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Profile of occupational accidents with children and adolescents in Brazil from 2011 to 2020

Perfil dos acidentes de trabalho com crianças e adolescentes no Brasil, de 2011 a 2020

Abstract

Objective: to describe the profile of occupational accidents involving children and adolescents aged 5 to 17 years in Brazil, in the period from 2011 to 2020. *Methods*: descriptive study based on data from the *Sistema de Informação de Agravos de Notificação* (SINAN – Notifiable Diseases Information System) and from the *Sistema de Informação sobre Mortalidade* (SIM – Mortality Information System). *Results*: from 2011 to 2020, a total of 24,909 cases of occupational accidents involving minors under 18 years of age were registered on SINAN. Most of these cases occurred with males (82.3%), aged 16 to 17 years (84.6%), whites (44.0%), mainly within "Service workers" job titles subgroup as assigned by Brazilian Classification of Occupations. Almost half of the accidents affected the hands and upper limbs (48.7%) and the main diagnosis was "fist and hand injury" (17.7%). A total of 466 deaths were registered in that time period, with 15.9% referring to deaths of children aged 5 to 13 years. *Conclusion*: registers show records of occupational accidents and deaths related to child labor, including those involving children under 14 years of age, a group in which work is prohibited. It is necessary to ensure the development of research and actions that contribute to the elimination of child labor.

Keywords: occupational accidents; descriptive epidemiology; child labor; occupational mortality; occupational health.

Resumo

Objetivo*: descrever o perfil dos acidentes de trabalho envolvendo crianças e adolescentes na faixa etária de 5 a 17 anos no Brasil, no período de 2011 a 2020.* Métodos*: estudo descritivo com dados do Sistema de Informação de Agravos de Notificação (SINAN) e do Sistema de Informação sobre Mortalidade (SIM).* Resultados*: de 2011 a 2020, foram registrados, no SINAN, 24.909 casos de acidentes de trabalho envolvendo menores de 18 anos. A maioria ocorreu com indivíduos do sexo masculino (82,3%), na faixa etária de 16 a 17 anos (84,6%), brancos (44,0%), principalmente em ocupações do subgrupo da Classificação Brasileira de Ocupações "trabalhadores dos serviços". Cerca de a metade dos acidentes atingiram mãos e membros superiores (48,7%) e o principal diagnóstico foi "ferimento do punho e da mão" (17,7%). Foram registrados 466 óbitos no período, sendo 15,9% referentes a mortes de crianças de 5 a 13 anos de idade.* Conclusão*: houve registro de casos de acidentes de trabalho e óbitos relacionados ao trabalho infantil, inclusive envolvendo menores de 14 anos, faixa etária para a qual o trabalho é proibido. É preciso assegurar o desenvolvimento de pesquisas e de ações que contribuam para a eliminação do trabalho infantil.*

Palavras-chave: *acidentes de trabalho; epidemiologia descritiva; trabalho infantil; mortalidade ocupacional; saúde do trabalhador.*

Introduction

Child labor is illegal and constitutes a serious violation of human rights, and eliminating it is one of the priorities of the International Labour Organization (ILO). Child labor is defined as work that deprives children of their childhood, potential and dignity and compromises their physical and mental development[1]. Being a cause and an effect of poverty, child labor has negative impacts on health and school performance, preventing children and adolescents from fully developing their skills and capacities, in addition to affecting the level of development of nations and often leading to forced labor in adulthood[2].

Estimates of the ILO and the United Nations Children's Fund (UNICEF) indicate that 160 million children are engaged in child labor in 2020, representing 1 in 10 children worldwide, with almost half of them (79 million) engaged in hazardous work. Sub-Saharan Africa is pointed out as the region with the highest prevalence of child labor in the world, with 86.6 million (23.9%) people aged 5 to 17 years in this situation; South America and the Caribbean have 8.2 million (6.0%). The agricultural sector (70.0%) is responsible for the highest proportion of child labor in the world, followed by the service sectors (19.7%) and industry (10.3%). As for the percentage distribution of children aged 5 to 17 years by professional situation, the majority (72.1%) work unpaid, for their family or in a family context[2,3].

According to Brazilian law, child labor refers to economic and/or survival activities, paid or unpaid, whether or not for profit, performed by children and adolescents under the age of 16 years. Civil society and the Brazilian government have endeavored to eliminate child labor, especially since the 1990s, with the ratification of ILO Conventions 138 and 182 and the implementation of protective provisions, such as the establishment of the Child Labor Erradication Program in 1996 and its subsequent expansion[4,5].

The Ministry of Health (MS) also included the eradication of child labor and the protection of adolescent workers in its agenda, instituting, in 2005, guidelines for providing comprehensive health care to economically active children and adolescents[6]. Finally, on October 9, 2020, the Supreme Federal Court (STF) declared the constitutionality of Constitutional Amendment No. 20/1998[7], which came into force prohibiting children under 16 years of age from working, except as an apprentice from 14 years of age, in addition to prohibiting night work, dangerous work or unhealthy work for children under 18 years of age.

The Continuous National Household Sample Survey (PNAD) estimated that 1.8 million children and adolescents aged 5 to 17 years were engaged in child labor in Brazil in 2019[8], representing 4.6% of people in this age group. Of the 1.5 million children and adolescents who had economic activity, 706,000 were engaged in the worst forms of child labor, such as slavery, dangerous work, sexual exploitation and drug trafficking, among other forms provided for in the list of the Worst Forms of Child Labor (TIP List), approved by Decree No. 6,481, of June 12, 2008[9].

