Ciência & Saúde Coletiva
cienciaesaudecoletiva.com.br
ISSN 1413-8123. v.30, n.9
DOI: 10.1590/1413-81232025309.11922023

Health care utilization after COVID-19 in persons with non-communicable diseases in Rio Grande, Rio Grande do Sul, Brazil

Utilização de serviços de saúde após COVID-19 em pessoas com doenças não transmissíveis em Rio Grande, Rio Grande do Sul, Brasil

Utilización de servicios de salud después de la COVID-19 en personas con enfermedades no transmisibles residentes en Rio Grande, Rio Grande do Sul, Brasil

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Abstract *The aim is to evaluate the health care utilization after COVID-19 in people with non-communicable diseases (NCDs) living in Rio Grande, Rio Grande do Sul, Brazil. We used data from the Sulcovid-19, a longitudinal study carried out with individuals who had COVID-19. Overall, 2,919 participants were asked if they attended any health care services after COVID-19 infection. We asked participants about medical diagnosis of systemic arterial hypertension (SAH), diabetes mellitus (DM), respiratory diseases (RD), and heart diseases (HD). We used poisson regression to assess the association between health care utilization and NCDs. Having a NCD was associated with an increased likelihood of using urgent and emergency services (prevalence ratio [PR] 1.67, 95%CI 1.33; 2.11). An increased use of specialized services (i.e., cardiologist) is highlighted among individuals with at least one NCD (PR 3.77, 95%CI 2.97; 4.80), SAH (PR 3.47, 95%CI 2.97; 4.31), and DM (PR 3.87, 95%CI 3.11; 4.81). People with NCDs required more health care services after COVID-19, regardless of their disease when compared to those without it.*
Key words *COVID-19, Health services research, Noncommunicable diseases*

Resumo *O objetivo é avaliar a utilização dos serviços de saúde após a COVID-19 em pessoas com doenças crônicas não transmissíveis (DCNT) residentes em Rio Grande, Rio Grande do Sul, Brasil. Utilizamos dados do Sulcovid-19, estudo longitudinal com indivíduos que tiveram COVID-19. No total, 2.919 participantes foram questionados se procuraram algum serviço de saúde após a COVID-19. Questionamos os participantes sobre o diagnóstico médico de hipertensão arterial sistêmica (HAS), diabetes mellitus (DM), doenças respiratórias (DR) e doenças cardíacas (DC). Utilizamos regressão de Poisson para avaliar a associação entre utilização de serviços de saúde e DCNT. Ter uma DCNT foi associado a uma maior probabilidade de utilizar serviços de urgência e emergência (razão de prevalência [RP] 1,67, IC95% 1,33; 2,11). Um aumento no uso de serviços especializados (por exemplo, cardiologista) é destacado entre indivíduos com pelo menos uma DCNT (RP 3,77, IC95% 2,97; 4,80), HAS (RP 3,47, IC95% 2,97; 4,31) e DM (RP 3,87, IC95% 3,11; 4,81). Pessoas com DCNT necessitaram de mais serviços de saúde após a COVID-19, independentemente da doença, quando comparadas àquelas sem DCNT.*
Palavras-chave *COVID-19, Pesquisa em serviços de saúde, Doenças não comunicáveis*

Resumen *El objetivo es evaluar la utilización de servicios de salud después de la COVID-19 en personas con enfermedades no transmisibles (ENT) residentes en Rio Grande, Rio Grande do Sul, Brasil. Utilizamos datos del estudio longitudinal Sulcovid-19 realizado con individuos que tuvieron COVID-19. En total, se preguntó a 2,919 participantes si acudieron a algún servicio de salud después de la infección por COVID-19. Se les preguntó a los participantes sobre el diagnóstico médico de hipertensión arterial sistémica (HAS), diabetes mellitus (DM), enfermedades respiratorias (ER) y enfermedades cardíacas (EC). Utilizamos regresión de Poisson para evaluar la asociación entre la utilización de servicios de salud y las ENT. Tener una ENT se asoció con una mayor probabilidad de utilizar servicios de urgencias y emergencias (razón de prevalencia [RP] 1.67, IC95% 1.33; 2.11). Se destaca un aumento en el uso de servicios especializados (por ejemplo, cardiólogo) entre individuos con al menos una ENT (RP 3.77, IC95% 2.97; 4.80), HAS (RP 3.47, IC95% 2.97; 4.31) y DM (RP 3.87, IC95% 3.11; 4.81). Las personas con ENT requirieron más servicios de salud después de la COVID-19, independientemente de su enfermedad, en comparación con aquellas sin ENT.*
Palabras clave *COVID-19, Investigación de servicios de salud, Enfermedades no transmisibles*

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Introduction

The COVID-19 pandemic has triggered several changes in health care service at all levels[1]. With the fast disease dissemination and consequently increased mortality, health care services needed to be restructured and adjusted worldwide[2]. Urgency and emergency medical services were prioritized[3], and primary and specialized care services had to be restructured hampering patients follow-up. Thus, this scenario led to impaired disease management of patients with non-communicable diseases (NCDs), worsening the clinical status of their pre-existing disease[4].

