assumption and the no anticipatory effect assumption (Roth et al., 2022; De Chaisemartin and D'Haultfoeuille, 2022). The parallel trend assumption states that the average health outcome would have evolved in parallel for the treated and untreated populations if the treatment had not occurred. Although this assumption cannot be tested, we can test if the outcomes were evolving in parallel before the pandemic. To test this assumption, we use the four periods of observation before the pandemic. More specifically, we test whether the coefficients  $\beta_j$ , for  $j = 2013, 2015, 2017$ , are significantly different from 0. Indeed, if these coefficients are not different from 0, then this would mean that, on average, the health



**Fig. 3.** Effect of unmet GP care needs on health outcomes. Note: The sample is composed of individuals observed in the first and second waves of the SHARE Corona survey, as well as wave8 of the regular SHARE survey. Sample is restricted to observation who did not declare excellent or very good health in wave 8. See Table B.5, B.6, B.7 and B.8 for the sample size, the standard errors and the p values for each coefficient of each regression. Bootstrapped standard errors with 100 replications clustered at the country level. Vertical lines are 95% confidence intervals.

outcomes have evolved in parallel for the treated and untreated populations before the pandemic (i.e., before potential treatment).

With respect to the no anticipatory effect assumption, it “states that the treatment has no causal effect prior to its implementation” (Roth et al., 2022). A violation of this assumption can lead to a violation of the parallel trend assumption. One should note that  $\beta_j$ , for  $j = 2013, 2015, 2017$ , can be interpreted as a pre-treatment ATTs from period  $j$  to period 2019 (the wave just before the pandemic). Hence, a violation from this assumption is likely if the pre-treatment ATTs are jointly significantly different from 0. Nonetheless, we can argue that such anticipatory effect is unlikely given the fact that the lockdown was not anticipated.

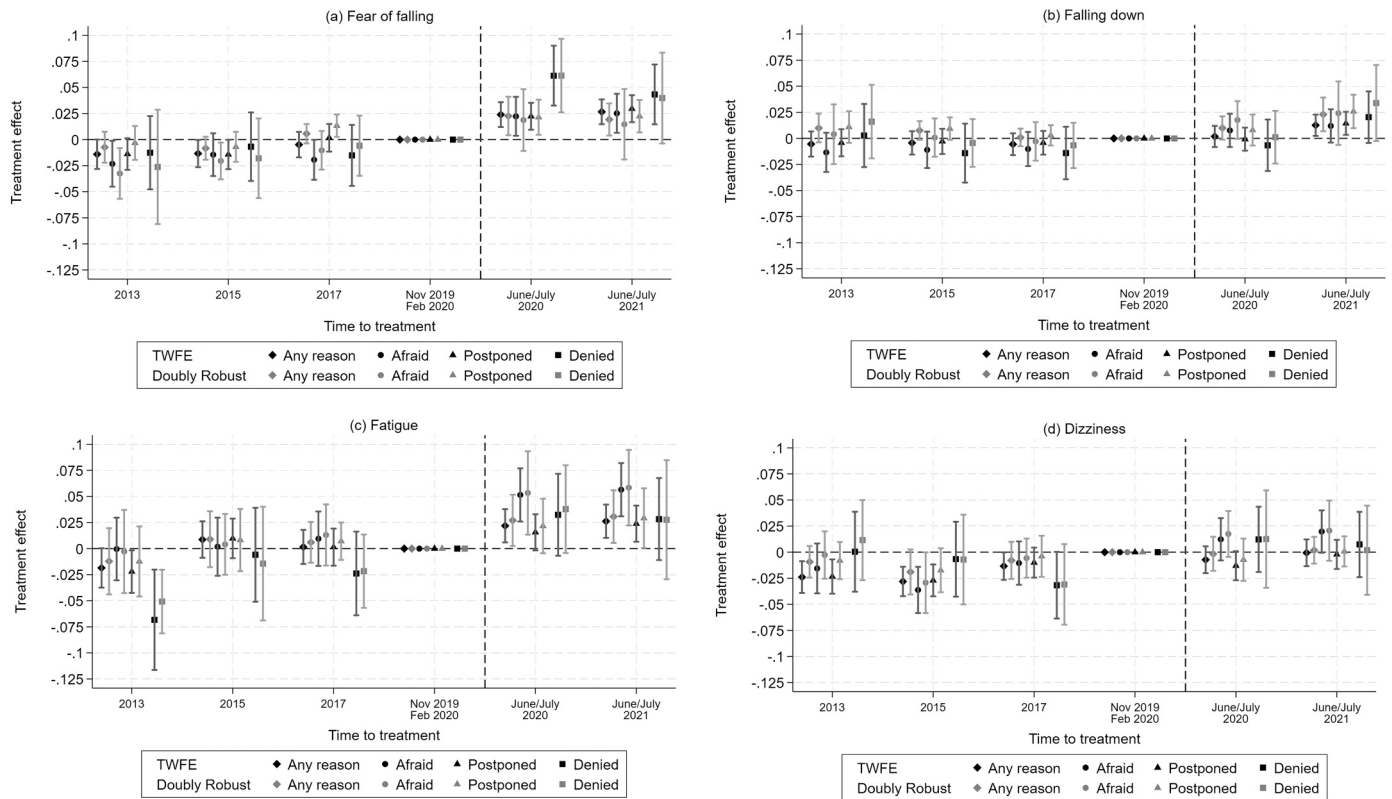
To assess the plausibility of the parallel trend assumption, we first provide descriptive statistics on the evolution of the average health outcomes over time for individuals who have had unmet care needs (i.e., the treated population) and those who did not (i.e., the control population) in Fig. 1. We have decided to restrict our attention for this descriptive analysis to the more global definition of unmet needs, that is, whether the individuals have had at least one unmet need, to avoid an excessive number of graphs. This preliminary analysis shows that the parallel trend assumption might be particularly violated for falling issues and dizziness. We can also see that the treated population had a poorer health status than those who did not. This might be related to the fact that individuals with poor health were more likely to seek or need a medical appointment or treatment. For both the treated and untreated populations, the most prevalent health issues were fatigue and dizziness. The difference between the treated group and the control group, at baseline, was rather minimal for the fear of falling and for falling, with a difference of 2 and 1 percentage points just before the pandemic,