Among the children and adolescents engaged in child labor, 53.7% were in the 16–17 years age group; 25.0% in the 14–15 years age group; and 21.3% in the 5–13 years age group. As for the distribution by sex and race/skin color, 66.4% were male and 66.1% were black or brown, a higher proportion than that of black or brown people in the 5–17 years age group (60.8%). Individuals engaged in child labor were mainly service workers, retail and market sellers (29.0%), and workers in elementary occupations (36.2%). "Agriculture" and "trade and repair" were the groups of activity that comprised, respectively, 24.2% and 27.4% of the children and adolescents engaged in child labor. However, the highest percentage (41.2%) was found in the "other activities" group. Among adolescents aged 16–17 years who had economic activities, estimates indicate 772,000 in informal occupations, which represents an informality ratio of 74.1% in this age group[8].

Unfortunately, Brazil is still far from ensuring the elimination of the worst forms of child labor or eradicating child labor as part of the fulfillment of the United Nations (UN) global agenda of Sustainable Development Goals[10]. Considering the importance of the subject and the scarcity of epidemiological studies on the occurrence of occupational accidents in this population, this study aimed to describe the profile of occupational accidents involving children and adolescents aged 5 to 17 years in Brazil, in the period from 2011 to 2020.

Methods

Study design

Descriptive epidemiological study based on data on occupational accidents and work-related deaths involving children and adolescents aged 5 to 17 years in Brazil, in the period from 2011 to 2020.

Data sources

We used data from the Notifiable Diseases Information System (SINAN) and from the Mortality Information System (SIM). Work-related injuries started to be included in SINAN after the introduction of GM/MS Ordinance No. 777/2004[11], which was considered an extraordinary advance for the surveillance of occupational accidents. In 2006, there was the publication of the protocol for *Notification of fatal and severe occupational accidents, and involving children and adolescents*[12]. SINAN's severe occupational accident databases include occupational accidents with minors aged below 18 years and deaths from occupational accidents. The SIM database includes deaths from all causes, with a field to indicate the existence of a relation between the event that triggered the death and the work process.

Health information systems within the scope of the Unified Health System (SUS) have the major advantage of covering the population as a whole, including formal and informal workers, which enables establishing a profile on occupational accidents that is closer to reality. Despite notification problems still occurring, it is observed that quality and coverage have increased[13].

Variables

Cases of occupational accidents with children and adolescents were selected in SINAN considering those that affected workers aged below 18 years on the date of their occurrence. The variables studied were: year of occupational accident, sex (male or female), age (in years), Federation unit (UF) of notification, race/skin color, labor market status (formal employee, informal employee, self-employed, hired public servant, civil servant, retiree, unemployed, temporary work, cooperative worker, freelance worker, employer, others or unknown), place where the accident occurred (employer's facilities, public road, third-party facilities, own domicile or unknown), type of accident (typical, commuting or unknown), occurrence of medical care (yes, no, or unknown), treatment regimen (hospital, outpatient clinic, both, or unknown), evolution of the case (cure, temporary disability, partial disability, permanent total disability, death from severe work accident, death from other causes, other or unknown), body part affected (eye, head, neck, chest, abdomen, hand, upper limb, lower limb, foot, whole body, other or unknown), cause of the accident according to the International Classification of Diseases and Health Related Problems, 10th revision (ICD-10), diagnosis of injury according to ICD-10 and large groups and subgroups (two digits) of the Brazilian Classification of Occupations (CBO).

Based on the SIM, we selected deaths that had the "occupational accident" field marked in the "external causes" block of the death certificate. The following variables were analyzed: year of death, sex, race/skin color and large groups and subgroups of the CBO.

For the analysis, the age variable was subdivided into three groups, considering the age group of 5 to 13 years, in which work is prohibited according to Brazilian legislation; the age group of 14 to 15 years, in which work is allowed only as an apprentice; and the age group of 16 to 17 years. In the tables, black and brown people were grouped and categorized as "blacks."

Access to data and cleaning methods

The SINAN and SIM data used in this study were made available by the Collaborating Center for Occupational Health Surveillance (CCVISAT), associated with the Institute of Collective Health of the Federal University of Bahia (ISC-UFBA) and the General Coordination of Occupational Health Surveillance (CGSAT/DSAST/SVS/MS). They were extracted on December 19, 2021 from the CCVISAT database[14].

Data processing

To verify consistency, the dates of birth and the dates of occurrence of accident were compared. Records in which the date of birth was the same as the date of accident were excluded.

Other variables, such as education level and the National Classification of Economic Activity (CNAE), despite their relevance, were not analyzed, given that they presented a high percentage of incompleteness. Variables in which the number of unknown cases and unfilled fields were greater than 20% were not used in the analyses. Economic activity, for example, cannot be studied due to the large number of unfilled records – 75.5% had this field blank. The only exception was the variable race/skin color, which was maintained due to its great importance and poor visibility in research on worker health. This variable had 22.4% incompleteness.

We chose to describe separately the frequencies in the categories "blank" and "unknown " for the variables studied.

Statistical analyses

The analyses were performed using descriptive statistics (absolute and relative frequencies). We also calculated the Proportional Percentage Variation (PPV) of the number of accidents in the period studied and the following indicators:

- Mortality rates related to occupational accidents involving children and adolescents: number of deaths from occupational accidents involving children and adolescents (5-17 years) obtained from SINAN and SIM divided by the estimated number of employed children and adolescents (5-17 years) and multiplied by 100,000.

The estimated numbers of employed children and adolescents, in each year of the period, were obtained from the 2019 Continuous PNAD[8]. The Microsoft Office Excel program (Version 2211) was used to clean the databases and to process and analyze the data.

Ethical considerations

The research was carried out using exclusively secondary data in the public domain with unrestricted access and that do not allow identification of subjects.

Results

In the period from 2011 to 2020, Brazil had notifications of 24.909 cases of occupational accidents, including deaths, in the age group of 5 to 17 years, which represented 2.7% of the total number of severe occupational accidents in the SINAN database. The annual average in the period was 2,490 cases and median of 2,404 cases. The state of São Paulo notified almost half of the cases (47.0%), followed by Paraná (10.0%), Minas Gerais (8.0%), Rio Grande do Sul (6.0%) and Santa Catarina (5.0%).