A study conducted in the Americas showed that NCDs prevention and treatment services were impaired because health care professionals were reallocated to aid patients with COVID-19[5]. Patients with diabetes, cardiovascular disease and cancer decreased their health care utilization in Germany during social restriction measures[6]. In Brazil, a study showed that scheduling appointments, acquiring medications, and accessing scheduled appointments were difficult for people with NCDs[7]. This population uses health services twice as much compared to people without NCDs[7] and they have a 70.0% higher risk of complications due to COVID infection, increasing their vulnerability when chronic conditions are not well controlled and managed[8]. A study conducted in the Rio Grande do Sul state, southern Brazil, revealed that 43.1% of people with NCDs required medical care, and 28% reported difficulties in managing their condition during social distancing[9].

These changes generate negative impacts on the health of people with NCDs since COVID-19 can aggravate their condition increasing the risk of death[10]. Furthermore, evidence on health care utilization is important for planning future actions to reduce mortality and disease-related complications. Thus, this study aimed to evaluate health care utilization after COVID-19 in people with NCDs in individuals from Rio Grande, Rio Grande do Sul, Brazil.

Methods

Study design

We analyzed the baseline data from the Sulcovid-19 study, a longitudinal study that track health indicators in individuals infected by SARS-CoV-2 in the city of Rio Grande, Rio Grande do Sul, Brazil. Participants were 18 or older, have received a COVID-19 diagnosis through RT-PCR testing between December 2020 and March 2021, experienced symptoms related to COVID-19, and have sought medical care in Rio Grande. The study protocol was approved by the Health Research Ethics Committee (CEPAS) of the Federal University of Rio Grande (FURG) (CAAE: 39081120.0.0000.5324) following the rules and regulatory guidelines for Research involving human beings. The participants had their rights respected, ensuring their willingness, anonymity, and the possibility of withdrawal at any time, as recommended by the Resolution of the National Health Council No. 466, dated December 12th, 2012. Ethical principles were upheld through verbal (during telephone data collection) and consent form signature (during home visits). Both consents were thoroughly explained to the participants, and the verbal consent was approved by the Research Ethics Committee.

Setting

The study was conducted in the city of Rio Grande, Rio Grande do Sul state, Brazil. Rio Grande is located at the southern coast of the state and has a population of approximately 212,881 inhabitants. We contacted the Epidemiological Health Surveillance department of Rio Grande. Subsequently, a list comprising 4,014 individuals who had tested positive for SARS-CoV-2 through RT-PCR, along with their relevant details such as name, address, phone number, and the presence of symptoms was compiled. We excluded individuals who had incomplete data in the epidemiological surveillance patient list, any cognitive impairment, and who were in long-stay institutions or deprived of freedom (prisons), leading to 3,822 individuals being considered eligible for the study. Further details can be found in Figure 1.

Participants

Eligible participants were contacted by a telephone call and invited to take part in the study. When telephone calls were not possible or participants were not reached after five attempts, a home visit was made. Individuals who were not located after five contact attempts and two home visits were considered as lost. The interviews were conducted by previously trained interviewers and lasted 15-20 minutes.

The data were collected using the Redcap software. The instrument was designed to be applied both by phone and in-person (using tablets), covering semi-structured questions

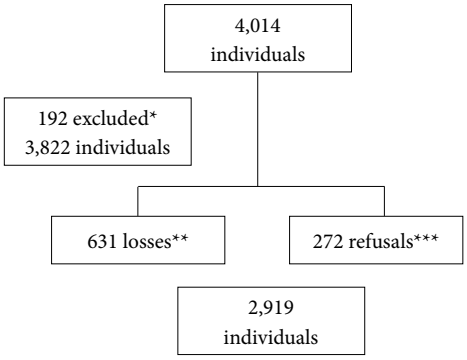

Figure 1. Recruitment and exclusion process of individuals infected by SARS-CoV-2. Sulcovid-19 Survey.

*Excluded due to lack of information such as address and telephone. **Individuals who did not respond to the three telephone contacts and who were not found at home during home visits were considered losses. Individuals whose addresses could not be found were also considered lost. *** Individuals' refusals included, among others, lack of time and interest in talking about their infection.

