Characteristics of deferred care during COVID using the SHARE study: a quantitative study

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Preface

With special thanks to prof. dr. Mortelmans and prof. Dr. Van Royen, for all their help and advice. Without them, this thesis would not have been possible.

The COVID-19 pandemic has brought to light significant challenges in healthcare access, particularly the issue of deferred care. As a general practitioner, I have observed that many patients face barriers that prevent them from seeking timely medical attention. These barriers, which include financial constraints, geographic limitations, and social stigmas, result in a substantial portion of the population not receiving necessary healthcare. Consequently, this leads to a deterioration in overall health and a lack of preventive measures.

During the pandemic, these barriers became even more apparent, highlighting the urgent need to address them. This thesis aims to analyse the various obstacles that hinder patients from visiting general practitioners and to explore the consequences of deferred care. By understanding these barriers, I hope to contribute to future initiatives that will improve healthcare accessibility for underserved populations.

This thesis includes two parts. First we performed a literature review to gain insights into the state of the art on deferred care during the COVID-19 pandemic and the factors that influenced this.

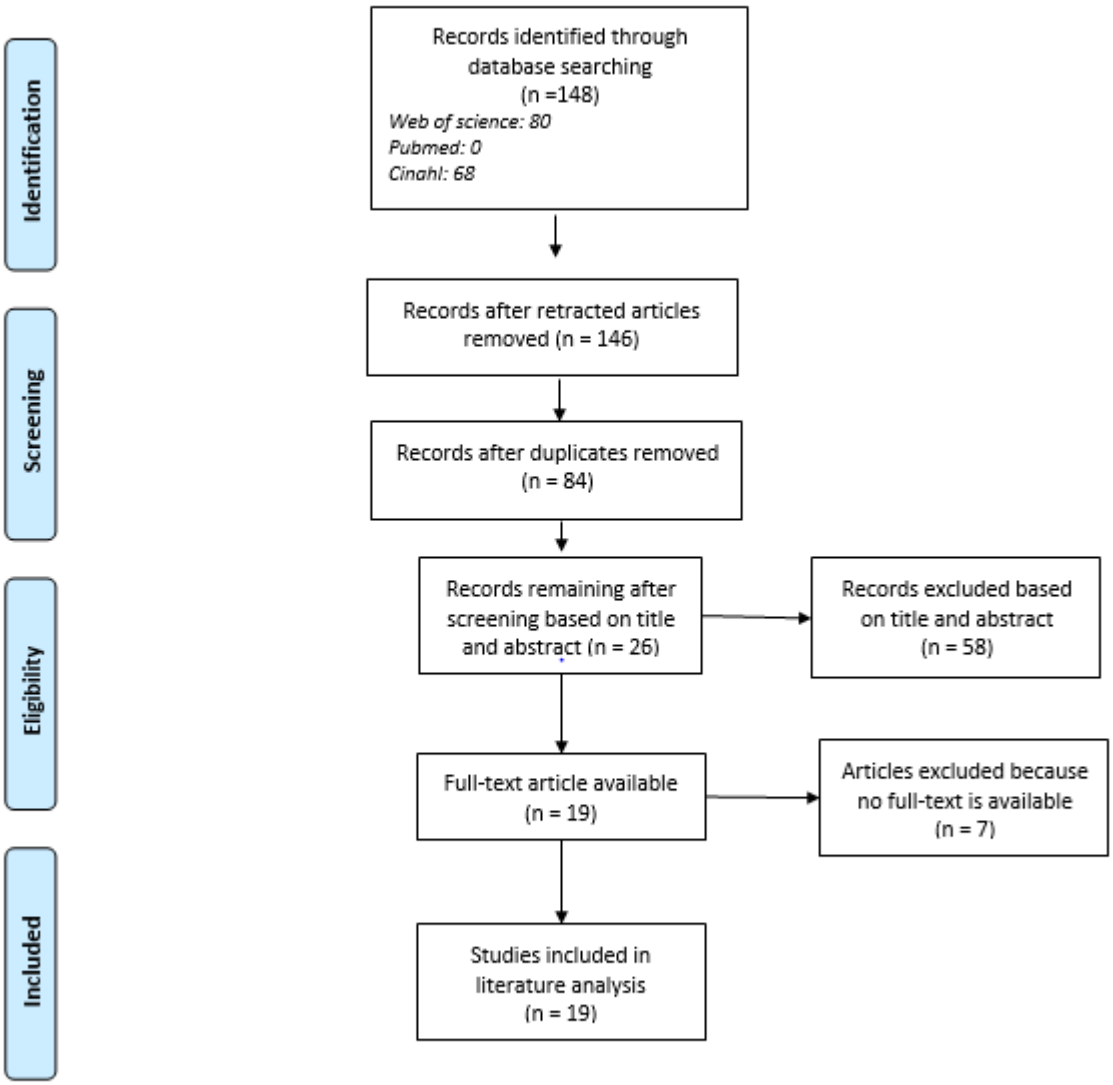
The second part of this thesis is a manuscript based on our field research, using the COVID module of the SHARE survey. The Survey of Ageing, Health and Retirement in Europe (SHARE) is a longitudinal, multidisciplinary, international study that collects data from 28 European countries and Israel.

