Disasters and the historical recurrence of tragedies: implications for the health and aging process

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Abstract   *In a context of disaster recurrence, naturalization or demotion of the concept to tragedy does not include all the dynamics and processes involved in affecting the communities and population groups most vulnerable to death and illness, such as the older adults. This paper aims to describe and analyze the socioeconomic, environmental, and health context of impact on older adults in four municipalities in the states of Santa Catarina and Rio de Janeiro. We carried out documentary research and open data survey of sociodemographic, environmental, economic, and health aspects of these locations and population groups. Also, descriptive, interrupted time series and documentary analyses were integrated. Among the results, collected documents and data point to the lack of preventive or mitigating actions for priority groups. Significant changes in hospital admissions for older adults were observed for some groups of causes. We conclude that institutional learning based on collective construction is required to corroborate the disruption of the disaster repetitive cycle.*
Key words   *Natural disasters, Older adults, Hospitalization, Socioeconomic aspects*

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Introduction

A tragedy is something unexpected. It surprises us and demands quick organization, either by society or bodies with experience responding to such events or occurrences. Disasters related to environmental events, in turn, cannot be understood as tragedies or even as natural events in Brazil, given the historical context marked by their repetitive cycle.

Between 2003 and 2015, for example, on average, 25.7% of Brazilian municipalities declared an emergency or state of public calamity[1]. This is a matter of concern, as disasters, in general, can impact health at different times, from hours to years, with direct, indirect, and interrelated effects, whose performance setting becomes challenging to health care and surveillance systems[2] and different sectors and secretariats working directly with the population at the municipal level.

Therefore, how we understand disasters is fundamental for the design of actions to face the triggering processes and their expressions in the social fabric, given the chronicity of related, frequently recurring events. Disasters are expressed as a social process in a social time[3,4]. Four elements are essential in characterizing a disaster from the perspective of the social construction of risk. First, harmful physical events related to hydrological, meteorological, hydrological, or climatological phenomena. These are followed by human exposure to these events, the social and environmental vulnerability conditions for their occurrence, and the insufficient local capacity to address the adverse effects or to take actions to reduce the risk of being affected in these events[5].

However, on the national scene, little is known about the impact on older adults and the aging process in these events, whose complexity is expressed in interconnected processes of a social, environmental, economic, cultural, technological, political, and physical nature, with disruptions in daily life that can lead to biological or social death[4,6].

It is essential to recognize the history of disasters and generate knowledge/learning from these experiences, as Narváez et al.[6] remind us, to prevent future risks, reduce existing risk, prepare the response, respond, rehabilitate, recover, and rebuild, within an intervention process that encompasses risk and disaster in different perceptions and social actors. Thus, we aim to describe and analyze the socioeconomic, environmental, and health context of the impact on older adults in four municipalities in the states of Santa Cata-

rina and Rio de Janeiro severely affected by disasters between 2008 and 2011.

Methods

The data and information collected refer to four Brazilian municipalities affected by major disasters in the last decade, related to hydro-meteorological events, recognized at the federal level: Ilhota/SC, Blumenau/SC, Nova Friburgo/RJ, and Teresópolis/RJ. The studied public consists of older adults residing in these locations, aged over 60 years. The criterion was adopted for analysis purposes, but as Neri[7] reminds us, social class, ethnicity, profession, education, and other psychological and biological criteria are intertwined with age for such characterization.

This is quantitative-qualitative research, using mixed methods for data collection and analysis. The methods of data collection, documentary research, and secondary data collection in databases were composed as described in Table 1. Document analysis, descriptive statistical analysis, and analysis of interrupted time-series of the ARIMA class were employed through the STATA® software for processing them (Chart 1).

Different elements of the socioeconomic, environmental, and legal context and data on hospital admissions, disaster history, and human impact in these scenarios are gathered. As Castellanos[8] reminds us, an effort is required to understand health as a process. The health situation and health conditions are expressions of social reproduction processes, resulting from the interdependent relationship between complex processes, such as biological, ecological, economic, and reproductive forms of awareness and behavior. Therefore, the elements incorporated in the analysis described in Table 1 are essential for understanding the outlook of these municipalities and the possible implications of disasters for the health of older adults and the processes involved in human aging. Processes, due to the heterogeneity of the segment, and the life courses experienced by them[7].

At first, all chapters of the ICD-10 were included for the analysis of data from hospital admissions. However, due to the absence or low frequency of records for some groups of diseases, five chapters were removed from the sample (Chapter VIII, XV, XVI, XVII, and XXI), as they did not allow the analysis of time-series in the ARIMA class.

We opted for the analysis of interrupted time-series proposed by Antunes and Cardo-

Chart 1. Summary of the methodological procedures adopted.