respectively.

With respect to the evolution after the first wave of the pandemic, we observe a relatively flat curve between the pre-pandemic survey and the corona survey conducted in June/July 2020 for falling and dizziness. This might be due to the fact that the time period between these two surveys is rather short, and changes in these conditions can take time to manifest. The result is however not interpretable due to potential reverse causality bias. We then observe that health outcomes depreciated faster for those who have had unmet needs, although the difference in evolution is rather small.

Because the parallel trend assumption as specified in equation (1) might not be verified, we use a doubly robust estimator that allows us to condition the parallel trend assumption on some pre-treatment covariates (Sant’Anna and Zhao, 2020; Callaway and Sant’Anna, 2021; Roth et al., 2022). The purpose of this estimator is to make the control and treated group more comparable, hence making the identification more credible. This estimator combines two estimation procedures, the inverse probability weighting estimator (Abadie, 2005) and the regression adjustment procedure (Heckman et al., 1997; Heckman et al., 1998). The estimator relies on different assumptions than the previous regression. First, it relaxes the strict parallel trend regression to a conditional parallel trend assumption. Second, it requires a common support assumption.

The estimator proposed by Sant’Anna and Zhao (2020) has been adapted to dynamic treatment effects in Callaway and Sant’Anna (2021); their estimator of the ATT at each date  $t$  is defined as follows:



**Fig. 4.** Effect of unmet specialist care needs on health outcomes. Note: The sample is composed of individuals observed in the first and second waves of the SHARE Corona survey, as well as wave8 of the regular SHARE survey. Sample is restricted to observations who did not declare excellent or very good health in wave 8. See Table B.9, B10, B.11, B12 for the sample size, the standard errors and the p values for each coefficient of each regression. Bootstrapped standard errors with 100 replications clustered at the country level. Vertical lines are 95% confidence intervals.