Literature review

Aim and methods

To gain insights on the state of the art on barriers to health care, we explored the literature. The main databases used are the Web Of Science, Pubmed and Cinahl. To answer the question, we searched for [“continuity of care” AND COVID-19 AND outpatient]. Since the term ‘outpatient’ was still too general, it was adapted to “family medicine”. In a second search, the terms “health inequality”, “health disparity” and “health access” were used. These terms were always combined with “COVID-19” and “family medicine”. The search was conducted on 01/11/2024 resulting in 148 articles. After removing the duplicates and retracted articles, 84 articles remained. Then a final selection was obtained through careful analysis of the title and the abstract. This resulted in a total of 26 articles. Full texts were available for 19 articles. All others were excluded.

Inclusion of studies: flowchart



Results of the literature review

Unmet healthcare needs and deferred care increase morbidity and mortality (1). It is an underreported problem that became apparent during the COVID-19 pandemic. Quarantine measures were installed to prevent a rapid spread of the virus among the population. Consequently, multiple public services closed down or became available only online. Healthcare, specifically primary healthcare, was often exempted from these measures. Nevertheless, the percentage of deferred care and unmet healthcare is expected to have increased during the COVID-19 pandemic (2).

There is an essential distinction between deferred care and unmet healthcare needs. Most studies consider unmet healthcare needs. *Unmet healthcare* needs refer to subjective needs. They assess the self-reported lack of healthcare (3). This includes the perceived accessibility to

healthcare and the person's general physical and mental status. Because of its subjectivity, unmet healthcare needs are considered a broad and general concept. Some studies also refer to unmet healthcare needs as *subjective health needs* (SUN)(4). In contrast, *deferred care* refers to care that cannot occur physically. During the pandemic, this was mainly caused by the overwhelmed healthcare system. This resulted in limited resources and thus unavoidable deferred care (5). This paper will discuss deferred care.

Deferred care can be attributed to two factors: the health care system and the patient's situation. During the COVID-19 pandemic, healthcare resources were limited and thus resulted in deferred care. The necessity to prioritise resources escalated into a global issue, leading to widespread deferred care. The extent of deferred care depends on the healthcare system and the governmental measures implemented during this period (2, 5).

A framework for healthcare access was formulated in 2013 by Levesque et al.. They break healthcare access into six stages: healthcare needs, perception of needs, seeking care, reaching care, utilisation, and outcomes or consequences (6). Deferred care can be defined as the inability to access healthcare, which can occur at any of these six stages. This study will focus on seeking care, reaching care and utilisation, as these stages were available in the SHARE database.

Our following research will investigate the demographic and individual factors influencing the specified three stages. Additionally, the role and impact of the healthcare system during these stages will be thoroughly examined by comparing healthcare systems in Europe.

The first factor associated with deferred care is economic vulnerability. Individuals with lower socio-economic status face more significant barriers to accessing healthcare. This became more apparent during the pandemic. Financial hardship was an important predictor of unmet healthcare needs, with financially constrained individuals more likely to forgo or postpone care (7). Inequalities in healthcare access in lower-income countries became more apparent during the COVID-19 pandemic. Mainly, digital and surgical services showed more disparities in access based on income. It is emphasised that digital health services could mitigate these disparities if supported by adequate infrastructure and policies. Furthermore, countries implementing measures to enhance digital accessibility demonstrated pro-poor digital challenge inequality estimates (5). We hypothesise that economic vulnerability has a significant impact on the motivation to seek healthcare, the ability to access it, and the utilisation of healthcare services.

The second factor that plays a role in access to healthcare services is mental health. The pandemic had a profound impact on mental health, particularly among women and those with prior depressive episodes. Restricted access to healthcare services further worsened mental health outcomes. Due to isolation and social distancing, there was a decline in healthcare access, furthering pre-existing mental health issues as well as creating new ones. The need for more mental health support has become apparent during the pandemic (2). Fear also played an important role in deferred care during the pandemic (8). We hypothesise that mental health not only affects access to healthcare but also influences the need to seek healthcare services. This is a crucial hypothesis, but is beyond the scope of this paper. Future research should be dedicated to this hypothesis.

The third factor of influence is age. Middle-aged and older people had more unmet healthcare needs during the pandemic. This discrepancy in healthcare access results from diverting resources to COVID-19 prevention and care, which reduces the availability of these resources

for other pathologies. Hospital suspensions, healthcare worker infections, and strikes further strained medical services, particularly affecting geriatric care in overwhelmed regions during the early days of COVID-19 (9). We hypothesise that age influences both the pursuit and accessibility of healthcare services.

To examine if deferred care differs in different healthcare systems, we must first analyse what types of healthcare systems exist and which factors play a crucial role in the inner workings of these systems. Healthcare systems can be understood through three main dimensions: financing mechanisms, health service provision, and regulations (or governance). The key aspect is not just the level of these dimensions but who is responsible for them. Not only the state can take on these responsibilities, but also non-governmental or private market actors. As such, 27 possible combinations could arise. In Europe, out of these 27 combinations, three ideal-type healthcare systems emerged. These systems are characterised by the concentration of responsibility for all three dimensions - financing, service provision, and regulation - within a single institution. In *state-based healthcare systems*, the state assumes responsibility for all three dimensions. When societal actors are responsible for financing, the system is termed a *societal healthcare system*. Conversely, when the private sector finances all three dimensions, we refer to a *private healthcare system*. In addition to these ideal-type systems, mixed-type healthcare systems also exist (10).

