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Analysis of mortality in children under 10 years due to choking in the Southern Region of Brazil: 2013-2022

Análise da mortalidade de crianças menores de 10 anos por engasgo na região Sul do Brasil: 2013-2022

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Abstract

Aim: To analyze mortality due to choking in children in the Southern Region of Brazil.

Methods: An ecological study with data extracted from the *"Sistema de Informação sobre Mortalidade" (SIM/DATASUS)* - Mortality Information System and the *"Instituto Brasileiro de Geografia e Estatística" (IBGE)* - Brazilian Institute of Geography and Statistics 2013 to 2022. Sociodemographic data on deaths due to foreign body aspiration were analyzed. Descriptive statistics were used to organize the research results.

Results: Between 2013 and 2022, there were 322 deaths due to choking in children aged zero to nine years in the Southern Region of Brazil. In 2013, the highest number was recorded with 44 cases, while 2020 had the lowest number with 24 deaths. In 2013, 11 children died for every one million inhabitants under the age of ten, and in 2020, six children died per one million inhabitants in this age group. Analyzing by sex, there were more deaths among boys, totaling 193 deaths, while girls accounted for 129 deaths. The male mortality rate was 0.098‰, higher than the female mortality rate, which was 0.069%, indicating that boys are approximately 42% more likely to die from choking than girls.

Conclusion: In summary, the study revealed a concerning mortality rate due to choking in children aged zero to nine years in the Southern Region of Brazil between 2013 and 2022. The analysis highlighted a higher mortality rate among boys, attributed to distinct behavioral characteristics. The predominance of food choking reinforces the need for awareness and effective preventive measures.

Keywords: Brazil, Children, Child Health, Gagging, Infant mortality.

Resumo

Objetivo: Analisar a mortalidade por engasgo em crianças na região Sul do Brasil.

Métodos: Estudo ecológico com dados extraídos do Sistema de Informação de Mortalidade pelo Departamento de Informática do Sistema Único de Saúde e da Fundação Instituto Brasileiro de Geografia e Estatística 2013-2022. Foram analisados dados sociodemográficos sobre óbitos por aspiração de corpo estranho. Utilizou-se estatística descritiva a fim de organizar os resultados de pesquisa.

Resultados: Entre 2013 e 2022, houve 322 óbitos por engasgo de crianças na idade de zero a nove anos na região Sul do Brasil. Em 2013 houve o maior número com 44 registros, enquanto em 2020 teve o menor número, com 24 óbitos. Em 2013, morreram 11 crianças a cada um milhão de habitantes menores de dez anos, e em 2020, seis crianças por um milhão de habitantes nessa faixa etária. Analisando por sexo, houve mais mortes entre meninos, totalizando 193 óbitos, enquanto as meninas contabilizaram 129 mortes. A taxa de mortalidade masculina foi de 0,098‰, superior à feminina, que foi de 0,069%, indicando que meninos têm aproximadamente 42% mais chances de morrer por engasgo que meninas.

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Conclusão: Em síntese, o estudo revelou uma preocupante mortalidade por engasgo em crianças na faixa etária de zero a nove anos na região Sul do Brasil entre 2013 e 2022. A análise destacou uma maior taxa de mortalidade entre os meninos, atribuída às características comportamentais. A predominância de engasgos por alimentos reforça a necessidade de conscientização e medidas preventivas eficazes.

Palavras-chaves: Brasil, Crianças, Engasgo, Mortalidade Infantil, Saúde da Criança.

Introduction

According to the Brazilian Ministry of Health, choking is defined as the body's defense mechanism to expel a foreign body that has reached the wrong path and is directed to the airways, aiming to protect these airways (1). Choking can occur in any age group; however, it is most common in children due to factors like insufficient dental support, immature chewing and failure in the laryngeal closure reflex (2, 3). Other related aspects include inadequate nutrition through the availability of solid foods such as peanuts, chestnuts, fruits with seeds, especially in children under four years of age, as well as the handling of small objects and toys with small or removable parts that are not suitable for the age (3, 4).

The clinical manifestations resulting from the aspiration of foreign bodies can be diverse, depending on the type, size and location of the foreign body, ranging from persistent cough and wheezing to sudden shortness of breath, hoarseness, and cyanosis (5, 6).

Furthermore, foreign body aspiration (FBA) can be classified into organic and inorganic causes: some of the organic causes include beans and peanuts, and inorganic causes include plastic pen caps, earrings, stones, plastic toys, among others (3, 4, 6). The diagnosis of FBA may vary depending on the interval between the accident and the onset of symptoms, therefore a diagnosis made within the first 24 hours is considered early; in most cases, however, diagnosis is only made after weeks or even months (3, 7).