Specific objectives	Sources employed	Procedures (collection and analysis)
To describe and analyze the socioeconomic and environmental impact in disasters in four municipalities affected by disasters in 2008 and 2011	. IBGE Cidades (2010 Demographic Census) - Demographic density - Life expectancy at birth - Aging rate - Proportion of private households occupied in subnormal clusters - Proportion of households in subnormal clusters without access to the general water supply network - Proportion of households in subnormal clusters without access to the general sewage or rainwater network - Proportion of households in urban areas with regular planning, connected to the general distribution network without a culvert/manhole	Search for data regarding the studied municipalities ↓ Data extraction ↓ Tabulation and interpretation using Excel®
	. Atlas Brasil (based on the 2010 Demographic Census) - MHDI - Income per capita (in R$) - Proportion of extremely poor - Proportion of poor - Gini Index	Search for data regarding the studied municipalities ↓ Data extraction ↓ Tabulation and interpretation using Excel®
	. Sites (to search for the Master Plans of the studied municipalities) - Official websites of the four municipalities studied - Legislation Portal - Official Gazette	Search for current master plans ↓ Analysis and selection of papers on disaster risk management
	. S2iD - Recognition system for emergency and public calamity situations (Jan/1970 to Dec/2015) →Ordinances, AVADANs, FIDEs, Newspaper, Technical report. - AVADANs (Nov/2008 [SC] and Jan/2011 [RJ]) → number of displaced, homeless, and affected in general aged ≥60 years	Documentary research ↓ Survey of the historical series of records in months and year + Selection of documents referring to the studied disasters
To analyze the morbidity profile of older adults living in four municipalities affected by disasters in 2008 and 2011.	. S2iD - AVADANs (Nov/2008 [SC] and Jan/2011 [RJ])→ number of deaths, sick, and injured aged ≥60 years	↓ Impact data extraction ↓ Tabulation and interpretation using Excel®
	. SIH - People ≥ 60 years old admitted to the SUS from Jan/2000 to Jan/2018, by place of residence and gender → Elderly hospitalization rate per 10,000 hospitalizations in the city for all age groups and sex.	Data collection ↓ Processing and tabulation of data using Excel® ↓ Analysis of interrupted time series (ARIMA) using Stata® Software
	. Care Network (DATASUS) - Proportion of population coverage estimated for the Family Health Strategy in the month and year of the disaster decree and in May 2018*	Data extraction ↓ Tabulation and interpretation using Excel®

* Month preceding data collection.

Captions: IBGE: Brazilian Institute of Geography and Statistics; S2iD: Integrated Disaster Information System of the National Secretariat for Civil Protection and Defense (SEDEC); AVADAN: Damage Assessment Form; FIDE: Disaster Information Form; Atlas Brasil: Atlas of Human Development in Brazil from a partnership between the United Nations Development Program (UNDP), the Institute for Applied Economic Research (IPEA), and the João Pinheiro Foundation (FJP); MHDI: Municipal Human Development Index; SIH: Hospital Information System of the Unified Health System (SUS); DATASUS: Information Technology Department of the Brazilian Unified Health System.

Source: Author elaboration

so[9]. The month of the disaster in the time series is demarcated as intervention (I), and when it is significant (p-value <0.05; 95% CI), it indicates an immediate impact (known as a step or level change) or a progressive impact (known as a ramp or trend change) on the values of the time-series.

Results and discussions

Characterization of the municipalities

In November 2008 in Santa Catarina and in January 2011 in the State of Rio de Janeiro, large landslide and flood disasters affected several municipalities, among which four stand out here for the highest proportion of deaths and, at the same time, similar geological and climatic characteristics, whose terrains are uneven, with a high slope and with a drainage network at the bottom of the valley[10].

Teresópolis/RJ, Nova Friburgo/RJ, and Blumenau/SC are large municipalities (over 100 thousand inhabitants). Among them, Blumenau/SC has a more significant number and concentration of residents. In turn, small-sized Ilhota/SC stands out for the lower levels of inequality, poverty, and extreme poverty (Table 1).

Teresópolis/RJ and Nova Friburgo/RJ have similar demographic density, life expectancy at birth, MHDI, and per capita income. Teresópolis/RJ has the most unfavorable scenario among the four municipalities, indicating the highest percentile of poverty, extreme poverty, households in subnormal clusters and without access to the public water supply network, and higher social inequality rate, although it follows the national average (Table 1).

On the other hand, Blumenau/SC stands out due to the higher life expectancy at birth and the lowest aging rate, and higher MHDI, average annual population growth rate, and per capita income. Conversely, it has a more significant proportion of households in subnormal clusters without access to a public sewage or rainwater network (Table 1).

The historical context of disasters

Given the historical limitation of the lack of records of disasters, the first records available online on the S2iD Platform of the Ministry of Regional Development date back to 1970.