$$\begin{aligned}
 ATT(t) = E & \left[ \left( \frac{D_i}{\frac{1}{N} \sum_{j=1}^N D_j} - \frac{(1-D_i)\hat{p}(X_i)}{1-\hat{p}(X_i)} \right) \left( Y_t - Y_{2019} - \hat{E}(Y_t - Y_{2019} | X, D_i = 0) \right) \right] \\
 & = 0)
 \end{aligned}
 \tag{2}$$

where  $\hat{p}(X_i)$  is the propensity score estimated with a logit model and  $\hat{E}(Y_t - Y_{2019} | X, D_i = 0)$  is predicted using a linear regression and is the regression adjustment part. The ATTs are estimated with a two-step procedure: First, linear regression is used, as specified in Eq. (1), but with the observed pre-pandemic covariates are interacted with the different variables to predict the expected evolution if not treated for the individuals, and the propensity score is estimated using a logit regression on the pre-pandemic covariates. Next, we plug in the estimated propensity score and the predicted outcome evolution when not treated in Eq. (2). The standard errors from such a plug-in estimation method are estimated with a bootstrap procedure with 100 replications. Note that we cluster standard errors at the country level.

The covariates we include in this regression are quadratic age, gender, education, economic vulnerability as measured by ability to make ends meet, number of visits to a GP, number of visits to a specialist, and a dummy for at least one visit to a dentist during the last twelve months, forgone care due to financial reasons during the last twelve months, forgone care due to availability or difficulties to access during the last twelve months, self-assessed health, at least one chronic

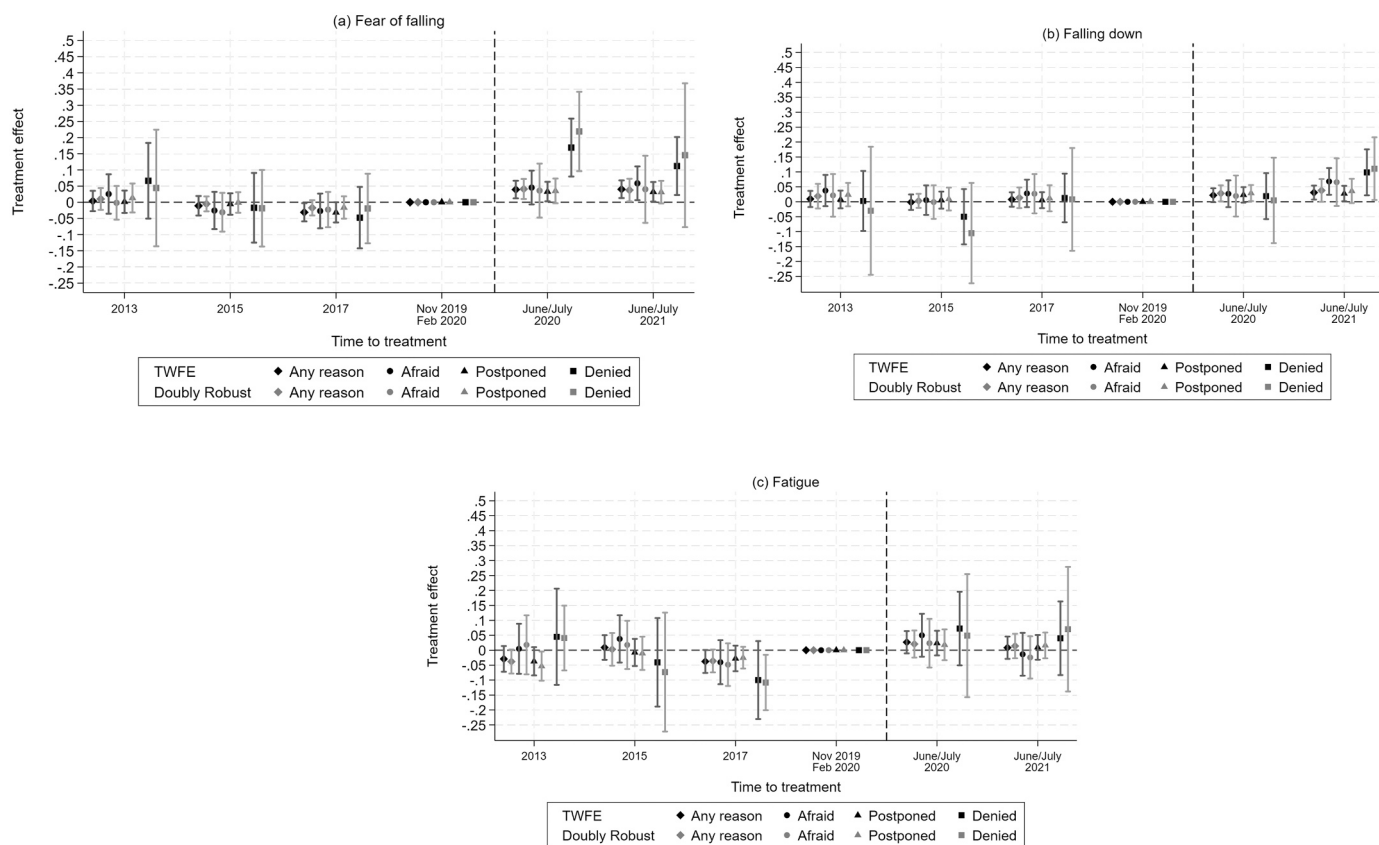
diseases, and country dummies. All these covariates are derived from wave 8 of the SHARE survey, which is the last survey before treatment occurs. Descriptive statistics of these observed characteristics are presented in Table 2. We particularly see that individuals with unmet needs during the first wave of the pandemic are about the same age as those who did not. In contrast, those with unmet needs appear to have a higher healthcare consumption for GPs, specialists, and dentists, which is also reflected by their more deteriorated health (see Fig. 1). We also observe that those who have had unmet needs during the pandemic are slightly more likely to have had unmet needs before the pandemic and less likely to have difficulties to make ends meet. Finally, those with unmet needs appear to have a better self-reported health and more educated. This might be a result of the healthcare prioritization of individuals with a poorer health status to during the pandemic. All these differences justify that we try to account for the observed difference between the control and treatment groups.