In the United States, foreign body aspiration ranks as the fifth leading cause of death resulting from unintentional injuries (8). Similarly, in Brazil, FBA was among the top ten causes of child mortality in 2015 (9). This is a very common pediatric emergency among children aged zero to ten years that can cause various complications such as pneumonia, atelectasis, pneumothorax, massive hemorrhage and, in worst cases, death due to complete or partial obstruction of the larynx or trachea (10).

To date, there are no Brazilian studies investigating the number of deaths due to choking in children in the Southern Region of Brazil. Therefore, there is an urgent need for such studies to understand the aspects of choking mortality according to the reality of the Southern Region. This epidemiological knowledge can help better direct financial resources to services aimed at assisting this population (hospitals, health centers, daycares, and schools). These investments should also focus on educational initiatives to ensure that health professionals, teachers, and the community know how to prevent choking in children or respond effectively in an emergency. Knowing that death by choking is preventable, it becomes possible to get closer to achieving target 3.2 defined by the United Nations (UN) as one of the sustainable development goals: to end preventable deaths of newborns and children under five years of age (11). Therefore, the present study aims to analyze mortality due to choking in children in the Southern Region of Brazil.

Method

Ecological study conducted using data extracted from the *"Departamento de Informação e Informática do Sistema* Único *de Saúde" (DATASUS)* - Information Technology Department of the Unified Health System sourced from the *"Sistema de Informação sobre Mortalidade" (SIM/DATASUS)* - Mortality Information System and the *"Instituto Brasileiro de Geografia e Estatística" (IBGE)* - Brazilian Institute of Geography and Statistics (12, 13).

Data on confirmed deaths due to choking in the Southern Region of Brazil from 2013 to 2022, affecting children under 10 years of age, were analyzed. According to the International Statistical Classification of Diseases and Related Health Problems (ICD10), these causes of death were

coded as follows: inhalation and ingestion of food causing obstruction of the respiratory tract (W79), and inhalation and ingestion of other objects causing obstruction of the respiratory tract (W80). Different variables were analyzed, such as age group, year and place of death, sex and item that caused the choking. From data collection, descriptive statistics were applied to summarize and organize the research findings.

This study does not require submission to the Research Ethics Committee, as it will be based on the use of public databases. This procedure is aligned with the provisions of Art. I, Item III of Resolution 510/2016 of the National Research Council, which establishes guidelines and standards for research in human and social sciences.

Results

There were 322 documented deaths due to choking in children aged zero to nine years between 2013 and 2022 in the Southern Region of Brazil. **Table 1** presents the complete description of the sample and compares the variables between the years studied.

TABLE 1 - Analysis of deaths of children due to choking in the age group of zero to nine years in the Southern Region of Brazil.

Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Total** n(%)
n	44	35	37	32	28	25	25	24	30	42	
Deaths by age group, year											
< 1	35	25	29	21	21	19	16	18	20	35	239 (74,2)
1-4	8	10	7	7	5	5	6	5	6	5	64 (19,9)
5-9	1	0	1	4	2	1	3	1	4	2	19 (5,9)
Deaths by Sex											
Male	26	22	24	21	18	13	16	13	17	23	193 (59,9)
Female	18	13	13	11	10	12	9	11	13	19	129 (40,1)
Mortality rate Total	11,6	9,2	9,7	8,4	7,3	6,5	6,4	6,1	7,6	10,7	8,4
Mortality CID 10											
W79	37	32	27	26	25	19	23	21	23	39	272 (84,5)
W80	7	3	10	6	3	6	2	3	7	3	50 (15,5)

W79: Inhalation and ingestion of food causing obstruction of the respiratory system; W80: Inhalation and ingestion of others objects causing obstruction of the respiratory tract.

Figure 1 shows the number of deaths by state in Southern Brazil. In the ten years studied, the Southern Brazilian state with the highest number of deaths was Rio Grande do Sul, with the exception of the last three years of the analysis, in which Paraná occupied the first position.