The main records are flash floods (n=48), followed by storms (n=19), inundations (n=18),

landslides (n=8), floods (n=2), drought (n=1) and forest fire (n=1). Of the municipalities, only Teresópolis/RJ had a greater quantity of landslides.

Regarding the history of occurrences (Figure 1), Blumenau/SC has the most significant number of records on disasters available for public search (n=47) and the oldest among those available. Next is Ilhota/SC, with 28 records, starting in 1978; Teresópolis/RJ, with 13 records released from 1974 on; and Nova Friburgo/RJ, with four records, available as of 2005. Advances in civil protection and defense, with expanded teams, equipment, registration and communication system, enactment of laws, and legal provisions for financing actions[11], explain the increase in the number of records.

The disasters studied here are preceded by a long history of events that precede the records made available by the Civil Defense on the S2iD Platform. As the historical research by Mattedi[12] on the region of the Itajaí valley (SC) brought up, we have records of significant events in these locations dating back to the Brazilian Empire. Here we worked with official records. However, as the study by Venturado-Landmann[13] showed, some current large-scale disasters are not recognized through decrees.

One would expect to have instruments for planning and risk management in place given the annual recurrence of decrees of the most diverse sizes and types of disasters. However, in 2013, a survey drew attention to the situation of municipalities regarding the lack of preparedness for emergencies and public calamity, and 59.4% of the municipalities had no risk management plan[14].

In Teresópolis/RJ and Ilhota/SC, most of the listed instruments, such as "Land Use and Occupation Laws" or "Master Plan" that included the prevention of floods, flash floods, and landslides, and "Basic Sanitation Plan" for urban cleaning, solid waste management, and urban rainwater[14], were non-existent. None of the four municipalities had specific laws to prevent and fight floods, flash floods, or landslides, although recurring[14].

When analyzing the master plans in force, understanding that these are vital instruments for municipal management to direct actions to reduce the risk of disasters, we observed plans for measures in this regard. However, only Blumenau/SC updated its Master Plan after the disaster, with greater detail of disaster risk prevention actions.

In Ilhota/SC, through Complementary Law Nº 16/2007, in Art. 20, item I, floodable areas in

Table 1. Sociodemographic characterization of four municipalities affected by disasters in 2008 (SC) and 2011 (RJ), based on the 2010 Census, IBGE.

	Teresópolis/RJ	Nova Friburgo/RJ	Blumenau/SC	Ilhota/SC	Brazil
Inhabitants					
Demographic density (inhabitants/km²)	163,760	182,086	304,805	12,409	190,732,694
Residing older adults	210.78	194.97	591.02	48.79	22.43
Life expectancy at birth (in years)	13.2%	14.3%	9.7%	9.6%	10.8%
Aging rate	76.27	75.77	78.64	77.95	73.08
MHDI	27.5%	32.5%	23.1%	27.4%	26.56%
Mean annual population growth rate	0.730	0.745	0.806	0.738	0.727
Proportion of private households occupied in subnormal clusters	1.72	0.49	1.80	1.57	1.17
Proportion of households in subnormal clusters without access to the general water supply network	23.4%	0.15%	6.8%	-	5.62%
Proportion of households in subnormal clusters without access to the general water supply network	28.9%	0%	7.3%	-	11.7%
Proportion of households in urban areas with regular planning, connected to the general distribution network without a culvert/manhole	18.1%	18.6%	8.3%	50.1%	58.5%
Income, Poverty, and Inequality					
Per capita income (in BRL)	859.79	894.75	1,253.17	853.29	767.02
Proportion of extremely poor	1.58	0.57	0.12	0.29	5.9
Proportion of poor	7.06	4.08	1.02	0.97	8.5
Gini Index	0.56	0.51	0.46	0.38	0.56

Sources: 2010 IBGE Census and Municipal Human Development Atlas.

the rural zone are now permanent preservation areas, along with the tops of hills and springs. In Art. 298, the release of the land subdivision project requires the analysis of the presence of areas with risk of landslides, significant erosion, or inundation[15].

In Teresópolis/RJ, Complementary Law Nº 79/2006, in Art. 23, item II, establishes in the short term a Program to contain irregular occupations and remove the population from risk areas. Art. 61, item III, provides that land occupation allows soil permeability to reduce the risk of landslides, silting, and flooding but prohibits buildings on marshy land or land subject to flooding. The elimination of risk situations and the stabilization of slopes and stream banks are provided for in Art. 110, item II, paragraph f, including the regularization of settlements located in risk areas, according to Art. 114[16].

However, it is necessary to pay attention to the fact that, if risk mapping is at the service of the population since the use of technical risk maps is often limited to evict residents from certain areas without any group decision-making process, it should consider different intervention possibilities[4,11,17].