Analyzing the distribution of the absolute number of occupational accidents by sex over time, there is a higher occurrence of notified cases in males, in relation to females. There was a reduction in cases from 2011 to 2020 (PPV: −50.8%) in both sexes, with a more pronounced decline from 2013 for males (**Figure 1A**). In the 5–13 years age group, there was an increase of 3.8%, while in the other two age groups analyzed there was a decrease of 46.7% (14–15 years) and 53.6% (16–17 years) (**Figure 1B**).

Table 1 describes the occurrence of occupational accidents and deaths involving children and adolescents, according to sociodemographic and occupational variables. The age range in which work is legally allowed in the country (from 14 years old) concentrated 96.8% of the occupational accidents notified in SINAN. Despite lower numbers, it should be noted the occurrence of 792 notified cases of occupational accidents and 74 deaths of children aged below 14 years (age group in which work is prohibited in Brazil) in the 10-year period of the study.

The analysis of SIM data (**Table 1**) showed that most deaths occurred among male, black and brown children and adolescents. The age group of 5 to 13 years had 16.0% of the deaths of working children. SIM records present almost double the number of deaths in the age group of 5 to 17 years compared to SINAN, a difference of 91.8% between the two systems.

The "occupation" variable — after disregarding the "student" category, which represented 47.2% of deaths — had the category "service workers" in the first position, followed by "farm workers" and "extractive industry and civil construction workers."

As for the causes of occupational accident deaths in the SIM database (**Table 1**), two major groups are pointed out: "W00-X59 Other external causes of accidental trauma," which includes falls, drowning, exposure to inanimate and animate mechanical forces, exposure to electric current, exposure to smoke, fire and flames, poisoning and exposure to harmful substances, among others; and "V01-V99 Transport accidents."

Among the cases and deaths from occupational accidents in children and adolescents in Brazil, there was a predominance of males in the studied period in all age groups. As for race/skin color, most accidents notified in SINAN involved white children and adolescents (44.0%), followed by browns (27.6%) and blacks (5.2%). However, analysis of the different age groups showed that the 14–15 years and 5–13 years age groups had a predominance of black race/skin color (brown and black) children and adolescents. In turn, among the deaths notified in SIM, the proportion of deaths of blacks (56.2%) exceeds that of whites (40.1%), as shown in **Table 1**.

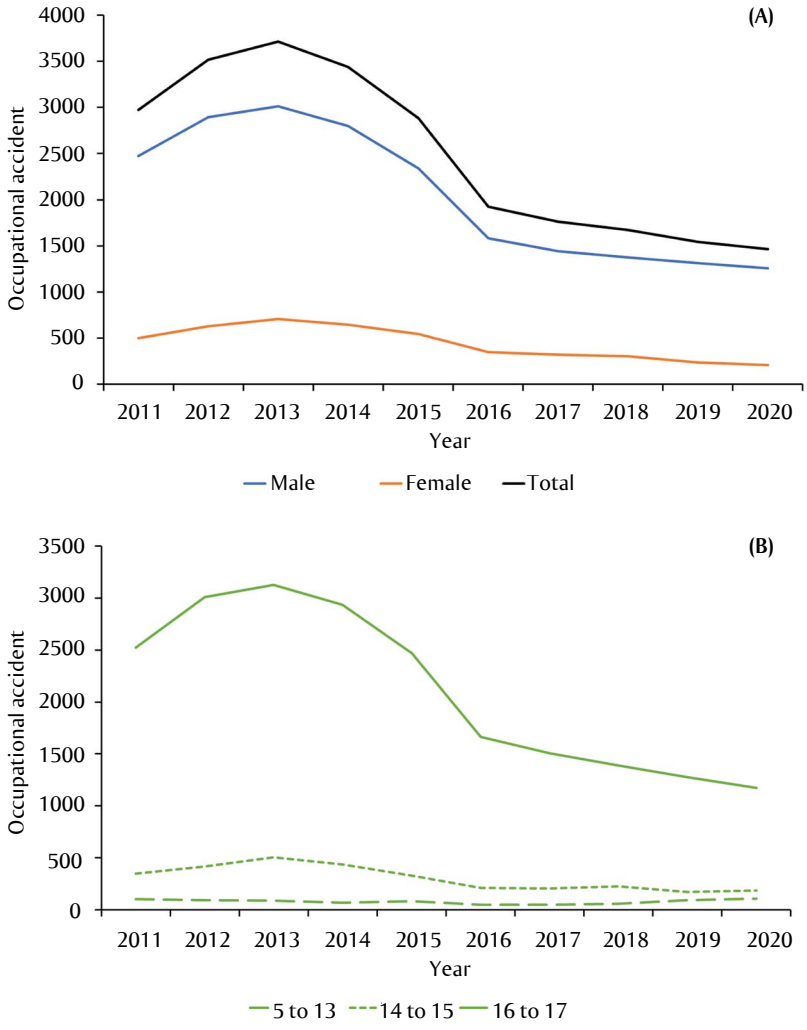

Figure 1 Time series of the absolute number of occupational accidents involving children and adolescents aged 5–17 years, in Brazil, from 2011 to 2020, by sex (A) and by age group (B)

Regarding the labor market status, there is a significant contingent of informal employees among the cases of occupational accidents notified in SINAN. Most informal workers were male (89.4%), black (48.9%) and aged 16 to 17 years (78.2%).

Analysis of the occupation variable in the SINAN database according to the CBO subgroups showed in first position the "service workers," which group, among others, "domestic service workers in general," "hotel and food service workers," "health service workers," and "beautification and personal care workers." In second position, there is the "cross-functional workers" classification, which groups "production packers and feeders," for example. Then there are the sub-groups of "office workers," "retail sellers and service workers," "extractive industry and civil construction workers," and "farm workers."