Source: Authors.

that were built based on standardized instruments. Questions addressed socioeconomic variables, COVID-19 symptoms during and after the acute infection phase, health care utilization, health conditions, fatigue, physical activity, behavior and food safety, functional capacity, musculoskeletal symptoms, and behavioral characteristics. The instrument was previously tested through a pilot study conducted with individuals meeting the inclusion criteria but who had been infected in a period prior to that specified in the study. Further information regarding the study design and recruitment process can be found elsewhere[11].

Variables

We asked participants about a medical diagnosis of the following NCDs: systemic arterial hypertension (SAH), diabetes mellitus (DM), respiratory diseases (ie., asthma/bronchitis/emphysema/chronic obstructive pulmonary diseases) (RD), and heart diseases (HD). The NCDs variable was created considering those participants with at least one of the four self-reported diseases as a dichotomized variable (no/yes).

We asked participants whether they used health care after COVID-19. The following services were listed: urgency and emergency services (e.g., emergency room, urgent care unit), basic health unit, general practitioner, emergency room (in portuguese "pronto socorro"), emergency care unit (in portuguese "unidade de pronto atendimento"), private emergency care unit (in portuguese "unidade de pronto atendimento particular"), medical specialists (i.e., pulmonologist, cardiologist, psychiatrist, neurologist), specialized services (e.g., neurologist, pulmonologist, cardiologist, psychiatrist, psychologist, physical therapist, speech therapist), pulmonologist, neurologist, cardiologist, psychiatrist, physical therapist, psychologist, and speech therapist. All questions related to health care utilization were dichotomized (yes/no).

The following covariates were used to adjust for possible confounding: sex (male/female), age (19-29/30-39/40-49/50-59/60 or more), ethnicity (white; yellow/black; brown; indigenous), educational level (elementary school/high school/college education), marital status (married; living with partner/single; separated; widowed) and economic class (A/B; C; D/E)[12].

Statistical methods

Descriptive data is presented as proportions (%) with their corresponding 95% confidence intervals (95%CI). We used Poisson regression to evaluate the relationship between health care utilization after COVID-19 and NCDs. Adjusted analyzes were performed using Poisson regression with robust adjustment of variance. Furthermore, the Poisson model estimates measures of prevalence ratio (PR) with 95%CI. All associations with 95%CI with no overlap between categories were considered statistically significant. Data were analyzed using the statistical package Stata 16.1.

Results

A total of 3,822 participants with a positive COVID-19 test were eligible for the study and after losses and refusals 2,919 were interviewed (76.4%). Participant's characteristics are displayed in Table 1. Briefly, most of the participants aged 18-59 (83.3%), were female (58.6%), white (77.9%), lived with a partner (60.6%), had high school education (42.2%), and were from economic class C (54.8%). NCDs diagnosis was reported by 41.5%, being 25.3% SAH, 10.1% DM, 9.0% HD, and 16.8% RD.

Table 2 shows the prevalence of health care utilization according to independent variables.

Table 1. Characteristics of participants with absence and presence of NCDs in Rio Grande, Rio Grande do Sul, Brazil, 2021 (n = 2,919).