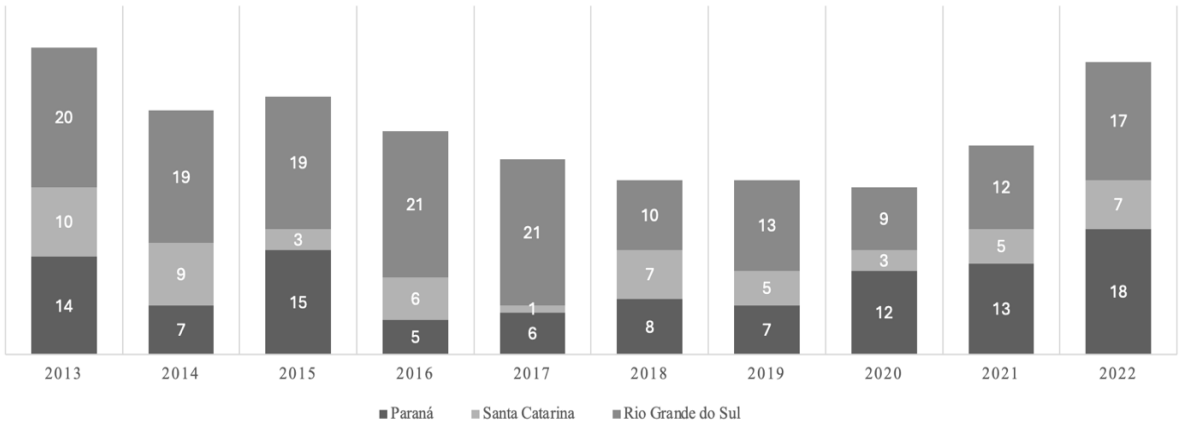

FIGURE 1 - Deaths of children due to choking in the age group of zero to nine years by state in the Southern Region of Brazil.

It is possible to observe that the year 2013 was marked by the highest number of deaths due to choking, with 44 records, while 2020, in contrast, had the lowest number of deaths, with 24. In the first situation, 11 children died from choking for every 1,000,000 inhabitants under ten years of age, while in the second, six children died for every 1,000,000 inhabitants under ten years of age.

When compared by sex, there are more deaths in the male population, with a total of 193 deaths during the analyzed period, while the female population had 129 deaths, resulting in a male mortality rate higher than the female rate, 0.10‰ versus 0.07‰. These results indicate that boys are approximately 42% more likely to die from choking than girls.

It was observed that proportional mortality, considering the sum of the age groups studied, was 6.6‰ children, meaning that out of every 1,000 children who died in the Southern Region of Brazil, six died from choking. It appears that the highest risk of dying from choking occurred in the age group of one to four years of life, with ten deaths for every thousand deaths at this age. The age group under one year old had a proportional mortality rate of 6.1‰ and the age group between five and nine years old had 5.2‰.

The most common item that caused choking was food, especially in children under one year of age, 93.0% of whom died from food-related choking. The total number of deaths from food obstructing the respiratory tract was 272, while other objects causing obstruction were 50, that is, food was responsible for five times more deaths due to choking than other objects.

Regarding the location where the deaths occurred, more than half took place in the hospital, corresponding to 45.3% of deaths. The second most common location was at home, totaling 33.9% during the analyzed period. Other locations, in descending order, included: other health establishments (12.7%), other places (5.9%), and public roads (2.2%).

Discussion

The current study highlights the highest mortality rate from choking in male children. This finding corroborates data from the literature. A study reviewing the main publications on foreign body aspiration in pediatrics found that this condition predominantly affects males, accounting for 51.0% to 73.0% of cases (4). Another study (systematic review) conducted with data from 203 countries showed that, in fact, it is not just the aspiration of foreign bodies that is more common in boys, but rather all emergencies involving foreign bodies, such as intraocular foreign bodies and foreign bodies in other parts of the body: in 2019, the

incidence of foreign bodies was 43,408,573 (95% UI: 32,858,330–57,276,213) for males and 23,113,947 (95% UI: 18,531,029–29,212,350) for females. In the same year, the number of deaths due to foreign bodies was 71,350 (95% UI: 64,438–78,579) among males and 53,283 (95% UI: 48,484–59,896) among females (14).

The observed difference between genders may be related to behavioral characteristics of each sex. This is because girls tend to have more measured behavior, while boys exhibit more active and inquisitive behavior (15).

The high mortality rate from foreign body aspiration in children found in this study is consistent with existing literature, which identifies it as one of the leading causes of death in children, especially those under four years of age (16).

Several authors believe that the difference in mortality between age groups is due to distinct anatomical and physiological factors, such as incomplete dentition (do not have molars to chew certain foods adequately) and inadequate swallowing coordination, which are present in younger children (16, 17). Additionally, the behavioral aspects of both the child and the parents and caregivers can influence the outcome (6).