Note: The sample is composed of individuals observed in first and second waves of the SHARE Corona survey, as well as the wave 8 of the regular SHARE survey. Individuals who have had unmet health care needs for the first time during the second wave of the SHARE Corona survey are excluded. We also exclude individuals who have had unmet needs during the wave 8 of regular SHARE survey. Sample is restricted to observations who did not declare excellent or very good health in wave 8.

### 3. Results

We now present the results from regression analyses that estimate the effect of unmet care needs during the first wave of the pandemic on health outcomes. The estimated coefficients can be found in in the appendix B. In Fig. 2, we display the estimated ATT of unmet needs by





**Fig. 5.** Effect of unmet planned care needs on health outcomes. Note: The sample is composed of individuals observed in the first and second waves of the SHARE Corona survey, as well as wave 8 of the regular SHARE survey. Sample is restricted to observations who did not declare excellent or very good health in wave 8. See Table B17, B.18, B.19 and B.20 for the sample size, the standard errors and the p values for each coefficient of each regression. Bootstrapped standard errors with 100 replications clustered at the country level. Vertical lines are 95% confidence intervals.

reason on the different health outcomes. First, if we look at the coefficients just before the COVID-19 outbreak to assess whether the parallel regression is satisfied, we see that it is significantly different from zero most of the time when using the TWFE estimator but not when using the doubly robust estimator. This indicates that the parallel trend is more likely to be verified conditional on the pre-treatment observed characteristics, so we focus our interpretations on the results from the doubly robust estimator.

For the probability of having a fear of falling, irrespective of the reason for unmet needs, we estimate an increase of 3 percentage points (ppt) one year after the pandemic. This means that the probability of having a fear of falling for treated observations is, one year after, 3 ppt higher than what it would be if they had not been treated. This finding suggests substantial one-year effects of unmet care needs. If we zoom in on the reason for the unmet care needs, we find that the parallel trend is verified only when the reason for unmet needs is because the care appointment or treatment has been postponed or denied. For postponed care, we estimate an increase of 1.7 ppt. For denied care, the increase is of 3.4 ppt.

For the probability of falling down, we estimate a 1.9 ppt increase when all the reasons are included, and a 1.9 ppt (3.4 ppt) increase when the appointment or treatment was postponed. We do not detect any significant effect for the other reasons of unmet care needs.

