

Notification of noise-induced hearing loss in female workers: analysis from 2007 to 2022

Notificação de perda auditiva induzida por ruído em trabalhadoras: análise de 2007 a 2022

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ABSTRACT

Purpose: To establish the sociodemographic and occupational profile of Brazilian female workers reported for noise-induced hearing loss in the Information System between 2007 and 2022. **Methods:** Cross-sectional and descriptive study, carried out with noise-induced hearing loss notification forms in Brazil, between 2007 and 2022. The variables analyzed were: age group, race, education, Brazilian region, labor market status, type of noise, work absence, issuance of the Work Accident Report, and occupation. **Results:** 1,080 notifications were found in female workers during the period. There was a higher incidence of notification among women aged 50-59 years (30.7%), white skin color/race (49.1%), with a high school diploma (17.5%), of Central-West region (39.3%), working as seamstresses (13.2%), employed with a formal employment contract (34.7%) and concomitant exposure to uninterrupted and intermittent noise (38.3%). Only 8,8% (of the cases) had been given a medical leave from work and a Work Accident Report was issued in only 11.4% of cases. **Conclusion:** This study, by characterizing the sociodemographic and occupational profiles of Brazilian female workers reported for noise-induced hearing loss from 2007 to 2022, raises the need for a better understanding and management of this condition in them, considering characteristics observed in the study, such as their main occupations, formal employment relationships, and low rates of Work Accident Report issuance. Reflection on the importance of public policies and actions aimed at prevention, monitoring, and hearing health care is fundamental to address the problem, considering the specificities of sex in the area of occupational health.

Keywords: Disease notification; Work; Hearing loss, noise-induced; Female workers; Health information systems

RESUMO

Objetivo: estabelecer o perfil sociodemográfico e ocupacional de trabalhadoras brasileiras notificadas para perda auditiva induzida por ruído no Sistema de Informação de Agravos de Notificação, entre 2007 e 2022. **Métodos:** estudo transversal e descritivo, realizado com dados das fichas de notificação da perda auditiva induzida por ruído no Brasil, entre 2007 e 2022. As variáveis analisadas foram: faixa etária, raça, escolaridade, região brasileira, situação no mercado de trabalho, tipo de ruído, afastamento do trabalho, emissão da Comunicação de Acidente de Trabalho e ocupação. **Resultados:** foram encontradas 1.080 notificações em trabalhadoras no período. Houve maior ocorrência de notificações entre 50-59 anos (30,7%), cor da pele/raça branca (49,1%), com ensino médio completo (17,5%), pertencentes à Região Centro-Oeste (39,3%), cargo de costureira (13,2%), empregadas com carteira assinada (34,7%) e exposição concomitante a ruído contínuo e intermitente (38,3%). Em apenas 8,8% das notificações houve afastamento do trabalho e a Comunicação de Acidente de Trabalho foi emitida somente em 11,4% dos casos. **Conclusão:** o presente estudo, ao caracterizar o perfil sociodemográfico e ocupacional de trabalhadoras brasileiras notificadas para perda auditiva induzida por ruído, de 2007 a 2022, suscita a necessidade de melhor compreensão e manejo do agravo em trabalhadoras, levando-se em conta as características observadas, como as principais ocupações, o vínculo empregatício formal e os baixos índices de emissão de Comunicação de Acidente de Trabalho. A reflexão sobre a importância de políticas públicas e ações voltadas à prevenção, fiscalização e assistência à saúde auditiva é fundamental para o enfrentamento dessa problemática, considerando as especificidades do sexo na área de saúde do trabalhador.

Palavras-chave: Notificação de doenças; Trabalho; Perda auditiva provocada por ruído; Mulheres trabalhadoras; Sistemas de informação em saúde

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Conflict of interests: No.

Authors' contribution: TSDG, DH and FZ were responsible for the conception and design of the study, data collection, analysis and interpretation, drafting or critically revising the article for important intellectual content, and approval of the final version submitted to the journal.

Data availability: Research data is available in repository.

Funding: None.

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Received: December 20, 2024; **Accepted:** August 25, 2025

Editor-in-Chief: Maria Cecília Martinelli Iorio.

Associate Editor: Ana Cláudia Fiorini.

INTRODUCTION

The first World Report on Hearing, released by the World Health Organization (WHO) in 2021, indicates that by 2050, one in four people will live with some degree of hearing loss, and 700 million will require care and access to rehabilitation services⁽¹⁾. Noise-induced hearing loss (NIHL) is included in the scenario above. Although preventable, it affects approximately 1.3 billion workers exposed to noise, representing 16% of disabling hearing loss in adults⁽²⁾.