In addition to the structure of the healthcare system itself, the level of trust that the public places in the system is also of critical importance. Beller et al. showed in 2022 that approximately 21% of participants distrusted the healthcare system during the COVID-19 pandemic, despite the majority expressing trust. Key predictors of lower trust included being middle-aged or older, female, having lower education, unemployment, poor health, income difficulties, unmet healthcare needs, lack of healthcare contact, mental distress, and loneliness. Unmet healthcare needs emerged as the strongest predictor of decreased trust, particularly in Western Europe. The subgroup with the lowest trust was from Eastern Europe, characterised by income difficulties and unmet healthcare needs (11).

Conclusion

This literature review highlights the gaps in research on the subject of deferred care. These gaps underscore the necessity of this study, which aims to investigate correlations between postponed, foregone, and denied care and various personal, household, and healthcare characteristics.

Due to the significance of this research, we have decided to write an article, which is presented below. This article outlines the insights gained from the study, along with discussion points and areas for further research.

MANUSCRIPT MAIN STUDY:

Characteristics of deferred care during COVID using the SHARE study: a quantitative study

ABSTRACT

Introduction The COVID-19 pandemic highlighted significant barriers to healthcare access, particularly deferred care. These barriers may have existed before the pandemic, but the COVID-19 pandemic increased their visibility.

Methodology This study uses the SHARE Corona Survey dataset to analyse individual, household, and health-related factors influencing deferred care during the pandemic, employing multilevel logistic regression models. Data collection involved computer-assisted telephone interviews across 28 European countries.

Results Analysis of survey data indicate that 4.6% of respondents postponed care, 4.7% forwent care, and 1.4% were denied care, with higher rates among women and those with chronic illnesses. Employed individuals and those with better self-perceived health were less likely to postpone or forgo care, while younger respondents experienced higher rates of denied care. The study found no significant association between income and deferred care. Differences between countries were observed, but these could not be attributed to specific healthcare systems.

Discussion The findings underscore the need for gender-sensitive healthcare policies and support systems for individuals with chronic illnesses. Future research should expand sample diversity and investigate specific socio-economic factors to develop targeted interventions for improving healthcare access during crises.

Introduction

During the COVID pandemic, general practitioners noticed several barriers to patients visiting the general practitioner. These barriers are raised by the health care system and the patient's situation. These barriers may have existed before the pandemic, but the COVID-19 pandemic increased their visibility. Verhoeven et al. reported that chronic care was predominantly deferred during the COVID-19 pandemic. While non-COVID-related health issues were also postponed, this occurred to a lesser extent. The authors highlighted the profound impact of the pandemic on the psychological and socio-economic well-being of individuals, particularly those who are vulnerable (2, 5, 7, 9, 12). However, the precise factors contributing to the associated barriers to care and their consequences remain unclear. Whether the threshold to primary care was effectively raised during the COVID-19 pandemic is subject to empirical inquiry, as are the societal factors that significantly impacted them.

Our study aims to identify individual and societal barriers that impede access to healthcare. Specifically, we investigate why individuals postpone seeking care and explore the potential links between gender, socioeconomic status, and healthcare utilisation. Additionally, we aim to examine whether these characteristics vary across European healthcare systems. To achieve this, we will utilise the Survey on Ageing, Health and Retirement in Europe (SHARE), a cross-national questionnaire administered during the first wave of the COVID-19 pandemic.

Identifying these barriers is crucial, as they may persist despite being less apparent. By identifying these barriers, the healthcare system can work towards mitigating them. Furthermore, awareness of these challenges allows for targeted action if another pandemic occurs.

Methodology

Dataset

This study uses the SHARE Corona Survey (SCS) dataset (a part of wave 8 of the general SHARE study). Initiated in 2004, the Survey of Ageing, Health and Retirement in Europe (SHARE) is a longitudinal, multidisciplinary, international study that collects data from 28 European countries and Israel. This data is ideal for examining individual and population ageing and socio-economic and environmental factors over their lifespan, as it is a longitudinal study with a great number of participants. Participants are chosen from households with at least one individual aged 50 or older who resides permanently in the respective SHARE country at sampling. Partners of these suitable participants, regardless of their age, are also eligible for interviews. However, individuals who are in prison, hospitalised, living abroad during the survey period, unable to speak the official language(s) of the SHARE country, or have moved to an unknown address are considered ineligible (13).

The COVID-19 pandemic interrupted the regular data collection of Wave 8 via computer-assisted personal interviews (CAPI). Consequently, data collection was diverted to telephone mode and a targeted Corona Survey. During the pandemic, two such SCSs have been collected. The first SCS was conducted between June and September 2020. The second SCS was conducted one year later, between June and August 2021. These two telephone surveys give insights into the respondents' lives during the pandemic. The SCS was conducted via “computer-assisted telephone interviews” (CATI) (14). The SCS questionnaires focused on key areas to assess the impact of the COVID-19 crisis on the 50+ population, including health effects, work-related and economic changes, and modifications in social networks (15).