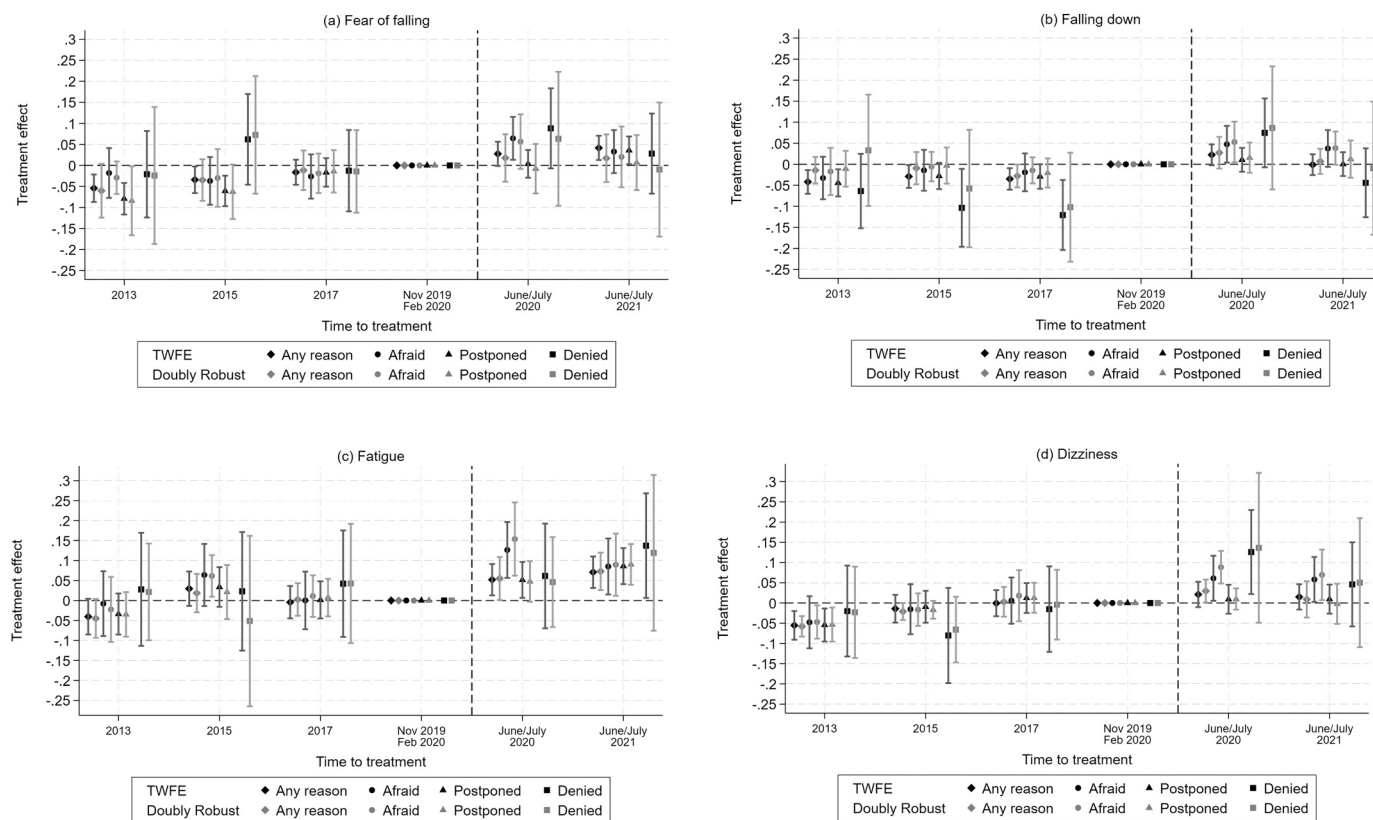
If we look at the probability of having fatigue issues, the parallel trend assumption is verified for most reasons, except denied care. When combining all reasons, we find increases of 3.4 ppt one year later. When the reason for unmet needs is that the individual has neglected receiving care because he was afraid of being infected, we find an increase of 5.8 ppt one year after. When the reason is because the appointment or treatment was postponed, the results suggest an increase of 3.2 ppt one

year after. We shall note that the short-term effect for postponed care from the TWFE estimator is significant and large, and the parallel trend assumption seems verified. Overall, these results suggest a lasting effect on the probability of fatigue issues for these two different reasons of unmet care. Concerning the probability of having issues with dizziness, the parallel trend assumption does not seem to be verified for all reasons of unmet needs.