Variable	% 95%CI									
	NCDs		SAH		DM		RD		HD	
	No (1681)	Yes (1191)	No (2160)	Yes (733)	No (2605)	Yes (292)	No (2409)	Yes (488)	No (2630)	Yes (260)
Sex										
Male	45.3	36.0	44.2	33.0	42.0	36.0	43.0	33.2	42.0	35.8
	42.9;47.6	33.4;38.8	42.1;46.3	29.7;36.5	40.1;43.9	30.6;41.7	41.1;45.0	29.1;37.5	40.0;43.8	30.1;41.8
Female	54.7	64.0	55.8	67.0	58.0	64.0	57.0	66.8	58.1	64.2
	52.3;57.1	61.2;66.6	53.7;57.9	63.4;70.3	56.1;60.0	58.3;69.4	55.0;58.9	62.4;70.9	56.2;60.0	58.1;69.9
Age (years)										
18-29	26.9	13.1	27.3	3.1	23.4	1.3	20.3	25.3	22.8	5.0
	24.8;29.1	11.3;15.1	25.5;29.2	2.1;4.7	21.8;25.1	0.5;3.6	18.8;22.0	21.6;29.4	21.2;24.4	2.9;8.5
30-39	32.7	15.7	30.9	9.9	26.7	7.2	26.2	22.8	27.3	7.3
	30.4;34.9	13.8;18.0	29.0;31.9	7.9;12.3	26.0;29.4	4.8;10.9	24.4;28.0	19.3;26.7	25.7;29.1	4.7;11.3
40-49	21.5	21.7	21.3	22.6	22.1	17.0	21.9	20.6	22.3	15.1
	19.3;23.6	19.4;24.1	19.6;23.1	19.6;25.7	20.6;23.8	13.0;21.8	20.3;23.6	17.3;24.4	20.8;24.0	11.2;20.4
50-59	11.2	20.5	11.3	26.0	13.8	26.3	15.2	14.2	14.4	20.9
	9.7;12.8	18.3;22.9	10.1;12.7	22.9;29.3	12.5;15.1	21.5;31.7	13.8;16.7	11.4;17.6	13.1;15.8	16.3;26.4
60 or more	7.6	28.9	9.1	38.4	12.9	48.0	16.4	17.1	13.1	51.6
	6.4;9.0	26.4;31.6	7.8;10.4	34.9;42.0	11.8;14.3	42.3;53.9	15.0;17.9	14.0;20.7	14.5	45.4;57.6
Skin Color										
White/ Yellow	78.6	76.7	78.2	77.0	77.7	79.5	78.4	75.2	77.7	78.7
	76.6;80.5	74.2;79.0	76.4;79.9	73.8;80.0	76.0;79.2	74.4;83.8	76.7;80.0	71.2;78.8	76.1;79.2	73.3;83.3
Black/ Brown/ indigenous	21.4	23.3	21.8	23.0	22.3	20.5	21.6	24.8	22.3	21.2
	19.5;23.4	21;0;25.8	20.0;23.6	20.1;26.2	20.8;24.0	16.2;25.6	20.0;23.3	21.2;28.8	20.7;23.9	16.7;26.7
Education										
Never studied	0.2	0.9	0.3	1.1	0.4	1.8	0.6	0.2	0.2	3.8
	0.09;0.6	0.05;1.7	0.01;0.7	0.5;2.3	0.02;0.7	0.7;4.3	0.03;0.9	0.02;1.4	0.01;5.1	2.0;7.1
Elementary	18.8	33.3	19.6	40.8	22.2	48.9	24.9	24.5	22.6	48.3
	17.0;20.7	30.7;36.1	17.9;21.3	37.2;44.5	20.6;23.9	43.0;54.8	23.2;26.6	20.9;28.6	21.0;24.2	42.0;54.6
High school	48.0	38.5	46.5	36.9	45.3	34.1	45.3	38.2	45.1	33.3
	45.6;50.5	35.8;41.4	44.4;48.7	33.3;40.5	43.3;47.2	28.7;39.9	43.3;47.3	33.9;42.6	43.2;47.0	27.6;39.6
College education	33.0	27.2	33.6	21.2	32.1	15.2	29.2	37.1	32.1	14.6
	30.7;35.3	24.7;29.8	31.6;35.6	18.3;24.4	30.4;33.9	11.4;20.0	27.4;31.0	32.9;41.5	30.2;33.9	10.6;19.7
Marital status										
Married/ living with partner	60.6	60.6	59.4	64.1	60.1	64.6	61.9	53.8	60.8	58.2
	58.2;62.9	57.8;63.3	57.3;61.4	60.5;67.5	58.2;62.0	58.9;70.0	60.0;63.9	49.3;58.2	58.9;62.7	52.0;64.1
Single/ separated/ widowed	39.4	39.4	40.6	36.0	39.9	35.4	38.1	46.2	39.2	41.8
	37.1;41.7	36.7;42.2	38.5;42.7	32.5;39.4	38.0;41.8	30.1;41.1	36.2;40.0	41.8;50.7	37.3;41.1	35.9;48.0
Economic class										
A/B	15.7	14.8	16.0	13.0	15.8	10.4	14.5	18.7	15.7	10.1
	14.0;17.8	12.7;17.0	14.5;17.7	10.6;15.7	14.4;17.3	7.2;14.6	13.1;16.1	15.3;22.4	14.3;17.2	6.8;14.6
C	57.2	50.7	56.1	50.5	55.1	51.1	55.9	48.7	55.3	47.9
	54.8;59.7	47.8;53.6	53.9;58.2	46.8;54.3	53.1;57.1	45.1;57.1	53.8;57.9	44.1;53.3	53.3;57.3	41.6;54.3
D/E	27.1	34.5	27.9	36.5	29.1	38.5	29.6	32.7	29.0	42.0
	24.9;29.3	31.8;37.4	26.0;29.9	33.0;40.2	27.3;30.9	32.9;44.4	27.7;31.5	28.5;37.2	27.2;30.8	35.9;48.4

SAH: systemic arterial hypertension; DM: diabetes mellitus; HD: heart diseases; RD: respiratory diseases; NCDs: non-communicable chronic diseases.