Measures

Dependent variables. This study utilises three dependent variables, all of which are dichotomous. The first variable, "postponed care," identifies patients who rescheduled their appointments but ultimately visited the general practitioner. The second dependent variable is "forgoing care," indicating patients who could not see their general practitioner due to their decision to avoid the appointment. The third variable, "denied care," refers to patients who could not see their general practitioner due to cancellations initiated by the doctor.

Explanatory variables. The explanatory variables are categorised into three groups of characteristics. The first group comprises individual characteristics, including the patient's gender, age, and employment status at the time of the questionnaire. The second group encompasses household-related characteristics, such as the number of children and grandchildren, the patient's relationship status, and household income. The third group pertains to health-related individual characteristics. A key characteristic in this group is ADL (Activities of Daily Living) limitations, which measure an individual's ability to perform self-care tasks. A score of one or more on the ADL scale indicates an ADL limitation in this study.
A second important health characteristic is the presence of one or more chronic illnesses, as self-reported by the participants. They were asked: "Has a doctor ever told you that you have any

of the following chronic illnesses or conditions?" The list included heart attack or other heart problems, high blood pressure (hypertension), high blood cholesterol, stroke or cerebral vascular disease, diabetes or high blood sugar, chronic lung disease (e.g., chronic bronchitis or emphysema), asthma, arthritis (including osteoarthritis or rheumatism), osteoporosis, cancer or malignant tumour (including leukaemia or lymphoma, but excluding minor skin cancers), stomach or duodenal ulcer, peptic ulcer, Parkinson's disease, cataracts, hip fracture or femoral fracture, other fractures, Alzheimer's disease, dementia, organic brain syndrome, senility, or any other severe memory impairment, benign tumour, liver disease, kidney disease, and other chronic diseases. Additionally, self-reported serious illnesses were included as a health characteristic. Participants were asked: "Has a doctor ever told you that you have any of the following serious illnesses or conditions?" The list of serious illnesses included cancer, heart attack, stroke, chronic lung disease, severe liver disease, severe kidney disease, severe neurological conditions (e.g., Parkinson's disease, multiple sclerosis), and severe mental health conditions (e.g., schizophrenia, bipolar disorder). Lastly, the perceived health status was included. Patients were asked whether they deem themselves to be generally healthy.

The analysis of healthcare systems was categorized into distinct clusters, utilizing Reibling's cluster method as the foundational framework (16). Detailed information regarding the clustering methodology is provided in Appendix 1.

Analytical strategy

Next to a preparatory, descriptive analysis of the main variables, we estimated a multilevel logistic regression to examine the determinants of older adults' experiences with general practitioner (GP) care during the COVID-19 pandemic. Specifically, we modelled three binary outcomes in separate cumulative models: whether care was postponed (POSTPONED), foregone (FORWENT), or denied (DENIED). Each outcome was analysed using four hierarchical models estimated via the PROC GLIMMIX procedure in SAS, with a logit link and a binary distribution.

We included random intercepts at the country and household levels to account for the nested data structure. Model 0 served as the empty model, capturing the baseline variance decomposition without predictors. Model 1 introduced individual demographic characteristics (gender, age, birth cohort, education, and employment status). Model 2 added household-level variables (number of children, presence of grandchildren, couple status, and household income). Model 3 further included health-related factors (activities of daily living limitations, chronic conditions, recent diagnoses, and self-rated health).

This stepwise approach allowed us to assess the relative contribution of individual, household, and health characteristics to the likelihood of foregone, postponed or denied GP care across countries during the pandemic.

Results

Descriptive results

Table 1 presents the distribution of explanatory variables across postponed, forgone, and denied care, revealing that 4.6% of respondents postponed care, 4.7% forgone care, and 1.4% were denied care. Despite the lower incidence of denied care, the overall number of respondents experiencing postponed, forgone, or denied care is substantial enough to warrant multivariate analysis. Notably, female participants exhibit higher rates of postponed, forgone and denied

care, while age differences appear to have minimal impact. Respondents employed at the time of the survey reported higher instances of postponed and forgone care but lower instances of denied care, potentially because their regular commutes for work made it easier to visit general practitioners. Those in a relationship reported lower rates of postponed and forgone care. Increased limitations in activities of daily living (ADL) correlate with higher rates of postponed, forgone and denied care. Additionally, respondents with chronic illnesses reported higher rates of forgone and denied care, and those with poorer self-reported health status are more likely to postpone or forgo care.

There are minimal differences in country characteristics regarding deferred care. The highest rate of postponed care, at 7%, was observed in cluster two (Performance and primary-care oriented public systems), while the lowest rate, at 3.6%, was found in cluster four (Low-supply and low performance mixed systems). The rates of forwent care were similar to those of postponed care, with the highest rate of 6.7% in cluster two and the lowest rate of 4.0% in cluster three (Regulation oriented public systems). Denied care rates ranged from 1.1% to 1.7%, with the lowest in cluster one (Supply and choice oriented public systems) and the highest in cluster two.