We also investigate the effects by type of care. We present the results for unmet GP care needs in Fig. 3. First, we find that the parallel trend assumption is verified for all outcomes. When considering the probability of having issues with falling down, we find a significant effect (at the 10% level) after one year when all reasons are combined: unmet GP care needs increase the probability of having falling issues by 2.5 ppt. A slightly larger effect is found when the reason is because the individual was afraid (3 ppt).

Concerning fatigue, we find very large effects. The probability of having fatigue issues is increased 5.8 ppt one year after when all reasons are combined. When care needs were unmet because the individual was afraid to be infected, it resulted in an increase of approximately 8 ppt. When GP care has been postponed, we estimate an increase of approximately 4.9 ppt medium term, respectively. This result suggests lasting effects that increase over time. Regarding issues with dizziness, the only statistically significant effect we can detect is a substantial increase by 4.9 ppt when care has been postponed.

The results for unmet specialist care are presented in Fig. 4. When all reasons are combined, we estimate a significant increase in the probability of having issues with the fear of falling by 1.9 ppt one year after. We also find an increase of 2.2 ppt when care was postponed and 3.9 ppt when it was denied (significant at the 10% level). No significant effect is found for forgone care due to fear of being infected. With respect to the



**Fig. 6.** Effect of unmet physiotherapy/psychology/rehabilitation care needs on health outcomes. Note: The sample is composed of individuals observed in the first and second waves of the SHARE Corona survey, as well as wave 8 of the regular SHARE survey. Sample is restricted to observation who did not declare excellent or very good health in wave 8. See Table B.13, B.14, B.15 and B.16 for the sample size, the standard errors and the p values for each coefficient of each regression. Bootstrapped standard errors with 100 replications clustered at the country level. Vertical lines are 95% confidence intervals.

probability of falling, one year later, we find an increase of 2.3 ppt when all the reasons are combined and when care was postponed.

Regarding fatigue, once again, we find substantial detrimental effects. We estimate an increase in the probability of having fatigue issues of 3.1 ppt when all reasons are combined. When we examine findings by reasons for the unmet specialist care, the largest effect is found for forgone care due to the fear of being infected: the probability of having fatigue issues increased by 5.8 ppt one year later. When care has been postponed, we find an increase of approximately 2.9 ppt. Finally, when care was denied, no significant effect is detected. Finally, the effect of specialist unmet care needs on dizziness can be found in panel (d) of Fig. 4. When we do not find any statistically significant effect and the parallel trend assumption does not seem verified.

For planned care (Fig. 5 and 6), we find an increase of 3.8 ppt one year later on the probabilities of having fears of falling and falling issues. Similar effects are found when the planned medical treatment or appointment was postponed, even if it is significant at the 10% level only. When appointment was denied, a significant effect of 11 ppt is found. Postponed planned care also increased the probability of having dizziness issues by 4.4 ppt one year after. We also find some effects of denied care on dizziness, but the pre-treatment ATTs are large in magnitude, threatening the credibility of the parallel trend assumption.

Finally, concerning unmet physiotherapy/psychology/rehabilitation care needs, we find substantial effect on fatigue issues. We observe an increase of 7.3 ppt when all reasons are combined, and an increase of about 9 ppt when care was postponed, or the individuals was afraid. An increase of 3.8 ppt (7 ppt) of falling (dizziness) issues is also observed when care has been forgone by fear the virus. We do not find significant effect when care was denied.

#### 4. Discussion and conclusion

Our results suggest that unmet care needs during the first wave of the pandemic have had substantial detrimental effects on health outcomes (significant at the 5% level), except for dizziness/faints/blackout issues. One particularly strong result we find is that unmet specialist care, especially when it is because care was postponed, increases the probability of having health issues one year after the pandemic. GP unmet care affects the probabilities of having fatigue and fear of falling issues. GP unmet care needs nonetheless have no effects on the probability of falling issues. The difference between GP and specialist care can be explained by either the fact that GP care has been easier to obtain later or that specialist care can have particular effects to prevent old age individuals' loss of autonomy. In addition, we also observe some detrimental effects of unmet planned care and physiotherapy/psychology/rehabilitation care. The probability of having fatigue issues is increased by unmet care from all type of care, except planned care. The probabilities of having falling issues or being afraid of falling are particularly affected by postponed care.