Source: Authors.

Private emergency care units showed the highest prevalence regardless of disease. When analyzed by disease, the highest prevalence was observed for private emergency care units for HD (53.5%; 95%CI 35.1-70.7), while the lowest prevalence was observed for speech therapist for SAH (0.3; 95%CI 0.07-1.1), and DM (0.3; 95%CI 0.05-2.4). Health care utilization among individuals with NCDs was higher in all services when compared to those without NCDs. These differences ranged from 2 to 50%, as observed in the use of private emergency for HD.

The crude analysis between healthcare services and NCDs can be found in Table 3. Table 4 shows the adjusted analyzes between these variables. Overall, the high prevalence of health care utilization among participants with NCDs was up to four times when compared to participants without NCDs. Specifically, participants with NCDs had a higher prevalence of urgent and emergency services utilization compared to individuals without NCDs (PR = 1.67; 95%CI: 1.33-2.11). When analyzed by specific NCDs, only HD was associated with emergency room

Table 2. Prevalence of health care utilization after COVID-19 according to NCDs in individuals of Rio Grande, Rio Grande do Sul, Brazil, 2021 (n = 2,919).

Variable	% 95%CI					
	Without NCDs	NCDs	SAH	DM	RD	HD
Use of urgency and emergency services[a]	10.6 (9.2;12.2)	15.2 (13.3;17.4)	15.6 (13.1;18.4)	12.8 (9.4;17.2)	18.4 (15.4;22.1)	15.5 (11.6;20.5)
Basic health unit	23.7 (21.7;25.8)	33.5 (30.8;36.2)	35.6 (32.2;39.2)	39.8 (34.3;45.6)	33.3 (29.3; 37.7)	35.7 (30.0; 41.8)
General practitioner	23.7 (21.7;25.8)	30.0 (27.4;32.7)	31.3 (28.0;34.8)	29.9 (24.9;35.4)	29.1 (25.2;33.3)	32.8 (27.3;38.8)
Emergency room	2.0 (1.4;2.8)	3.7 (2.8;5.0)	4.0 (2.8;5.7)	3.1 (1,6;5.9)	5.2 (3.5;7.5)	5.0 (2.9;8.5)
Emergency care unit	7.5 (6.3;8.8)	12.7 (11.0;14.8)	12.9 (10.7;15.6)	10.7 (7.6;14.8)	15.0 (12.1;18.5)	11.6 (8.2; 16.2)
Private emergency care unit	2.5 (1.9;2.4)	44.0 (36.2;52.1)	46.8 (36.9;57.0)	42.0 (25.6;60.3)	41.3 (30.6;52.9)	53.3 (35.1;70.7)
Medical specialists[b]	11.7 (10.2;13.3)	32.1 (29.5;34.8)	37.2 (33.8;40.8)	36.4 (31.2;42.1)	30.4 (26.4; 34.6)	52.1 (46.0;58.2)
Specialized services[c]	16.1 (14.5;18.0)	36.3 (33.6;39.1)	40.3 (36.8;43.9)	39.5 (34.0;45.3)	36.5 (32.3;40.9)	54.7 (48.5;60.7)
Pulmonologist	5.2 (4.2;6.4)	10.2 (8.6;12.1)	11.1 (9.0;13.6)	11.7 (8.5;15.9)	14.8 (11.9;18.3)	12.0 (8.5;16.5)
Neurologist	1.9 (1.3;2.6)	4,9 (3.9;6.4)	6,7 (5.1;8.8)	6,5 (4.2;10.2)	5,6 (3,8;8.0)	9,3 (6,3;13,5)
Cardiologist	5.5 (4.5;6.7)	24.8 (22.4;27.3)	30.9 (27.6;34.4)	29.6 (24.6;35.1)	20.0 (16.3;23.4)	47.9 (41.8;54.0)
Psychiatrist	3.6 (2.8;4.6)	4.3 (3.3;5.6)	4.4 (3.1;6.2)	6.5 (4.2;10.0)	4.9 (3.3;7.3)	3.5 (1.8;6.6)
Physical therapistterapeut	2.3 (2.8;4.6)	4.8 (3.7;6.2)	5.9 (4.4;7.9)	4.8 (2.9;8.0)	5.4 (3.7;7.8)	5.8 (3.5;9.4)
Psychologist	5.5 (4.5;6.7)	7.8 (6.3;9.4)	7.2 (5.5;9.3)	8.2 (5.6;12.0)	10.5 (8.1;13.6)	8.1 (5.3;12.1)
Speech therapist	0.4 (0.2;0.9)	0.8 (0.4;1.5)	0.3 (0.07;1.1)	0,3 (0,05;2.4)	1,4 (0,7; 3.1)	1,2 (0,4;3.6)

NCDs: non-communicable chronic diseases; SAH: systemic arterial hypertension; DM: diabetes mellitus; HD: heart diseases; RD: respiratory diseases. [a] Emergency room, urgent care unit, private urgent care unit or private emergency. [b] Pulmonologist, cardiologist, psychiatrist, neurologist. [c] Neurologist, pulmonologist, cardiologist, psychiatrist, psychologist, physical therapist, speech therapist.