Analysis of occupations according to age group showed that occupations in the "service workers" and "cross-functional workers" groups predominated in the age group from 16 to 17 years. In the lower age groups, of 5 to 13 years and 14 to 15 years, there was predominance of "farm workers" and the subgroup "service workers." Among the deaths notified in SIM, the "service workers" occupation remains in the first position, but "farm workers" and "extractive industry and civil construction workers" gain relevance (**Table 1**).

Table 1 Sociodemographic and occupational characteristics of cases and deaths from occupational accidents involving children and adolescents, Brazil, 2011-2020

SINAN variables	*Age group (years)*							
	5-13		*14-15*		*16-17*		*Total*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Total	*792*	*3.2*	*3,033*	*12.2*	*21,084*	*84.6*	*24,909*	*100.0*
Sex								
Male	668	84.4	2,616	86.3	17,204	0.8	20,488	82.3
Female	123	15.5	417	13.7	3,876	0.2	4,416	17.7
Unknown	1	0.1	–	–	4	0.0	5	0.0
Blank	–	–	–	–	–	–	–	–
Race/Skin Color								
White	235	29.7	1,179	38.9	9,557	45.3	10,971	44.0
Black/Brown	453	57.2	1,300	42.9	6,419	30.4	8,172	32.8
Others	13	1.6	37	1.2	132	0.6	182	0.7
Unknown	67	8.5	429	14.1	4,246	20.1	4,742	19.0
Blank	24	3.0	88	2.9	730	3.5	842	3.4
Occupational status								
Formal employee	122	15.4	751	24.8	11,325	53.7	12,198	49.0
Informal employee	150	18.9	954	31.5	3,958	18.8	5,062	20.3
Self-employed	86	10.9	354	11.7	1,427	6.8	1,867	7.5
Temporary labor	23	2.9	152	5.0	476	2.3	651	2.6
Cooperative	4	0.5	14	0.5	97	0.5	115	0.5
Freelance worker	24	3.0	103	3.4	345	1.6	472	1.9
Others	231	29.2	325	10.7	927	4.4	1,483	6.0
Unknown	100	12.6	237	7.8	1,512	7.2	1,849	7.4
Blank	52	6.6	143	4.7	1,017	4.8	1,212	4.9
Main CBO Groups								
Service workers	65	8.2	257	8.5	2,890	13.7	3,212	12.9
Cross-functional workers	23	2.9	178	5.9	2,343	11.1	2,544	10.2
Office workers	21	2.7	188	6.2	1,963	9.3	2,172	8.7
Sellers and commerce service providers	20	2.5	176	5.8	1,812	8.6	2,008	8.1
Mining and construction workers	45	5.7	234	7.7	1,448	6.9	1,727	6.9
Farm workers	78	9.8	283	9.3	1,123	5.3	1,484	6.0
Metals and composites processing workers	23	2.9	157	5.2	921	4.4	1,101	4.4
Food, beverage and tobacco manufacturing workers	25	3.2	98	3.2	836	4.0	959	3.9
Mechanical repair and maintenance service workers	14	1.8	146	4.8	736	3.5	896	3.6
Textile, tanning, clothing and graphic arts industries workers	6	0.8	90	3.0	762	3.6	858	3.4

(Continues)

Table 1 Continuation

SIM variables	Age group in years							
	5-13		14-15		16-17		Total	
	n	%	n	%	n	%	n	%
Total	*74*	*15.9*	*89*	*19.1*	*303*	*65.0*	*466*	*100*
Sex								
Male	55	74.3	71	79.8	280	92.4	406	87.1
Female	19	25.7	18	20.2	23	7.6	60	12.9
Unknown	–	–	–	–	–	–	–	–
Blank	–	–	–	–	–	–	–	–
Race/Skin Color								
White	25	33.8	32	36.0	130	42.9	187	40.1
Black/Brown	47	63.5	55	61.8	160	52.8	262	56.2
Others	2	2.7	–	–	4	1.3	6	1.3
Unknown	–	–	–	–	1	0.3	1	0.2
Blank	–	–	2	2.2	8	2.6	10	2.1
Main CBO Groups								
Service workers	–	–	3	3.4	17	5.6	20	4.3
Farm workers	1	1.4	2	2.2	16	5.3	19	4.1
Mining and construction workers	1	1.4	1	1.1	13	4.3	15	3.2
Office workers	–	–	–	–	10	3.3	10	2.1
Farmers	–	–	1	1.1	7	2.3	8	1.7
Metals and composites processing workers	–	–	1	1.1	5	1.7	6	1.3
Cross-functional workers	–	–	–	–	6	2.0	6	1.3
Mechanical repair and maintenance service workers	–	–	1	1.1	4	1.3	5	1.1
Other conservation, maintenance and repair workers	–	–	–	–	5	1.7	5	1.1
Fishermen and forest extractivists	–	–	–	–	4	1.3	4	0.9
Main basic causes								
V01-V99 Transport accidents	36	48.6	41	46.1	136	44.9	213	45.7
W00-X59 Other external causes of accidental injuries	35	47.3	43	48.3	161	53.1	239	51.3
X60-X84 Voluntary self-injury	1	1.4	–	–	–	–	1	0.2
X85-Y09 Assaults	1	1.4	1	1.1	6	2.0	8	1.7
Y10-Y34 Events whose intent is undetermined	1	1.4	3	3.4	–	–	4	0.9
Y60-Y69 Accidents with patients during medical and surgical care	–	–	1	1.1	–	–	1	0.2

SINAN: Notifiable Diseases Information System; CBO: Brazilian Classification of Occupations; SIM: Mortality Information System;
1) In the CBO Group, the first 10 occupations are presented in relation to the total number of cases; 2) In the basic cause, the first 10 causes were grouped in relation to the total number of cases; 3) "–" denotes non-existent data.
Source: Prepared by the authors based on data from the Notifiable Diseases Information System (SINAN) and the Mortality Information System (SIM).