Overall, these results suggest that the first wave of the pandemic and unmet health care needs in general can have long-term effects on medical symptoms, accelerating the process of frailty for older individuals as well as their entry into a health state with loss of autonomy. The fact that most effects we find are significant for postponed care suggest that unmet care needs are related to validated needs that have been unmet or delayed (if they are satisfied later). This is particularly true for specialist care, for which an appointment is often asked after an appointment with a care professional who recommended to consult a specialist or as follow up. This is supported by our results that postponed specialist care has detrimental consequences on having issues with fatigue, falling and being afraid of falling. We believe this result is quite

new in the literature and allows to levy the general critique that self-assessed unmet care needs are subjective. This result suggests that the reallocation of resources in health system during the pandemic, which favoured urgent and vital healthcare, resulted in the postponement of healthcare that were really needed even if they were not judged as a priority. Finally, we also find significant effects when unmet needs were due to the fear of the virus. This suggests that individuals' fear about the pandemic led them to forgo health care that may be important for their health capital because this type of unmet care needs resulted in poorer health outcomes. One interpretation is that individuals were not aware of the appropriateness of the care they needed. A second could be that their fear of the pandemic was higher than the value they have attributed to this health care.

The originality of our results is to evaluate the consequences in a pandemic context, with motives for unmet care needs that are not driven by economic difficulties to pay for care. Quintal et al. (2023), the most related paper, do not find a significant effect of unmet care needs on self-assessed health but an increase for cancer. The latter result is in line with our study, while the former is not. One potential explanation for the difference is that self-assessed is not a medical symptom, and it can be impacted by other (subjective) factors that were improved during the pandemic. Another potential explanation is that we study transitions in health from the pre-pandemic period, while they study transitions between 2020 and 2021. One should note that our results are in line with Ko (2016), who find that unmet needs due to the lack of availability of care reduces self-assessed health for older individuals. Indeed, unmet care needs in the pandemic context can be thought as a lack of availability of care.

Our results are also in line with direct evidence from Alonso et al. (1997), Dourgnon et al. (2012), Lindström et al. (2020) and Ko (2016), who find that having unmet care needs negatively affects future health outcomes, and indirect evidence from Finkelstein et al. (2012), Goldin et al. (2021) and Card et al. (2009). We therefore contribute to the general literature on the negative consequences of unmet care needs on health outcomes.

Our results appear to hold regardless of the reason for the unmet needs, except for denied care, for which we have obtained unprecise estimates regardless of whether the unmet needs are due to supply (because care was postponed) or demand (forgone care due to fear of being infected). Therefore, in a pandemic context, during which health systems may mainly focus on the provision of health care for infected patients, it seems important to be able to maintain the provision of health care for other diseases than COVID-19, and for all patients. It is also important to maintain trust in the care practitioners' ability to protect patients from infections to limit deleterious delays in unmet care needs due to the fear of being infected. This is especially true in a context where patients with important needs, such as cancer patients, were more likely to be scared by infections when deciding about medical consumption (Dimelow et al., 2021). More generally, our findings support that reducing access to primary and secondary healthcare could be deleterious and an accelerating factor of the process of frailty for older individuals. Therefore, health systems should guarantee access to adequate healthcare for all to promote healthy ageing and to limit avoidable health expenses.

This work has several limitations that must be discussed. First, we do not know whether the individuals have sought care. Therefore, our control group might include individuals who did not need care. It would have been more appropriate to be able to compare the evolution of health outcomes of individuals who have had unmet needs with those who did not, conditional on having sought care. Unfortunately, this is not possible with our data. Second, as we explained in the methodological section, having unmet health care needs is not necessarily an exogenous event.

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## Declaration of Competing Interest

The authors have no conflict of interest to declare.

## Data Availability

The authors do not have permission to share data.

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## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.ehb.2023.101317](https://doi.org/10.1016/j.ehb.2023.101317).

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