Source: Authors.

Table 3. Crude analysis of health care utilization after COVID-19 according to NCDs in individuals of Rio Grande, Rio Grande do Sul, Brazil, 2021 (n = 2,919).

Variable	% 95%CI				
	NCDs	SAH	DM	HD	RD
Use of urgency and emergency services[a]	1.83 1.52;2.19	1.56 1.30;1.88	1.21 0.92;1.59	1.35 1.03;1.77	1.84 1.51;2.23
Basic health unit	1.41 1.25;1.59	1.42 1.25;1.60	1.50 1.28;1.75	1.32 1.11;1.57	1.25 1.08;1.44
General practitioner	1.26 1.12;1.43	1.27 1.11;1.45	1.15 0.96;1.39	1.28 1.06;1.54	1.12 0.96;1.31
Emergency room	1.87 1.20;2.92	1.78 1.13;2.80	1.18 0.59;2.34	2.05 1.15;3.67	2.37 1.48;3.77
Emergency care unit	1.71 1.36;2.14	1.49 1.18;1.88	1.11 0.78;1.58	1.23 0.86;1.75	1.73 1.35;2.22
Private emergency care unit	2.07 1.41;3.05	1.67 1.13;2.46	1.60 0.95;2.69	1.07 0.57;2.04	2.06 1.37;3.10
Medical specialists[b]	2.76 2.36;3.22	2.57 2.35;2.96	1.97 1.66;2.34	3.05 2.64;3.52	1.67 1.42;1.96
Specialized services[c]	2.24 1.96;2.56	2.08 1.84;2.35	1.71 1.46;2.01	2.52 2.21;2.88	1.64 1.43;1.88
Pulmonologist	1.95 1.50;2.55	1.85 1.42;2.41	1.72 1.21;2.43	1.75 1.22;2.49	2.55 1.95;3.33
Neurologist	2.67 1.74;4.10	3.27 2.20;4.87	2.28 1.40;3.72	3.45 2.21;5.39	2.04 1.32;3.16
Cardiologist	4.49 3.59;5.60	4.01 3.35;4.82	2.50 2.03;3.07	4.68 3.94;5.55	1.57 1.27;1.94
Psychiatrist	1.19 0.83;1.72	1.15 0.77;1.71	1.78 1.10;2.86	0.89 0.46;1.74	1.33 0.86;2.06
Physical therapistterapeut	2.10 1.41;3.15	2.30 1.56;3.40	1.48 0.95;2.57	1.84 1.08;3.15	1.78 1.15;2.76
Psychologist	1.42 1.07;1.88	1.16 0.85;1.58	1.33 0.88;2.01	1.30 0.84;2.02	1.90 1.40;2.59
Speech therapist	1.81 0.67;4.83	0.39 0.09;1.72	0.55 0.07;4.17	2.17 0.62;7.49	3.14 1.22;8.06

SAH: systemic arterial hypertension; DM: diabetes mellitus; HD: heart diseases; RD: respiratory diseases. [a] Emergency room, urgent care unit, private urgent care unit or private emergency. [b] Pulmonologist, cardiologist, psychiatrist, neurologist. [c] Neurologist, pulmonologist, cardiologist, psychiatrist, psychologist, physical therapist, speech therapist.

Source: Authors.

and emergency care unit use (PR 2.14, 95%CI 1.30; 3.54; PR1.70, 95%CI 1.31;2.20, respectively). The high prevalence of basic health unit utilization greater among in those participants with at least one NCD (PR 1.29, 95%CI 1.13; 1.46), as well as in those with SAH (PR 1.24, 95%CI 1.07; 1.43), DM (PR 1.23, 95%CI 1.02; 1.47) and HD (PR1.27, 95%CI 1.10; 1.47). The higher utilization of medical specialists and specialized services draws attention, which can be up to 3 times higher among individuals with NCDs. Among specialists, an increased use of specialized services (i.e., cardiologist) is highlighted among individuals with at least one NCD (PR 3.77, 95%CI 2.97; 4.80), SAH (PR 3.47, 95%CI 2.97; 4.31), and DM (PR 3.87; 95%CI 3.11; 4.81).