The highest percentage of occupational accidents in children and adolescents by sex and occupation was classified in the large CBO groups "service workers, sellers in retail and markets" and "workers in the production of industrial goods and services," which include activities such as food, domestic services, caregivers, beautification and hygiene services, packers and feeders of production line, among others. **Table 2** shows the highest number of notifications of the occupation "cafeteria attendant" among females and "hand packer" for males.

Table 2 Distribution of occupational accidents in children and adolescents by occupation and sex, Brazil, 2011-2020

Male		
Categories	*n*	*%*
Student	1,766	8.6
Unknown	1,298	6.3
Packer by hand	1,017	5.0
Shelf filler	896	4.4
Farm worker in general	795	3.9
Production line feeding workers	669	3.3
Others	14,047	68.6
Female		
Categories	*n*	*%*
Cafeteria Attendant	531	12.0
Student	407	9.2
Unknown	354	8.0
Retail seller	308	7.0
Packer by hand	253	5.7
Office Assistant, General	246	5.6
Others	2,317	52.5

Source: Prepared by the authors using data from the Notifiable Diseases Information System (SINAN).

Table 3 presents the characteristics of cases of occupational accidents in children and adolescents notified in SINAN. It is observed that 73.4% of the cases were classified as typical accidents. The place where most of the accidents occurred was at the employer's facilities (60.3%), followed by public road (19.0%). In almost all cases there was medical care (89.5%), with a predominance of outpatient care in relation to hospitalization. It was observed that, in the age group from 5 to 13 years, there was more hospital care (44.8%) than outpatient care (37.4%) and, in the age group of 14 to 15 years, the two types of care have almost the same proportion (40.9% and 45.4%, respectively). In the age group of 16 to 17 years, the opposite was observed as to the type of care, with a higher percentage of outpatient care (55.0%) compared to hospital care (29.7%).

Almost 80.0% of the accident victims evolved to cure or temporary disability. More severe cases that evolved to permanent partial or total disability represented only 3.0% of the total number of cases. **Table 3** shows that the highest percentage of this type of evolution occurred in the age group of 5 to 13 years (7.0%). Deaths due to severe accidents reported on SINAN (n = 243) – which, in total, represented only 1.0% of cases of occupational accidents – occurred in a higher proportion in this age group (2.0%), although this represents only 3.2% of cases, a percentage slightly above the values of the other age groups (14 to 15 years, 1.6%; and 16 to 17 years, 0.8%).

The most affected body parts were hands and upper limbs, with almost half of the injuries (48.7%), with "wrist and hand injury" being the most frequent diagnosis. Other parts affected were lower limbs, foot and head. These affected body parts are the same for the three age groups. It is noted that up to 3 body parts can be marked by accident, or the whole body, which in this research represented 2.0% of the cases (**Table 3**).

Regarding the causes of the occupational accident (**Table 3**), classified in ICD-10 between V01 and Y98 (Chapter XX – "External causes of morbidity and mortality"), the most frequent code was Y96 (work-related condition). This code was used in SINAN's form to classify the case as a severe accident, which made it difficult to better characterize the accident cause. Another code found was W31 (contact with other and unspecified machinery).

Figure 2 shows the mortality rates for occupational accidents involving children and adolescents, obtained from SIM and SINAN data. There was an abrupt increase in the mortality rate in 2017, according to SINAN data, followed by a reduction in calculated rates, according to data from both information systems. In the last year studied (2020), the mortality rate was 1.054 per 100,000 employed people in the age group of 5–17 years in SIM, and 0.502 per 100,000 in SINAN (**Figure 2**).

Table 3 Characteristics of cases of occupational accidents in children and adolescents, Brazil, 2011-2020

SINAN variables	*Age group (years)*							
	5-13		*14-15*		*16-17*		*Total*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Total	*792*	*3.2*	*3,033*	*12.2*	*21,084*	*84.6*	*24,909*	*100.0*
Type of accident								
Typical	577	72.9	2,286	75.4	15,423	73.2	18,286	73.4
Route	105	13.3	474	15.6	3,855	18.3	4,434	17.8
Unknown	59	7.4	117	3.9	785	3.7	961	3.9
Blank	51	6.4	156	5.1	1,021	4.8	1,228	4.9
Place of accident								
Employer's facilities.	269	34.0	1,636	53.9	13,107	62.2	15,012	60.3
Public road	127	16.0	541	17.8	4,062	19.3	4,730	19.0
Third Party Facilities	55	6.9	231	7.6	1,077	5.1	1,363	5.5
Own domicile	214	27.0	310	10.2	669	3.2	1,193	4.8
Unknown	110	13.9	247	8.1	1,562	7.4	1,919	7.7
Blank	17	2.1	68	2.2	607	2.9	692	2.8
Treatment regimen								
Hospital	355	44.8	1,239	40.9	6,258	29.7	7,852	31.5
Outpatient clinic	296	37.4	1,378	45.4	11,606	55.0	13,280	53.3
Both	43	5.4	125	4.1	998	4.7	1,166	4.7
Unknown	47	5.9	129	4.3	1,029	4.9	1,205	4.8
Blank	51	6.4	162	5.3	1,193	5.7	1,406	5.6
Evolution								
Cure	299	37.8	1,161	38.3	8,188	38.8	9,648	38.7
Temporary disability	286	36.1	1,269	41.8	8,545	40.5	10,100	40.5
Partial disability	48	6.1	119	3.9	497	2.4	664	2.7
Permanent total disability	8	1.0	14	0.5	52	0.2	74	0.3
Death from major accident	16	2.0	50	1.6	177	0.8	243	1.0
Death from other causes	2	0.3	4	0.1	17	0.1	23	0.1
Other	14	1.8	33	1.1	210	1.0	257	1.0
Unknown	77	9.7	257	8.5	2,550	12.1	2,884	11.6
Blank	42	5.3	126	4.2	848	4.0	1,016	4.1
Body part								
1. Eye	26	2.5	131	3.7	889	3.7	1,046	3.7
2. Head	84	8.0	289	8.3	1,875	7.9	2,248	7.9
3. Neck	18	1.7	35	1.0	248	1.0	301	1.1
4. Chest	35	3.3	104	3.0	647	2.7	786	2.8
5. Abdomen	21	2.0	63	1.8	332	1.4	416	1.5
6. Hand	262	25.0	1,176	33.6	8,066	34.0	9,504	33.6
7. Upper limbs	128	12.2	485	13.9	3,655	15.4	4,268	15.1
8. Lower Limbs	130	12.4	486	13.9	3,270	13.8	3,886	13.7
9. Foot	96	9.2	319	9.1	2,175	9.2	2,590	9.2
10. Full body	49	4.7	103	2.9	460	1.9	612	2.2
11. Other	39	3.7	148	4.2	1,364	5.7	1,551	5.5
99. Unknown	161	15.3	158	4.5	767	3.2	1,086	3.8