Blumenau/SC stands out, through Complementary Law No. 1181/2018, Art. 5, item III, for providing for the review of the Master Plan in the event of disasters that affect urban, environmental, or economic development[18]. Session XIII is dedicated to the Municipal Public Policy for Disaster Prevention, which gathers prevention, mitigation, preparation, response, and recovery actions to avoid or minimize the risks of disasters to return to "social normality"[18].

However, progress is needed in the debate in civil defense regarding "normality", permeat-
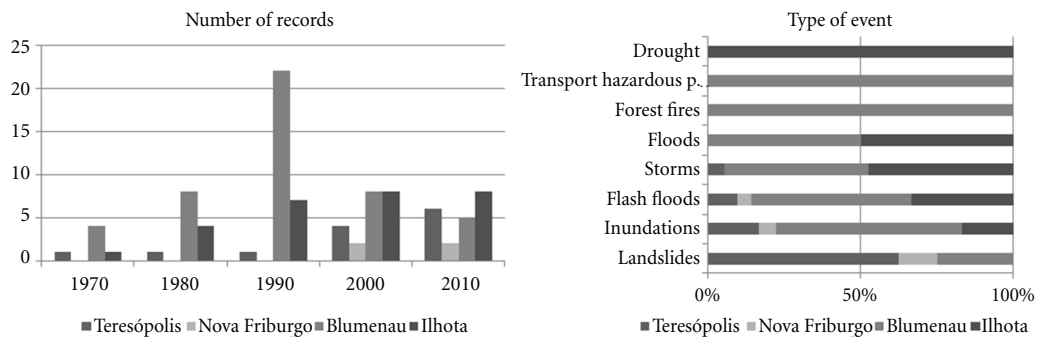
Figure 1. History of emergencies and public calamity between 1970 and 2015.

Source: S2ID/SEDEC (2018).

ed by continuous exposure to risks, especially in groups with "mobility restricted to the circuits of vulnerability"[19]. This consent/naturalization/incorporation of unacceptable conditions, unfair or unequal conditions is corroborated by the daily coexistence/exposure to such conditions and the ensuing lower expectations for their eradication[4,17,19].

Vulnerability is a relationship and not a situation of need to be supplemented[19]. Actions based on the compensation of assets are not sufficient to confront and interrupt the underpinning processes and relationships[19]. Therefore, the actions for confrontation must be directed towards the causes and relationships that generate vulnerability.

Considering population aging with quality, investment in integrated preventive actions in a systemic approach to disaster risk reduction would benefit reduced social, material, economic damages and losses and the lower exposure of the population to illnesses, injuries, traumas, and death risk. Hence, with public health gains for everyone in the aging process, not just older adults.

As addressed by the National Civil Protection and Defense Policy[20], preventive measures are the responsibility of the municipality and other federal entities. However, the budget and transfers of the union in 2020 for disaster risk preventive actions dropped dramatically compared to previous years. As the survey carried out by Folha de S. Paulo[21] shows, there was a progressive reduction in the budget for such actions in the last decade, and, in 2019, only a third of the budget was paid. In 2020, the available amount corresponded to only 6.7% of the 2012 available amount.

In the Master Plan in force in Nova Friburgo/RJ[22], currently under review, through Complementary Law Nº 24/2007, there is only a provision in Art. 11, item VII, and in Art. 27, the resettlement of populations that occupy risk areas. However, the housing solutions adopted in this and other municipalities studied would need to be revised due to the disasters decreed in Nov/2008 (SC) and Jan/2011 (RJ) as they go against the desires and rights of decent housing for those affected, in particular, that of older adults from rural areas[23].

Having instruments such as the Master Plan is the beginning of a risk management process, provided it is used in a more participatory and humanized way. Planning and managing to reduce the risk of disaster must occur together with the communities to not continue to have groups that are repeatedly vulnerable to such outcomes, whether they are death, missing people, homelessness, illness, or even social death[4].

The impact on older adults in the disasters decreed in Nov/2008 and Jan/2011

In Teresópolis/RJ, 28% of the population lives in areas at risk of inundations, flash floods, and mass movements. In Nova Friburgo/RJ, this percentile is 18% and in Blumenau, 25%[24]. The proportion of older adults living in such areas[25] is estimated at 13% in Nova Friburgo/RJ and 12% in Teresópolis/RJ. However, no such data were found for Blumenau/SC and Ilhota/SC.

Caution is recommended when reading the official data collected. In January 2011, official statistics (Table 2) accounted for 392 deaths in

Teresópolis/RJ. However, residents of the affected areas claim that the number of deaths is higher, as the missing were not adequately accounted for[11]. Also, there is a lack of data and documents, such as the AVADANs (except for Blumenau/SC and Ilhota/SC, as detailed in Table 2), data from field hospitals set up to serve those affected, and funds from donations and articulated by the public entity.