Discussion

We revealed a high prevalence of health care utilization after COVID-19 by people with NCDs, regardless of disease. Urgency and emergency services were highly used by participants with SAH and HD. When analyzing all NCDs, basic health units were used 30% more, except for RD. An increased use was observed for medical specialists and specialized services, with emphasis for cardiologist.

Urgency and emergency services utilization was 70% higher among participants with NCDs infected with COVID-19. Because of the COVID-19 pandemic healthcare services were reorganized and directed all their efforts to care infected patients[5,13]. NCDs are a risk factor for COVID-19 severity[14], and the course of infection can aggravate pre-existing conditions[13]. Monitoring NCDs in primary care might have been impaired due to the increased demand and focus directed to COVID patients[15]. Consequently, the increased utilization of urgency and emergency services for these patients can be explained by the lack of follow-up and further complications related to NCDs[16]. Only HD was associated with emergency rooms utilization , which is one of the main risk factors for increasing COVID-19 severity[17]. In addition, COVID-19 has serious implications for the cardiac system which can aggravate pre-existing conditions[18] requiring the use of urgency and emergency services.

In Brazil, basic health units are linked to the Unified Health System (known as SUS, for its initials in Portuguese), and offer health care free

Table 4. Adjusted analysis of health care utilization after COVID-19 according to NCDs in individuals of Rio Grande, Rio Grande do Sul, Brazil, 2021 (n = 2,919).

Variable	PR (95%CI)				
	NCDs	SAH	DM	RD	HD
Use of urgency and emergency services[a]	1.67 (1.33;2.11)	1.35 (1.05;1.73)	0.96 (0.67;1.38)	1.17 (0.82;1.65)	1.75 (1.39;2.21)
Basic health unit	1.29 (1.13;1.46)	1.24 (1.07;1.43)	1.23 (1.02;1.47)	1.13 (0.93;1.38)	1.27 (1.10;1.47)
General practitioner	1.27 (1.12;1.44)	1.34 (1.17;1.54)	1.16 (0.95;1.41)	1.42 (1.17;1.74)	1.09 (0.93;1.28)
Emergency room	1.75 (1.06;2.88)	1.60 (0.95;2.70)	0.93 (0.43;2.00)	1.86 (0.99;3.52)	2.14 (1.30;3.54)
Emergency care unit	1.68 (1.30;2.17)	1.31 (1.00;1.73)	0.95 (0.63;1.42)	0.97 (0.64;1.47)	1.70 (1.31;2.20)
Private emergency care unit	1.04 (0.78;1.49)	1.10 (0.81;1.48)	0.94 (0.58;1.53)	1.18 (0.76;1.83)	0.91 (0.65;1.26)
Medical specialists[b]	2.50 (2.12;2.96)	2.37 (2.02;2.78)	1.69 (1.39;2.06)	2.72 (2.28;3.24)	1.61 (1.37;1.90)
Specialized services[c]	2.06 (1.78;2.37)	1.95 (1.69;2.24)	1.58 (1.32;1.89)	2.35 (2.01;2.76)	1.55 (1.34;1.79)
Pulmonologist	1.75 (1.31;2.34)	1.65 (1.22;2.22)	1.52 (1.02;2.27)	1.50 (0.97;2.33)	2.57 (1.95;3.38)
Neurologist	2.05 (1.27;3.31)	2.67 (1.64;4.33)	1.62 (0.87;3.00)	1.91 (1.19;3.06)	1.94 (1.06;3.56)
Cardiologist	3.77 (2.97;4.80)	3.47 (2.79; 4.31)	1.81 (1.42;2.31)	3.87 (3.11;4.81)	1.53 (1.23;1.91)
Psychiatrist	1.15 (0.78;1.70)	1.30 (0.84;2.01)	2.16 (1.28;3.65)	1.10 (0.57;2.12)	1.10 (0.67;1.78)
Physical therapistterapeut	1.79 (1.12;2.86)	1.94 (1.20;3.12)	1.25 (0.68;2.30)	1.15 (0.56;2.39)	1.75 (1.09;2.83)
Psychologist	1.46 (1.09;1.96)	1.31 (0.93;1.83)	1.58 (1.00;2.50)	1.64 (1.03;2.60)	1.68 (1.22;2.32)
Speech therapist	1.21 (0.33;4.45)	X	0.65 (0.64;6.54)	2.41 (0.84;6.91)	0.66 (064;6;35)

SAH: systemic arterial hypertension; DM: diabetes mellitus; HD: heart diseases; RD: respiratory diseases. Adjusted for: sex, age, skin color, education, marital status and economic class. [a] Emergency room, urgent care unit, private urgent care unit or private emergency. [b] Pulmonologist, cardiologist, psychiatrist, neurologist. [c] Neurologist, pulmonologist, cardiologist, psychiatrist, psychologist, physical therapist, speech therapist.