Table 1 Descriptive results of forgoing, postponing or being denied care from the general practitioner (N=61722)

			Postponing care	Forgoing care	Denied care
	No		58845 (95.3%)	58863 (95.4 %)	60878 (98.6%)
	Yes		2877 (4.7%)	2859 (4.6 %)	844 (1.4%)
Individual characteristics – backgr.					
Gender	Man	(%Yes)	4.3 %	3.5 %	1.2 %
	Woman	(%Yes)	5.0 %	5.5 %	1.5 %
Age		(Mean - No)	70.4	70.4	70.5
		(Mean – Yes)	71.5	71.4	69.8
At Work	Yes	(%Yes)	3.3 %	3.6 %	1.3 %
	No	(% Yes)	4.8 %	4.8 %	1.4 %
Household characteristics					
No of children		(Mean - No)	2.04	2.04	2.04
		(Mean – Yes)	2.10	2.02	2.10
No of grandchildren		(Mean - No)	1.75	1.76	1.76
		(Mean – Yes)	1.88	1.87	1.94
In couple	Yes	(%Yes)	4.9 %	4.6 %	1.4 %
	No	(%Yes)	5.3%	5.7 %	1.6%
Household Income		(Mean - No)	26541	26714	26583
		(Mean – Yes)	27637	24328	27246
Individual characteristics - health					
+1 ADL limitations	Yes	(%Yes)	5.8 %	6.1 %	2.0 %
	No	(% Yes)	4.4 %	5.0 %	1.3 %
Chronic illnesses		(Mean – No)	1.92	1.92	1.94
		(Mean – Yes)	1.94	2.50	2.41
Serious diagnoses		(Mean – No)	0.71	0.71	0.72
		(Mean – Yes)	0.72	1.01	0.89
Overall Health	Good	(%Yes)	3.9 %	4.1 %	1.1 %
	Bad	(%Yes)	5.0 %	5.0 %	1.5 %
Country characteristics					
Supply and choice oriented public systems (AT,BE,CZ,DE,FR,LU,SI) (%Yes)			3.8 %	4.3 %	1.1 %
Performance and primary-care oriented public systems (FI,GR,PT,SE) (%Yes)			7.0 %	6.7 %	1.7 %
Regulation oriented public systems (CY,DK,ES,IT) (%Yes)			6.1 %	4.0 %	1.5 %
Low-supply and low performance mixed systems (BG,EE,HR,HU, LT,LV,MV,PL,RO,SK) (%Yes)			3.6 %	4.2 %	1.4 %
Supply- and performance oriented private systems (CH,IL) (%Yes)			5.1 %	6.1 %	1.3 %

Multivariate results

Table 2 presents the results of the multilevel logistic regression analysis concerning postponing, forgoing, and denied care. Each dependent variable is examined across three models. Model 1 analyses individual characteristics, Model 2 incorporates household characteristics, and Model 3 focuses on individual health characteristics. As indicated in Table 2, no significant differences were observed between forgoing care and individual factors such as gender and age. However, it was found that respondents who were employed at the time of the questionnaire were less likely to postpone their medical care (b=-0.467, SE = 0.109). This finding contradicts our initial hypothesis, suggesting that employed individuals are less prone to postponing medical care. Model 2 shows no effect of household characteristics on postponing care. Having (grand)children or being in a relationship has no significant effect on postponing care. It is even more remarkable that income had no effect, compared to what was hypothesised.

In model 3, we can see no effect of a higher ADL score on postponed care. However, people with self-reported chronic diseases are more likely to postpone care (*b*= 0.112, SE = 0.036). The same can be said for self-reported serious diagnoses (*b*= 0.135, SE = 0.047). There is an inversely proportional relationship between perceived health status and postponed care. Respondents who perceive their general health as good are less likely to postpone medical care (*b* = - 0.222, SE = 0.075).

In the group of individuals who forwent care, women were significantly more likely to forgo care than men (*b* = 0.457, SE = 0.064). No significant differences were observed in age, level of education, or income regarding forgoing care. However, similar to the postponed care findings, individuals employed at the questionnaire's time exhibited lower rates of forgoing care (*b* = -0.300, SE = 0.105). Respondents with more grandchildren were less likely to forgo care (*b* = -0.039, SE = 0.015). Compared to postponed care, there was a higher incidence of foregone care among patients with more chronic illnesses (*b* = 0.200, SE = 0.034), although no significant effect was found for serious diagnoses. Additionally, respondents who perceived their general health as good were less likely to forgo medical care (*b* = -0.339, SE = 0.072).

The final group of respondents consists of those who were denied care. There is no difference in the denial of care between male and female respondents, unlike postponed and forwent care. Age significantly influences the denial of care, with younger respondents experiencing higher rates of denied care (*b* = -0.499, SE = 0.122). Employment status does not significantly affect whether respondents were denied care. However, those with more chronic illnesses were more frequently denied care (*b* = 2.400, SE = 0.885). Conversely, respondents who perceived their health as good were less likely to be denied care (*b* = -0.499, SE = 0.122).

When comparing the different clusters of healthcare systems, no significant differences were found in the rates of postponing, forgoing, or denied care across the various clusters. However, an exception was observed in the regulation-oriented public systems, which exhibited a higher incidence of postponed care compared to other systems (*b* = 0.747, SE = 0.403).