It is noteworthy in Ilhota/SC that the data on homeless, displaced, and affected people are the same, with older adults representing 8.6% of the total number of affected people of each type, showing estimated data at the time of the event. In the case of the homeless, the older adults represented 18.5% of those affected; 11.1% of the missing; 6.0% of the injured; 39.0% of the sick; and 3.8% of the dead, (Table 2).

In Blumenau/SC, in the data broken down by age, the elderly group comprised 12.8% of the homeless, 7.2% of the injured, and 3.3% of the sick. Thus, Ilhota/SC had greater representation of homeless older adults (0.7 times more significant) and sick (11.8 times greater) than Blumenau/SC at the time of formulating and filling out the AVADANs (Table 2).

Moreover, what happens to the health of aging groups when disaster strikes in the short and long term? An interrupted time series analysis of hospital admissions within the Unified Health System for all leading groups of diseases was conducted to draw a macro picture of the main changes related to the studied disasters (Figure 2).

An increase related to infectious causes and external causes was expected[2,26] according to disaster specificities. However, other causes also appeared (Box 3). At the point of intervention in the series, in Blumenau/SC, the annual percentage change (APC) for the Confidence Interval (CI) of 95% increased significantly in hospitalizations for infectious and parasitic diseases among older females +211 .2% (APC_{Min} +135.98%; +310.5% APC_{Max}; 95% CI) and male +145.05% (+88.65%; +218.32%; 95% CI). Then, hospitalizations for diseases of the genitourinary system among older females +32.6% (+11.03%; +58.3%; 95% CI) and males +26.29% (+0.47%; +58.8%; 95% CI) (Figure 2).

In Teresópolis/RJ, in the intervention of the series, the hospitalizations due to eye diseases and attachments for older females (APC +186.6%) (+27.6%; +543.6%; 95% CI) and males (APC +87%) (+9.3%; +219.9%; 95% CI) increased significantly; then, we have hospitalizations for blood diseases of and hematopoietic organs diseases among older females (APC +28.21%) (+2.8%; +59.9%; 95% CI); skin diseases in older females (APC +30.9%) (+10.9%; +54.5%; 95% CI) and males (APC +22.1%) (+5.98%; +40.7%; 95% CI); and genitourinary system diseases (APC +37.5%) (+11.1%; +70%; 95% CI) (Figure 2).

In Nova Friburgo/RJ, in the intervention of the series, we highlight hospitalizations due to digestive tract diseases among older females (APC +93.3%) (+46.2%; +155.6%; 95% CI); due to genitourinary system diseases among older males (APC +81%) (+38.6%; +136.4%; 95% CI); due to blood diseases and hematopoietic organs diseases among older females (APC +11.54%) (+3.9%; +19.7%; 95% CI); and due to the circulatory system diseases among older females (APC +15.8) (+4.5%; +28.45%; 95% CI) (Figure 2).

Ilhota/SC had long periods with data equal to zero in the series, compromising the adopted method, and the gender variable was removed, adding the data. Thus, seven chapters of the ICD-10 brought results. For the point of intervention of the series, only hospitalizations due to symptoms, signs, and abnormal test findings had an annual variation of +60.85% (Figure 2).

Some groups identified here, such as hospitalizations for infectious and external causes, are recurrent in these disasters and among this age group[2,9]. However, few studies on other disease groups were found in the literature.

With results that converge with those observed here is the retrospective cohort study[27] on the risk of ocular, dermatological, and gastric diseases in 22 municipalities in Taiwan affected by inundations over ten years. Among the different age groups, older adults were the most susceptible to the three types of diseases over the period studied.

Among the hospitalizations for infectious diseases, those for leptospirosis and dengue stood out in most of the cities studied, especially in the months after the intervention, for both genders. National studies carried out with other age groups also corroborate these findings, as observed by Xavier, Barcellos, and Freitas[26] and Pereira et al.[28].

Regarding genitourinary system diseases, a study in an earthquake context identified these as the third primary demand for medical care (10.9% of cases)[29]. Patients with a history of kidney problems may face difficulties accessing hemodialysis services, impacting hospitalization, as seen in the study after the passage of a hurricane,

Table 2. Distribution of affectation by age group in four municipalities.