(Continues)

Table 3 Continuation

SINAN variables	Age group (years)							
	5-13		14-15		16-17		Total	
	n	%	n	%	n	%	n	%
Total	*1,049*	*100.0*	*3,497*	*100.0*	*23,748*	*100.0*	*28,294*	*100.0*
Cause of accident (ICD-10 – External causes)								
Y96 – Work-related condition	241	30.4	619	20.4	3,645	17.3	4,505	18.1
W31 – Contact with other and unspecified machinery	41	5.2	249	8.2	1,469	7.0	1,759	7.1
W20 – Struck by thrown, projected or falling object(s)	24	3.0	151	5.0	1,198	5.7	1,373	5.5
W23 – Caught, crushed, jammed or pinched in or between objects	29	3.7	150	4.9	1,163	5.5	1,342	5.4
W22 – Striking against or struck by other object(s)	9	1.1	96	3.2	921	4.4	1,026	4.1
W26 – Contact with other sharp object(s)	26	3.3	100	3.3	839	4.0	965	3.9
W01 – Fall on same level from slipping, tripping or stumbling	16	2.0	84	2.8	804	3.8	904	3.6
W27 – Contact with nonpowered hand tool	21	2.7	126	4.2	633	3.0	780	3.1
W29 – Contact with other powered hand tools and household machinery	24	3.0	87	2.9	508	2.4	619	2.5
V23 – Motorcycle rider injured in collision with car, pickup truck or van	7	0.9	57	1.9	529	2.5	593	2.4
W10 - Fall on and from stairs and steps	4	0.5	36	1.2	457	2.2	497	2.0
Main diagnoses of injury (ICD-10)								
S61 – Open wound of wrist and hand	73	9.2	478	15.8	3,864	18.3	4,415	17.7
Y96 Work-related condition	112	14.1	285	9.4	1,202	5.7	1,599	6.4
S60 – Superficial injury of wrist and hand	11	1.4	127	4.2	1,105	5.2	1,243	5.0
S62 – Fracture at wrist and hand level	42	5.3	162	5.3	943	4.5	1,147	4.6
S90 – Superficial injury of ankle and foot	8	1.0	56	1.8	605	2.9	669	2.7
S68 – Traumatic amputation of wrist and hand	50	6.3	113	3.7	476	2.3	639	2.6
S01 – Open wound of head	10	1.3	91	3.0	524	2.5	625	2.5
S91 – Open wound of ankle and foot	29	3.7	91	3.0	462	2.2	582	2.3
S93 – Dislocation, sprain and strain of joints and ligaments at ankle and foot level	8	1.0	39	1.3	521	2.5	568	2.3
S80 – Superficial injury of lower leg	5	0.6	38	1.3	426	2.0	469	1.9
S81 – Open wound of lowerleg	20	2.5	54	1.8	375	1.8	449	1.8

SINAN: Notifiable Diseases Information System; ICD-10: International Statistical Classification of Diseases and Health-Related Problems, 10th revision.

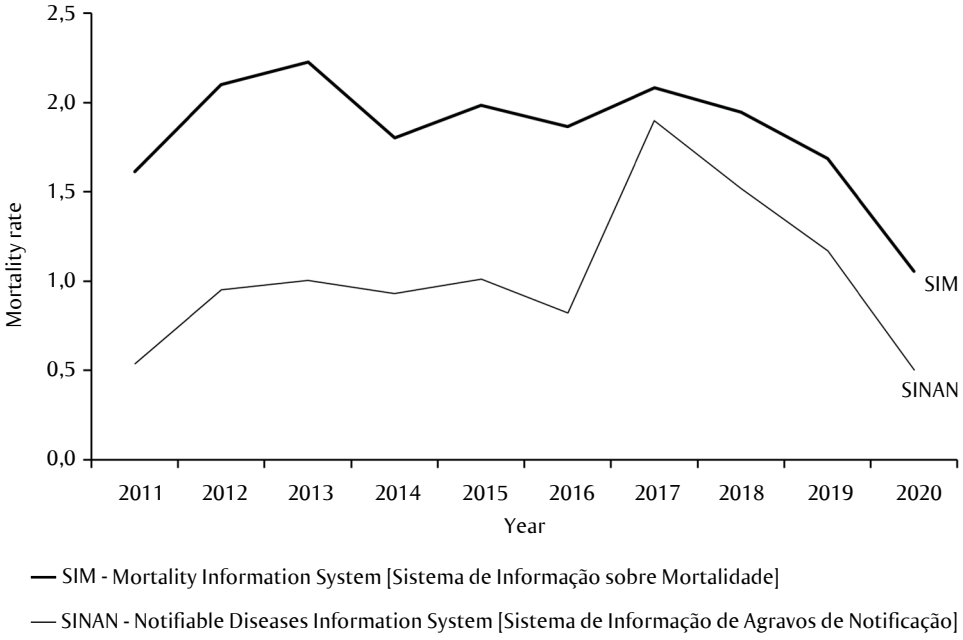

Figure 2 Mortality rate for occupational accidents involving children and adolescents (per 100,000 employed people in the age group of 5–17 years), Brazil, 2011 to 2020

Discussion

This research found, from 2011 to 2020, an annual average of almost 2,500 occupational accidents with children and adolescents aged 5–17 years in Brazil, according to SINAN, and an average of 47 deaths recorded per year, according to SIM. The data presented, although dramatic, only partially represent the true situation of accidents and deaths that affect child and adolescent workers in Brazil, considering the notorious underreporting of these events in Brazil[15-18].