Table 2 Results of multilevel logistic regressions on forgoing, postponing or being denied care from the general practitioner (N=)

	Postponing care				Forgoing care				Denied care			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	-3.960***	-3.996***	-4.550***	-4.721***	-4.401***	-4.282***	-4.759***	-4.795***	-6.635***	-6.722***	-6.977***	-7.219***
	(0.266)	(0.274)	(0.299)	(0.371)	(0.273)	(0.279)	(0.298)	(0.366)	(0.612)	(0.623)	(0.640)	(0.673)
Individual characteristics – backgr.												
Gender (Ref = Woman)	0.003	-0.005	0.010	0.010	0.482***	0.477***	0.457***	0.457***	0.123	0.090	0.080	0.079
	(0.061)	(0.063)	(0.064)	(0.064)	(0.061)	(0.063)	(0.064)	(0.064)	(0.104)	(0.107)	(0.108)	(0.108)
Birth Cohort (Ref. = 1921-1930)												
1931-1940	0.102	0.108	0.119	0.121	0.272	0.286	0.333	0.335	1.166**	1.197**	1.245**	1.248**
	(0.202)	(0.202)	(0.205)	(0.205)	(0.209)	(0.209)	(0.212)	(0.212)	(0.535)	(0.536)	(0.537)	(0.537)
1941-1950	0.013	0.033	0.123	0.127	0.247	0.258	0.397*	0.400*	1.121**	1.193**	1.349**	1.354**
	(0.196)	(0.199)	(0.203)	(0.203)	(0.204)	(0.206)	(0.210)	(0.210)	(0.529)	(0.531)	(0.534)	(0.534)
1951-1960	-0.097	-0.061	0.116	0.121	0.121	0.114	0.345	0.348	1.353**	1.467***	1.693***	1.703***
	(0.199)	(0.203)	(0.208)	(0.208)	(0.207)	(0.210)	(0.215)	(0.215)	(0.530)	(0.534)	(0.537)	(0.537)
1961-1970	-0.163	-0.109	0.127	0.137	-0.066	-0.097	0.191	0.198	1.260**	1.423**	1.678***	1.698***
	(0.233)	(0.238)	(0.243)	(0.243)	(0.234)	(0.239)	(0.243)	(0.243)	(0.557)	(0.564)	(0.566)	(0.566)
1971-1980	0.138	0.198	0.541	0.553	-0.664	-0.702	-0.299	-0.293	1.861**	2.061**	2.400***	2.424***
	(0.565)	(0.569)	(0.577)	(0.577)	(0.678)	(0.680)	(0.682)	(0.682)	(0.844)	(0.852)	(0.855)	(0.855)
Highest education	-0.014	-0.013	-0.001	0.002	-0.003	-0.004	0.010	0.011	-0.016	-0.012	-0.000	0.007
	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)	(0.013)	(0.013)	(0.020)	(0.020)	(0.020)	(0.021)
At Work (Ref = No)	-0.467***	-0.453***	-0.307***	-0.309***	-0.444***	-0.450***	-0.300***	-0.302***	-0.221	-0.193	-0.029	-0.040
	(0.109)	(0.109)	(0.111)	(0.111)	(0.103)	(0.104)	(0.105)	(0.105)	(0.161)	(0.162)	(0.163)	(0.163)
Household characteristics												
Number of children		-0.016	-0.018	-0.019		0.024	0.027	0.026		-0.022	-0.021	-0.023
		(0.032)	(0.032)	(0.032)		(0.031)	(0.031)	(0.031)		(0.050)	(0.049)	(0.049)
Number of grandchildren		0.020	0.017	0.017		-0.034**	-0.039***	-0.039***		0.044*	0.041*	0.041*
		(0.015)	(0.015)	(0.015)		(0.015)	(0.015)	(0.015)		(0.023)	(0.023)	(0.023)
In couple (Ref. = No)		-0.014	0.023	0.022		-0.044	-0.001	0.001		-0.104	-0.063	-0.067
		(0.075)	(0.076)	(0.076)		(0.071)	(0.072)	(0.072)		(0.121)	(0.120)	(0.120)
Household Income		-0.000	-0.000	-0.000		-0.000	-0.000	-0.000		-0.000	0.000	-0.000
		(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)