	Nova Friburgo/RJ		Teresópolis/RJ		Blumenau/SC		Ilhota/SC	
	General	Older adult	General	Older adult	General	Older adult	General	Older adult
Homeless	4,528	--	9,110	--	25,000	--	3,500	300
Unsheltered	789	--	6,727	--	5,209	667	1,300	240
Displaced	--	--	--	--	--	--	3,500	300
Missing –AVADAN	--	--	--	--	--	6	18	2
Missing – Public Prosecutor's Office	274	1	295	7	--	--	--	--
Slightly injured	--	--	--	--	2311	163	50	3
Severely injured	--	--		--	72	8	17	1
Sick	--	--	--	--	480	16	41	16
Dead	429	--	392	--	24	--	26	1
Affected	5,746	--	16,229	--	103,000	--	3,500	300

Source: Civil Protection and Defense data for the State of Rio de Janeiro obtained by Freitas et al.[2]; AVADANs of Civil Defense and Protection of Santa Catarina available at S2ID and number of missing by the Public Prosecutor's Office of Rio de Janeiro.

in which 10.3% of older adults over 65 years old missed three or more sessions and 19.8% missed one to two sessions[30].

Concerning blood diseases, studies on older adults in these contexts were not found. Regarding the circulatory system, a study[31] noted a significant increase in the rates of hospitalizations for cardiovascular disease among older adults, such as those observed in this research.

Among the limitations of the method is the analysis by grouping causes of hospitalization by ICD-10 chapter and the use of social, economic, and environmental indicators aggregated by the municipality and not by census tract. Further research is required to explore this vast and complx topic in-depth, which has been little explored in the country.

When disasters occur, regardless of the associated event – inundation or landslides –, the impact is multidimensional[4], in a social time that transcends the officially recognized, involving various aspects of older adults' life, such as physical and mental health, housing, family, and community relationships, and the environment/living place[11].

Knowing the reality of the territory, the situations of impact by disasters and vulnerability circumscribed in it, as the indicators worked in this paper, can help services and programs, whether in the health, social assistance, or civil protection and defense sectors, to organize short, medium and long-term actions in partnership with the communities.

It is important to remember that the health situation of older adults in disasters reflects the context in which they live, including the fast aging of the population compared to European countries, with changes in the epidemiological profile that tend to be marked by long-term illnesses, comorbidities, and functional and cognitive limitations[8,11].

With the desire to break with the cycle of repeated tragedies in a setting of increasing population longevity, integrated DRR actions are suggested here, considering the heterogeneous aging profiles and the conditions of vulnerability experienced. Therefore, involvement between different actors is essential, such as municipal secretariats and bodies, private and non-governmental institutions, communities in areas at greater risk of disasters, and social groups – such as older adults, indigenous people, women, children, and people with a physical disability.

Final considerations

The municipalities studied have a long history of being affected by disasters. Considering this fact helps us understand the challenges that accompany them throughout their stories and the consequences of the priority or not of actions on the theme in the context experienced.

It should not be forgotten that we addressed here four municipalities with a good Municipal Human Development Index, life expectancy at

	Female			Male		
ICD-10 chapter	Full period	Intervention	Após Intervenção	After the intervention	Intervention	After the intervention
1	→	↓	↑	↑	↓	↑
2	↑	→	→	↑	→	→
3	→	↑	→	↓	→	→
4	→	↓	↓	↑	↓	↓
5	-	-	-	-	-	-
6	↓	→	↑	↓	→	↑
7	↑	↑	↓	↑	↑	↓
9	→	→	↓	↑	→	↓
10	↑	→	↓	↑	↓	↓
11	→	→	→	↑	↓	↓
12	→	↑	↓	→	↑	↓
13	→	→	→	↓	→	↑
14	→	↑	→	→	→	→
18	↑	→	→	→	→	↑
19	↑	↓	→	↑	↓	→
20	-	-	-	-	-	-