During early childhood development, children typically explore by putting objects in their mouths, which significantly increases the risk of choking, mainly due to their inability to distinguish between appropriate and inappropriate foods and objects. Furthermore, high levels of activity during eating, such as walking, running and talking while chewing, contribute to the likelihood of choking (16-18).

The finding of this study, that food is the most common cause of choking deaths in children, is supported by literature from other countries (19). A study conducted in a hospital in Xangai - China, analyzing cases from 2013 to 2017 with a population mostly under the age of three, showed that 93% of choking cases were caused by food items (20). The same happened in Australia, where a more recent study published in 2019 showed that 69.2% of choking cases were caused by food (21).

The types of food most commonly associated with choking vary depending on each country's eating habits, as well as social, economic, and cultural factors. However, regardless of the type of food, these foods tend to share common characteristics, such as having a hard consistency and being small (18). In the United States and Europe, peanuts predominate; in Egypt, the watermelon seed; in Türkiye, the sunflower seed, and in Greece, the pumpkin seed (4). In Asian countries, where fish consumption is traditional, most choking occurred due to fish bones (22).

Both organic and inorganic foreign bodies pose risks. Organic items tend to cause more severe mucosal inflammation. Additionally, items like beans, seeds, and corn have the ability to absorb moisture, and their swelling can turn a partial obstruction into a complete one. In contrast, patients who inhale small inorganic materials often remain asymptomatic for a longer time, unless a complete obstruction of a distal airway occurs (23, 24).

The present study found the highest mortality rate due to choking occurred in hospital settings, followed by deaths at home. A survey conducted in Minas Gerais indicated that the majority of choking deaths occur at home, contrasting with the data presented in this study (25). Domestic accidents, such as choking, during childhood are very common, as the dangers that exist in a home are often underestimated and/or neglected by parents or guardians (26). Prevention of aspiration is crucial, and caregivers should be trained to avoid feeding these children foods such as nuts and seeds, as well as to keep potentially ingestible objects out of their reach.

Delayed recognition of choking at home or diagnosis in the hospital may lead to a poor prognosis for the child after removal of the foreign body. A time greater than 48 hours between the event and hospital admission is associated with a higher risk of complications. In an analysis of care provided at the Pediatric Emergency Unit of the *Hospital de Clínicas da Unicamp*, the time interval between the event and admission to the hospital varied from one hour to 60 days, with 26 children (37.7%) admitted in the first 24 h (6).

Although chest radiography is usually the initial method of choice when the child is admitted to the hospital, it is important to know that most aspirated foreign bodies are not radiopaque, so a normal radiography does not exclude the diagnosis of FBA. Therefore, bronchoscopy should be performed in all cases of suspected FBA (3). Bronchoscopy was the best method for treating choking in hospitals and significantly reduced the need for thoracotomy (27).

In this sense, knowing that recognizing FBA is a difficult task, greater awareness of first aid among families with children, as well as among healthcare professionals, is recommended. Lack of knowledge in this area can lead to delays in care and inappropriate actions that contribute to the increase in the number of deaths due to choking.

Choking mortality is a public health issue, thus, the present study emphasizes the importance of advancing research on the subject not only in the Southern Region, but also in other Brazilian regions. Furthermore, it is crucial to implement public policies and health assistance for caregivers and parents of young children regarding risk factors, as well as investments in the professional qualification of doctors and health professionals.

The main limitation of the current study was the use of secondary data coming from a platform subject to underreporting and information biases, either due to errors in data collection or data insertion into the system. Another limitation was the lack of sufficient studies on choking in Brazilian regions to compare the results obtained in this research with the existing literature. Despite these limitations, they did not preclude the study's continuation and importance.

Finally, it was possible to describe the epidemiological profile and mortality rate from choking in children in the Southern Region during the established period, with a higher concentration of cases among males, children aged one to four years, and choking incidents caused by food. It was observed that the issue of foreign body aspiration should be treated with greater relevance in the Southern Region of Brazil, as it is, in most cases, a preventable accident.

Notes

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Conflicts of interest disclosure

The authors declare no competing interests relevant to the content of this study.

Authors' contributions

All the authors declare to have made substantial contributions to the conception, or design, or acquisition, or analysis, or interpretation of data; and drafting the work or revising it critically for important intellectual content; and to approve the version to be published.

Availability of data and responsibility for the results

All the authors declare to have had full access to the available data and they assume full responsibility for the integrity of these results.

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