Child labor has the aggravating factor of having a large contingent of children and adolescents in informality and in "invisible" jobs, such as domestic work, drug trafficking, sexual exploitation and slave labor, which makes it difficult to present the real situation of children and adolescents that are victims of occupational accidents. This practice hinders and creates obstacles to guaranteeing a series of rights of children and adolescents, such as the right to school education, culture, leisure and protection against discrimination, exploitation and violence. As a very serious violation of human rights, child labor must be combated, aiming at its eradication[2,3,19].

Considering that, according to the Brazilian Institute of Geography and Statistics (IBGE)[8], almost half (45.8%) of people aged 5 to 17 years who had economic activity in the country had occupations considered as the worst forms of child labor[9], it is observed that Brazilian children and adolescents are subject to major exposure to occupational risks. Occupational accidents constitute one of the most perverse facets of child labor by imposing dangers to the health and physical integrity of children and adolescents, in addition to compromising their full development, leading to illness, sequelae, disability and death.

Studies on occupational accidents with children and adolescents are still scarce in Brazil, most of which having been published more than 10 years ago, and there are very few epidemiological studies using SINAN and SIM[20-30]. Even in the international literature there are few publications on the subject and, in general, studies on child and adolescent workers are focused on specific groups and occupations and on sectors such as agriculture[31-37].

In the 2019 continuous PNAD, which analyzed the work of children and adolescents aged 5 to 17 years, IBGE[8] investigated the condition of formality in the occupation, according to the criteria defined in the informality *proxy*, for the group of people aged 16 and 17 years. There was a 74.1% rate of informality among those who had economic activities in this age group, with concentration of employees in the private sector without a formal contract and domestic workers (66.6%).

By covering informal workers, SINAN expanded the universe of workers and the ability to trace occupational accidents. This survey traced about 20% of children and adolescents involved in accidents as informal employees. Analyzing this specific subset, it was found that most of the informal workers were male, black and in the age group of 16 to 17 years. Regarding the work status, the informality and invisibility of child labor certainly affected the data, especially in the age group of children aged below 14 years. The data for "informal employee" and other categorizations of this variable for this group must be observed with reservations, since work is prohibited in this age group in Brazil.

In the epidemiological bulletin on work-related fatalities in children and young people in Brazil[38], in the period of 15 years (2000 to 2014), when analyzing the age group of 10 to 17 years, it was observed that most deaths from occupational accidents occurred with black people (49.2%), a percentage slightly higher than that of white people (47.0%). Similarly, in this study, for this same age group in the 10-year period of analysis (2011-2020), there was a predominance of blacks among the fatal victims of occupational accidents.

Regarding the age group of deaths from occupational accidents, data from SIM – a system that showed greater coverage than SINAN in the identification of work-related fatalities – showed the occurrence of 74 deaths in the 5-13 years age group, and 392 in the 14-17 years age group. The SIM showed concerning data, such as 16.0% of the total notified deaths of working children having occurred in the age group of 5 to 13 years, in which work is prohibited. This finding denotes the severity of cases of occupational accidents involving children.

Social security data for the period from 2012 to 2021, released by the Prosecutor's Office for Labor (MPT) in partnership with ILO Brazil through the Smartlab Decent Work Initiative, recorded the occurrence of 50 occupational deaths in the age group of 14–17 years[39]. This number corresponds to 22% of the deaths found in this research, recorded in SINAN (total of 227 deaths), and only 13% of the deaths for this age group recorded in SIM, in the period of 10 years. Although it is not possible to establish comparisons, the data reinforce the notion of the extent to which social security estimates on occupational accidents are flawed to guide actions for health prevention and health promotion and how several workers and their families remain invisible and unassisted in these cases, a situation even more worrying among children and adolescents who do not have access to care services and benefits — many still without guarantee of social rights such as health and education.

Regarding the evolution of cases, most occupational accidents evolved to cure or temporary disability. However, the highest percentage of cases of permanent, partial or total disability affected children between 5 and 13 years, reinforcing the hypothesis that deaths and severe accidents have affected more the children who could not even be at work, in accordance with the Brazilian legislation.

The Smartlab Decent Work Initiative[39] presented data from 2019 from the Division of Labor Inspection, of the then Ministry of Economy, on inspection actions to combat child labor. They found 1,677 children and adolescents in an irregular work situation, 43.7% in the age group of 16–17 years, 38.8% in the age group of 14–15 years, and 17.5% in the age group of up to 13 years, most male (80.4%). Moreover, the states that most inspected and found children and adolescents in an irregular situation in 2019 were Pará (320 cases), Bahia (180), Pernambuco (176), Amazonas (98), Mato Grosso do Sul (98), Rio de Janeiro (97) and Rio Grande do Norte (86). Regarding the research on occupational accidents with children and adolescents, none of these states is on the list of those with the highest number of notifications. The state of Pará is one of those that least reported occupational accidents in the period studied, occupying the 19th position in relation to the other states, although it is in 6th position regarding the number of deaths of children and adolescents from occupational accidents.

As for the occupations of children and adolescents who were victims of occupational accidents notified in SINAN, the most frequent were the large CBO group "production of industrial goods and services"; in second, the group "service workers, sellers of retail stores and markets"; and, third, "administrative service workers." The three most prevalent groups in the study of Sousa et al.[22], which analyzed the period from 2008 to 2015, were "maintenance and repair" activities, followed by "production of industrial goods and services" and "service workers, sellers of retail stores and markets."