Source: Authors.

of charge to the entire population. More than 70% of the Brazilian population depends exclusively on SUS. NCDs patients are one of the priority care lines of this service, being monitored by the basic health units and ensuring a qualified, integral, and longitudinal care[19]. Considering the characteristics of this health care service, an increased utilization was expected. Regardless of COVID-19, a national survey conducted during the pandemic reported a health care utilization prevalence of 24% among people with NCDs[20]. This is similar to the prevalence found before the pandemic (25.6%) when compared to those without NCDs[7].

The high prevalence of specialized health care utilization was threefold in participants with NCDs when compared to their peers without chronic conditions. People with NCDs are regularly using the healthcare system to manage their diseases, having regular GP appointments or assessing prescribed medication[21]. However, people with NCDs have a high prevalence of ICU admission and endotracheal intubation, which might exacerbate the disease scenario changing treatment strategies in the long-term, since the inflammatory response of COVID-19 has the potential to provoke an atypical immune system response, consequently affecting several

body systems[22]. Also, in Brazil there is a delay in appointments for specialized services (e.g., cardiologist) in the public health system, and in some cases people choose to pay for these services out of pocket[23]. Most of our sample is highly educated and at least from the middle class, which might increase their access to specialized services, as well as their NCDs management.

Historically access to specialized care in SUS presents hardships related to the insufficient number of medical doctors and vacancies for appointments, high dependence on the private sector, and budget difficulties leading to fragmentation, disorganization, and discontinuity of services, and especially a repressed demand for specialized services[24]. The greater difficulty in using health services and consequently the increase in the problem can be explained by the extinction of government health policies such as the Family Health Support Center (NASF), policies to promote higher education in regions of greater social vulnerability, the return to the poverty line and the increased demand for services due to the sequelae of COVID or even the lack of continuity of care in periods of isolation, in addition to the political context experienced in Brazil in recent years[19,25].

Our results must be interpreted taking into account their limitations and strengths. First, as interviews were conducted after COVID-19 without a specific time frame, memory bias cannot be discarded. Second, we only interviewed symptomatic subjects tested with RT PCR. Thus, precluding an evaluation of health care utilization in asymptomatic patients or those diagnosed through serological tests. Third, our study was conducted with data from COVID-19 survivors, and survival bias might be a concern. Finally, as this is a cross-sectional study, caution is needed regard to recall bias, and it is important to note that the data belong to a local population and, therefore, cannot be extrapolated to other regions or cities. However, our study shows unprecedented data regarding health care utilization in patients with NCDs and COVID-19 in southern Brazil with a non-hospital representative sample.

Conclusion

Our results showed an association between people with NCDs and increased health care utilization after COVID-19, regardless of their specific disease. Also, one should note that both primary and secondary health care utilization showed higher prevalence among this population. Whilst there was a concern of a healthcare collapse during COVID-19 outbreak in a short- and mid-term, the increased in health care utilization in the long-term for people who had COVID-19, and specifically people with NCDs should be a concern for policy makers and stakeholders.

Finally, this study provides relevant information about the health care service burden for people with NCDs who have contracted SARS-CoV-2. People with NCDs tend to access health care services more frequently compared to healthy individuals, and the infection can intensify this demand. Future studies should focus on the long-term health care service burden, as well as strategies to alleviate the system through new treatments and disease management approaches.

Collaborations

YP Vieira, EL Caputo, JQS Rocha, MOS, and SMS Duro planned and conducted the analyses, YP Vieira prepared the manuscript and performed the data collection, MO Saes and SMS Duro developed the questionnaire and performed the reviews. YP Vieira, EL Caputo and JQS Rocha contributed to the writing of the article. All co-authors contributed to the conception or conception of the manuscript, or acquisition, analysis or interpretation of data, as well as reviewed and approved the content of the manuscript.

Acknowledgment

The study was carried out with financial support from FAPERGS (Fundação de Amparo à Pesquisa do Rio Grande do Sul, Brazil) Grant No. 21/2551-0000107-0 SUS Research Program: Shared Health Management (PPSUS).

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Article submitted 01/08/2023
Approved 19/08/2024
Final version submitted 21/08/2024

Chief editors: Maria Cecília de Souza Minayo, Romeu Gomes, Antônio Augusto Moura da Silva, Vânia de Matos Fonseca