	Postponing care				Forgoing care				Denied care			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Individual characteristics - health												
+1 ADL limitations (Ref. = 1 or no limitations)			-0.016	-0.016			-0.154	-0.155			0.058	0.061
			(0.100)	(0.100)			(0.098)	(0.098)			(0.159)	(0.159)
Chronic diseases			0.112***	0.112***			0.200***	0.200***			0.120**	0.122**
			(0.036)	(0.036)			(0.034)	(0.034)			(0.057)	(0.057)
Serious diagnoses			0.135***	0.135***			-0.014	-0.014			-0.001	-0.003
			(0.047)	(0.047)			(0.045)	(0.045)			(0.076)	(0.076)
Health is good (Ref. = Health is Bad)			-0.222***	-0.224***			-0.339***	-0.341***			-0.499***	-0.506***
			(0.075)	(0.075)			(0.072)	(0.072)			(0.122)	(0.123)
Country characteristics												
Health system (Ref.= Sup.&ch. oriented public)												
Performance and primary-care oriented public				0.121				0.211				0.403
				(0.473)				(0.456)				(0.395)
Regulation oriented public				0.747*				-0.106				0.470
				(0.403)				(0.391)				(0.348)
Low-supply and low performance mixed				-0.069				-0.061				0.103
				(0.343)				(0.327)				(0.298)
Supply- and performance oriented private				0.512				0.713				0.519
				(0.551)				(0.524)				(0.463)
Model												
Variance Country	0.476***	0.479***	0.539***	0.434***	0.426***	0.433***	0.451***	0.401***	0.327***	0.311**	0.288**	0.251**
	(0.155)	(0.156)	(0.174)	(0.143)	(0.134)	(0.136)	(0.141)	(0.128)	(0.126)	(0.123)	(0.116)	(0.105)
Variance Household	2.445***	2.437***	2.495***	2.495***	2.396***	2.385***	2.350***	2.352***	2.355***	2.320***	2.267***	2.267***
	(0.324)	(0.323)	(0.336)	(0.336)	(0.322)	(0.320)	(0.323)	(0.323)	(0.608)	(0.604)	(0.614)	(0.614)
Observations	33,262	33,262	33,262	33,262	33,262	33,262	33,262	33,262	33,262	33,262	33,262	33,262
Number of groups	27	27	27	27	27	27	27	27	27	27	27	27

*Note: Significance levels: * p < .05 * * p < .01 * ** p < .001. Standard errors between brackets.*

Discussion and conclusion

Deferred care became a prominent issue during the COVID-19 pandemic. While previous studies have predominantly examined which chronic diseases were inadequately managed, there is a paucity of research on the characteristics of deferred care. This study addresses this gap by categorising these characteristics into three distinct groups.

Based on previous research, we hypothesised that socioeconomic factors would significantly impact deferred care (9). Contrary to our expectations, no significant associations were found with income, and education level did not influence deferred care either. Thus, we conclude that socio-economic factors do not play as substantial a role in deferred care as initially anticipated.

In examining postponed care, we found that working respondents experienced less postponed care. One hypothesis is that employed individuals were permitted to leave their homes during the COVID-19 lockdown, although this theory lacks sufficient empirical support. Another hypothesis posits that non-working respondents, who were generally older, faced greater challenges in mobilising to visit their general practitioner. However, this hypothesis is not corroborated by our data, as we would expect a significant correlation between age and postponed care. Our data revealed that respondents with poorer self-reported health were more likely to experience postponed care during the COVID-19 pandemic. This finding is consistent with Hooper et al.'s study in the United States, which similarly identified a significant association between worse self-reported health and increased delays in accessing medical care (17).

Our study found that female respondents were more likely to forgo care than male counterparts during the COVID-19 pandemic. This disparity may be attributed to several factors, including differences in healthcare-seeking behaviour, caregiving responsibilities, and socio-economic conditions. Women often bear a disproportionate burden of caregiving, which can limit their ability to prioritise their own health needs (18). Additionally, socio-economic challenges such as lower income and employment instability may further exacerbate the likelihood of women foregoing necessary medical care(19). These findings highlight the need for gender-sensitive healthcare policies and interventions that address the unique barriers faced by women in accessing timely and adequate healthcare. Furthermore, our study revealed that respondents with more grandchildren, and presumably older grandchildren, experienced less foregone care during the pandemic. This trend may be attributed to the support and assistance provided by older grandchildren, which could facilitate access to healthcare services (20). Additionally, older grandchildren may be crucial in encouraging and assisting their grandparents in seeking medical care, reducing the likelihood of foregone care.

We found that respondents with more chronic illnesses were more frequently denied care during the COVID-19 pandemic. This trend highlights the challenges individuals face with multiple health conditions in accessing necessary medical services, possibly due to the increased complexity and resource demands of their care. Conversely, respondents who perceived their health as good were less likely to be denied care. This finding suggests that self-perceived health status plays a crucial role in healthcare access, with those who feel healthier encountering fewer barriers (17).

The analysis of different healthcare system clusters revealed no significant differences in the rates of postponing, forgoing, or denied care across the various clusters. However, regulation-oriented public systems showed a higher incidence of postponed care, likely due to their lower emphasis on primary care.

In conclusion, the study provides valuable insights into the factors influencing healthcare access during the COVID-19 pandemic. We found that female respondents were more likely to forgo care, highlighting the need for gender-sensitive healthcare policies. Additionally, respondents with more grandchildren experienced less foregone care, emphasising the importance of family support systems. Our data also revealed that individuals with more chronic illnesses were more frequently denied care, while those with better self-perceived health were less likely to face such barriers.

These findings highlight the profound impact of self-perceived health status on healthcare access during periods of crisis, highlighting the urgent need for targeted interventions to support vulnerable populations in maintaining timely access to essential healthcare services. Additionally, the results emphasize the necessity for healthcare systems to develop strategies that ensure equitable access to care for individuals with chronic illnesses, while also considering the subjective health perceptions of patients. Furthermore, the importance of a strong primary care orientation is evident in ensuring timely access to healthcare services, as bureaucratic processes and strict public regulation may contribute to delays, highlighting the need for healthcare policies that prioritize primary care to mitigate such issues. Together, these insights reveal the complex interplay between individual characteristics and healthcare access, highlighting critical areas for improvement in healthcare systems to better serve all populations, especially during times of crisis.