In relation to the CBO subgroups, accidents among service workers stood out, probably expressing the contingent of children and adolescents working as couriers or street vendors in urban areas or domestic and caregiving services. As for mortality, in addition to services, it should be noted the occupations of sectors known to be at high risk, such as agriculture, extractive industry and civil construction. Transport accidents were also among the main causes of death from occupational accidents in the SIM database (**Table 1**), which may indicate children working in prohibited and high-risk activities, exposure to the street environment and urban violence.

In this study, similar to the results presented in the epidemiological bulletin on work-related fatalities [38], in the age group of 15 to 17 years, the main groups of occupations involved were "agricultural workers" (29%), "workers in the production of industrial goods and services" (28%) and "service workers and sellers of retail stores and markets" (19.6%). In this study, the cases of deaths of male children and adolescents aged 10 to 14 years were equally distributed in two major groups: "agricultural workers" and "workers in the production of industrial goods and services." Regarding body parts, hand and upper limb were the most affected, corroborating results of other studies[22,25,26,28].

The results presented indicate the severeness of the situation of working children and adolescents in Brazil. The occurrence of accidents, disability and death reinforces that the prevention of occupational accidents in this population should be prioritized and child labor should be strongly combated. It is not possible to admit, in the 21st century, that the future of the country is threatened by the exposure of children and adolescents to so many dangers, especially when it comes to those belonging to the poorest strata of the population.

Social markers express power relations in a hierarchical and unequal society such as the Brazilian society, in which capitalist exploitation is perpetuated, which subjects people to degrading, painful and unhealthy labor. The research highlighted what is observable every day on the streets of large cities: inequities as to race, age and social class, which lead children and adolescents – especially black and poor children – to be excluded from school, leisure and culture and to be subjected to all kinds of violence. Oppressions that intertwine and intersect, potentiating social injustices.

As this is a descriptive epidemiological study, knowledge gaps must be overcome through new studies, seeking to explain relations between variables such as race/skin color, education level, labor market status, among others, which have as outcome occupational accidents and deaths; as well as qualitative studies that enable understanding symbolic aspects, perceptions, motivations and beliefs around child labor, aiming to build a political agenda for overcoming them.

Regarding the limitations of the research, there are still very few studies on occupational accidents with children and adolescents and a large volume of relevant data could not be discussed in depth, thus compromising the dialogue with the literature and the comparison of results. Challenges also remain in relation to data production and analysis considering the underreporting of cases and deaths, in addition to insufficient completeness and consistency of data in both information systems.

Both databases presented filling errors, lack of data, and a large amount of information recorded as "unknown "[12,39,40]. Some variables were not filled in and others were filled in incorrectly – such as occupation, education level and age, possibly due to lack of adequate training to fill out the form –, in addition to typos or misunderstanding about the usefulness of information by health professionals, which causes loss of relevant pieces of information[13,40,41].

Final considerations

The United Nations General Assembly defined 2021 as the international year for the elimination of child labor, in line with the objectives of the Global Agenda for Sustainable Development (2015-2030). However, the world is far from eradicating child labor. The COVID-19 pandemic and the consequent impoverishment of populations seems to have acutely affected global progress against child labor, with mainly black and poor children and adolescents being prevented from attending school and forced into early labor, increasing their exposure to risks, violence and death. ILO and UNICEF estimates suggest that more than 8.9 million children would be engaged in child labor by the end of 2022 as a result of increasing poverty driven by the pandemic.

The present study presented the profile of occupational accidents and deaths among children and adolescents in Brazil, their distribution and their evolution over time, shedding light on a topic that is still very little studied in the country. These results are useful to support the organization of occupational health services and the SUS health care network, the redirection of health prevention and health promotion initiatives, and the implementation of actions to address this serious problem.

The production of information on workers aged below 18 years involved in occupational accidents enabled better understanding the dramatic situation of many Brazilian children and adolescents, contributing to indicate a new agenda for promoting research and intervention on occupational accidents. The study revealed a sad reality about occupational morbidity and mortality of a part of our population, which needs to be the focus of greater attention of public managers, the health area, organizations defending the rights of children and adolescents and the whole society.

In addition to the risks of work-related accidents and diseases that can affect their development and their physical and mental integrity, the early entry

of children and adolescents into the labor market compromises school education and maintains the cycle of poverty, contributing to perpetuate inequities and social injustice. With the objective of changing this situation, the SUS has a role of great relevance in combating child labor and its consequences, and should seek to implement a system of surveillance of work-related injuries that prioritizes tracing cases involving children and adolescents who are, to a large extent, in informality, and performing dangerous, invisible or illegal activities, and implement initiatives to provide comprehensive health care to this population. Accordingly, it is essential that the health surveillance carries out intersectoral action in coordination with public agencies, such as the Prosecutor's Office for Labor (MPT) and other instances of civil society, including organizations that work in defense of the rights of children and adolescents.

Finally, it is necessary to persist in the enhancement of health information systems so they have high coverage, quality and opportunity to notify occupational accidents of children and adolescents and ensure greater investments in studies that can reveal the detrimental effects of child labor, favoring health surveillance actions and effectively contributing to the eradication of child labor.

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Authors' contributions:

Hennington EA contributed to research design, data analysis, manuscript preparation and final review. Rezende FAVS contributed to research design, data processing and data analysis. The authors approved the final version published and take full responsibility for the published content.

Data Availability Statement

The data of this study are public and available on the website of the Collaborating Center for Occupational Health Surveillance (CCVISAT), associated with the Institute of Collective Health of the Federal University of Bahia (ISC-UFBA) and with the General Coordination of Occupational Health Surveillance of the Ministry of Health (CGSAT/DSAST/SVS/MS). The databases can be accessed through the link: http://www.ccvisat.ufba.br/bases-de-dados/.

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