	Female			Male		
ICD-10 chapter	Full period	Intervention	Após Intervenção	After the intervention	Intervention	After the intervention
1	→	→	→	→	↓	↑
2	↑	↓	→	↑	→	→
3	→	↑	↓	→	→	→
4	→	→	↓	→	→	→
5	-	-	-	-	-	-
6	→	↓	→	→	↓	↑
7	-	-	-	-	-	-
9	→	↑	↓	↑	→	↓
10	→	→	→	↑	→	→
11	→	↑	↓	↑	→	↓
12	→	→	↓	→	→	→
13	↑	↓	→	→	→	→
14	→	→	→	→	↑	→
18	-	-	-	-	-	-
19	↑	→	→	↑	↓	→
20	↓	→	→	↓	→	→
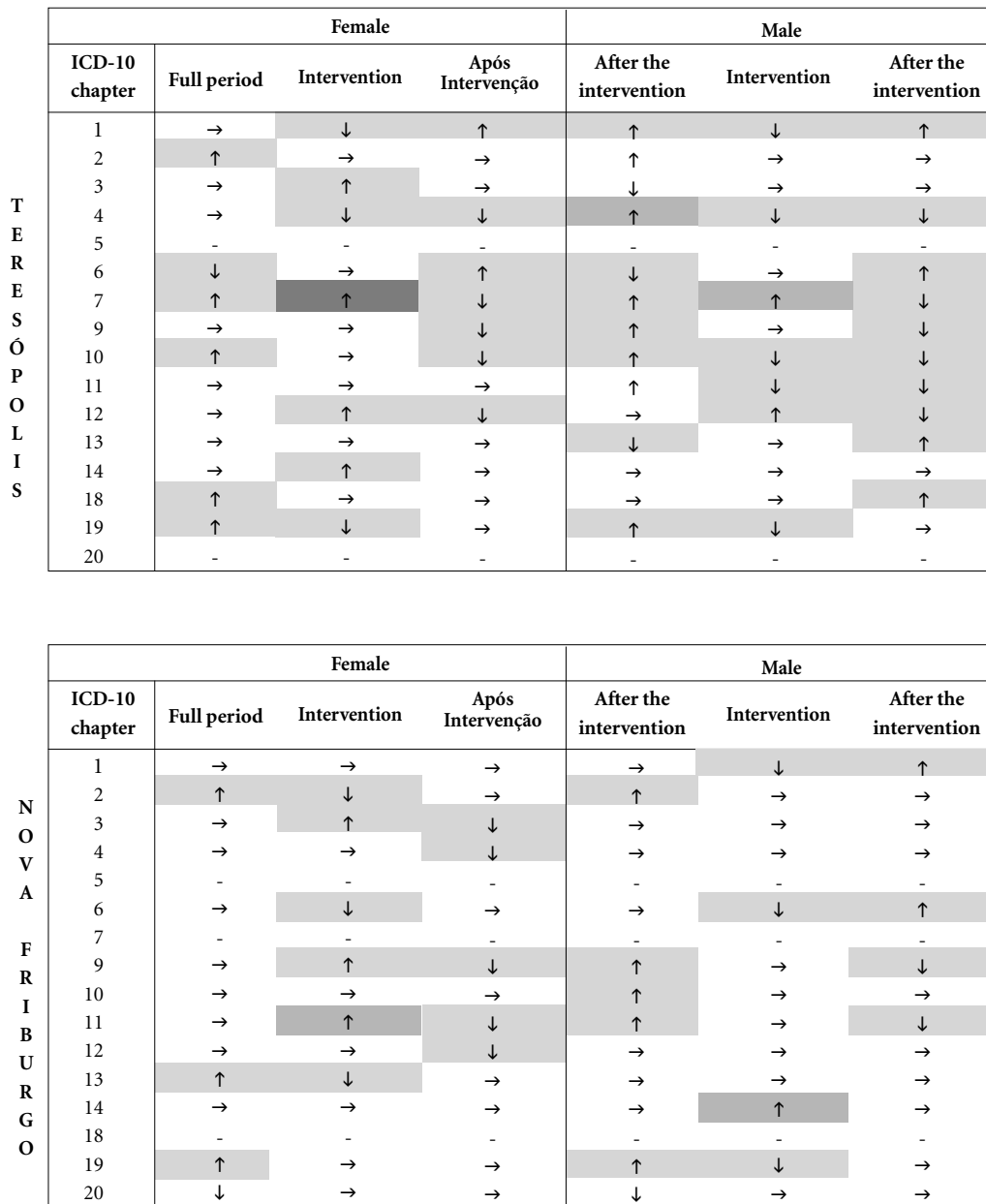
Captions: p<0.05 = significant