However, our study has several limitations. Though the longitudinal design allows for observing changes over time, it may still be subject to biases inherent in self-reported data. The sample size and demographic diversity may affect the generalizability of our results. External factors such as varying healthcare policies and pandemic responses across regions could also influence the findings. Another important limitation of the SHARE database is that the age comparison starts at 50 years and older. This restriction means that the findings may not fully represent the healthcare access challenges faced by younger populations during the COVID-19 pandemic. Consequently, the insights gained from this study are primarily applicable to older adults, potentially overlooking significant barriers experienced by individuals under 50. Future research should aim to include a broader age range to provide a more comprehensive understanding of deferred care across all age groups. Future research should also focus on expanding the sample size and demographic diversity to enhance generalizability. Investigating the impact of specific socio-economic factors and family dynamics on healthcare access in diverse populations will also be crucial for developing targeted policies and support systems. Furthermore, research should be conducted to target patient populations who cannot find their way to the general practitioner, addressing barriers such as transportation, digital literacy, and awareness of available services.

Addressing the barriers to healthcare access revealed during the COVID-19 pandemic is crucial for developing resilient healthcare systems that ensure timely and equitable care for all, especially during future crises. By focusing on the complex interplay between individual characteristics and healthcare access, and emphasizing the importance of primary care, healthcare policies can be better tailored to meet the needs of vulnerable populations. This approach will not only improve healthcare outcomes during emergencies but also strengthen the overall healthcare infrastructure, making it more adaptable and responsive to the needs of all individuals.

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Appendices

Appendix 1

Reibling. et al provides us with a clustering of healthcare systems. These clusters are based on several dimensions, including supply, public-private mix, access regulation, primary care orientation and performance. The supply dimension can be examined via two factors. The first factor is current expenditure on healthcare per capita. The second factor is number of general practitioners per one thousand inhabitants, and is a measure for the human resources supply. The second dimension of healthcare systems is the public-private mix. To operationalize the public-private mix, three key indicators should be considered: the proportion of public health expenditures within the total health expenditure, the percentage of out-of-pocket payments in the total health expenditure, and the method of specialist compensation (either fee-for-service or salary). Access to health care, a third dimension, is measured by two factors. The first factor is whether patients need to register with a general practitioner. The second factor is whether a referral from the general practitioner is necessary for access to specialist care. A fourth dimension is primary care orientation, which is determined by the ratio of general practitioners to specialists, as well as the proportion of health expenditure on outpatient care. The final dimension is the dimension of performance, which analyses the extent to which systems strive to achieve performance goals in prevention and quality of care (16).

This generated 5 clusters of healthcare systems. The first cluster is *supply and choice oriented public systems*. These systems have substantial financial and human resources from public funding, allowing citizens free choice among providers and specialists to work on a fee-for-service basis, which may lead to induced demand. It also has the highest proportion of general practitioners compared to other systems. This cluster was used as a reference category for it is the largest of the five clusters. Countries included in this cluster are Austria, Belgium, Czechia, Germany, France, Luxembourg and Slovenia. The second cluster is *performance and primary-care oriented public systems*. This cluster, dominated by public financing, spends less on healthcare and employs fewer doctors, with strong regulation limiting access to specialists and provider choice. Specialists are salaried, and the system emphasizes primary care, high outpatient spending, and prevention, particularly smoking. Most countries in this cluster are National Health Service countries. Countries included in this cluster are Finland, Greece, Portugal and Sweden. The third cluster is called *regulation oriented public systems*. With medium resources primarily from public funding, this system is distinguished by its strong public regulation, which limits provider choice and access. It features no formalized cost sharing and the lowest out-of-pocket expenses, but has less focus on primary care and lower performance in prevention and quality of care compared to the second cluster. Countries included in this cluster are Cyprus, Denmark, Spain and Italy. The fourth cluster is *low-supply and low performance mixed systems*. Characterized by low resources in terms of expenditures and doctors, this system relies heavily on public financing for nearly three-quarters of its expenditures but leads in out-of-pocket payments. It has strong access and some choice regulations without national cost sharing, resulting in high out-of-pocket expenses. This system has the lowest primary care orientation and the poorest performance in prevention and quality of care among the five clusters. This includes the following countries: Bulgaria, Estonia, Croatia, Hungary, Lithuania, Latvia, the Maldives, Poland, Romania and Slovakia. The last cluster is the *supply- and performance oriented private systems* cluster. This final system, like cluster one, has high healthcare expenditures and a high supply of resources. Despite the majority of funding being public, it is labelled a private system due to significant private financing and out-of-pocket

expenses. There are no national access regulations, but private and social insurance plans may have them, and cost sharing regulations like deductibles are used to control access. This system spends the most on outpatient care, has a medium GP-to-specialist ratio, and achieves medium to high performance, distinguishing it from other generous but mediocre-performing systems. This includes the countries of Switzerland and Israel (16).