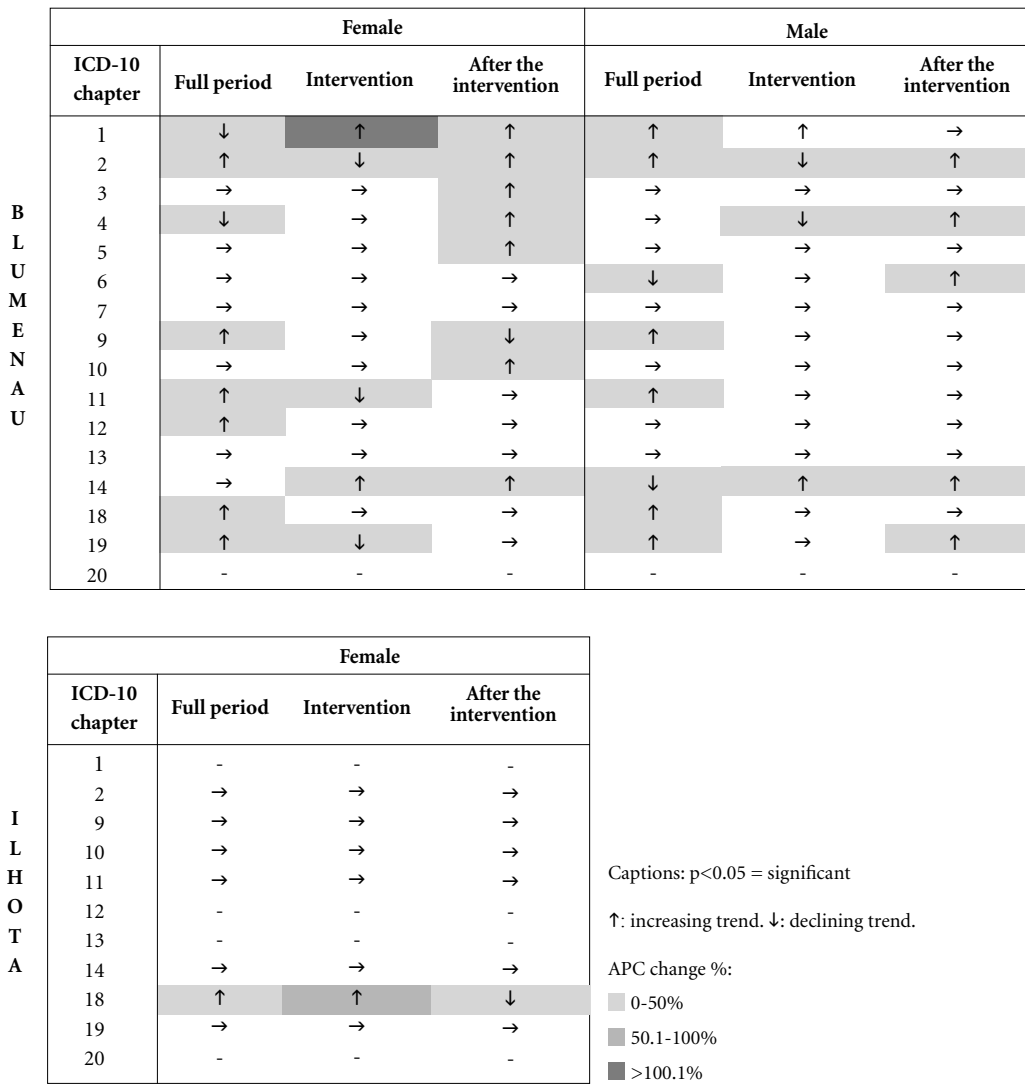↑: increasing trend. ↓: declining trend. APC change %: ▢ 0-50% ▤ 50.1-100% ▪ >100.1%

it continues

Figure 2. Level of significance and behavior of the interrupted time series of morbidity among older adults living in municipalities (Jan/2000-Jan/2018).

birth, and per capita income above the national average, with the proportion of poor people below the national average. However, when an event occurs, if there is no effective joint plan-

	Female			Male		
ICD-10 chapter	Full period	Intervention	After the intervention	Full period	Intervention	After the intervention
BLUMENAU						
1	↓	↑	↑	↑	↑	→
2	↑	↓	↑	↑	↓	↑
3	→	→	↑	→	→	→
4	↓	→	↑	→	↓	↑
5	→	→	↑	→	→	→
6	→	→	→	↓	→	↑
7	→	→	→	→	→	→
9	↑	→	↓	↑	→	→
10	→	→	↑	→	→	→
11	↑	↓	→	↑	→	→
12	↑	→	→	→	→	→
13	→	→	→	→	→	→
14	→	↑	↑	↓	↑	↑
18	↑	→	→	↑	→	→
19	↑	↓	→	↑	→	↑
20	-	-	-	-	-	-

	Female		
ICD-10 chapter	Full period	Intervention	After the intervention
ILHOTA			
1	-	-	-
2	→	→	→
9	→	→	→
10	→	→	→
11	→	→	→
12	-	-	-
13	-	-	-
14	→	→	→
18	↑	↑	↓
19	→	→	→
20	-	-	-

Captions: p<0.05 = significant

↑: increasing trend. ↓: declining trend.

APC change %:
☐ 0-50%
☐ 50.1-100%
■ >100.1%

Figure 2. Level of significance and behavior of the interrupted time series of morbidity among older adults living in municipalities (Jan/2000-Jan/2018).

Source: Author elaboration.

ning based on local knowledge, it can have consequences such as the repetition of disasters and institutional action based on announced tragedies.

Institutional learning is essential for better service provision, changing the paradigm of action centered on the response, and breaking with the production of situations that perpetuate disasters as recurrent tragedies. The knowledge generated needs to be shared with communities, different secretariats, and sectors of society. Having a scenario where disasters are perpetuated as part of the chronic crisis installed in the social fabric is unacceptable, as it incurs consequences for the survival, health, and well-being of the population exposed to risks.

Acknowledgments

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