In Brazil, the Notifiable Diseases Information System (Sistema de Informação de Agravos de Notificação - SINAN) stores notifications and investigations of cases of diseases and conditions subject to compulsory notification⁽³⁾. The NIHL became part of the National List of Compulsory Notification of diseases, injuries, and public health events (Lista Nacional de Notificação Compulsória - LNC) from Ordinance GM/MS (Ministry of Health) No. 777 of April 28, 2004⁽⁴⁾, maintaining its mandatory nature by Ordinance GM/MS No. 5.201 of August 15, 2024, now with the name Work-Related Hearing Loss (Perda Auditiva Relacionada ao Trabalho)⁽⁵⁾.

Despite the mandatory reporting of NIHL, a recent study found a total of 7,819 reports (6,895 for men and 924 for women) between 2006 and 2019, figures that suggest underreporting, given the prevalence of the condition⁽⁶⁾. This problem compromises health planning, as actions are based on data that may not accurately represent the epidemiological reality⁽⁷⁾.

According to a publication by the Ministry of Labor and Employment⁽⁸⁾, of the active workers in Brazil, 43,380,636, out of a total of 100,984,563, are women, accounting for one-third of the workforce in the industrial sector⁽⁹⁾. Despite the magnitude of these numbers, few studies analyze the relationship between health and work in the female universe. Among them, research that addresses labor interference during pregnancy⁽¹⁰⁾, in breast cancer⁽¹¹⁾, in the menstrual cycle⁽¹²⁾, and in arterial hypertension⁽¹³⁾ stands out.

Regarding noise exposure and female workers, the number of studies is even smaller, with emphasis on those that analyze the relationship between noise and complications during pregnancy⁽¹⁴⁾, gender, and factors associated with the use of hearing protection equipment at work⁽¹⁵⁾, and high-frequency audiometry in women, with and without exposure to noise in the workplace⁽¹⁶⁾.

When dealing specifically with NIHL, research typically does not conduct analysis through the lens of sex differences, focusing primarily on men, as they are the most affected by the condition^(2,6,17). Some aspects may justify this phenomenon, such as the difference in the number of male workers in industrial segments⁽⁹⁾, their occupational characteristics with greater exposure to noise, or even the hormonal factor, since estrogen can protect women against NIHL⁽²⁾.

No studies were found in the literature that analyze notifications of NIHL in SINAN specifically for female workers, meaning that there is currently no information available for this profile, which makes the analysis and interpretation of this condition in females challenging. This situation directly impacts the development of actions or public policies aimed at female workers, as guaranteed by Ordinance GM/MS No. 1.823 of August 23, 2012, which establishes the National Workers' Health Policy (Política Nacional de Saúde do Trabalhador e da Trabalhadora - PNSST)⁽¹⁸⁾.

Given the above, the objective of the present study was to establish the sociodemographic and occupational profile of Brazilian female workers notified with noise-induced hearing loss in the SINAN, between 2007 and 2022.

METHODS

A cross-sectional and descriptive study was conducted using data from NIHL notification forms in Brazil between 2007 and 2022, collected in SINAN.

The data are made available through the Collaborating Center for Surveillance of Occupational Health Issues (Centro Colaborador da Vigilância aos Agravos à Saúde do Trabalhador - CCVISAT), from the Institute of Public Health, Federal University of Bahia (Instituto de Saúde Coletiva - ISC-UFBA), for the General Coordination of Workers' Health of the Ministry of Health (Coordenação-Geral de Saúde do Trabalhador do Ministério da Saúde - CGSAT-MS)⁽¹⁹⁾. The provision of databases by the CCVISAT website aims to facilitate the construction of scientific and technological knowledge of worker health, mainly through epidemiological policies⁽²⁰⁾. The data were accessed on February 14, 2024.

For this study, two blocks of variables were considered: the first containing sociodemographic characteristics, such as age group (18 to 29; 30 to 39; 40 to 49; 50 to 59; 60 to 69; 70 or older; unknown); skin color/race (white; black; Asian complexion; mixed-race complexion; Indigenous; unknown); education (illiterate; incomplete 1st to 4th grade; complete 4th grade; incomplete 5th to 8th grade; complete elementary education; incomplete high school; complete high school; incomplete higher education; complete higher education; unknown/not applicable) and Brazilian region of notification (North; Northeast; Southeast; South; Central-West; unknown). In the second block, called occupational characteristics, the following variables were analyzed: situation in the labor market (registered employee with a contract; unregistered employee; self-employed/freelance; statutory and CLT public servant; retired; unemployed; temporary worker; cooperative member; occasional worker; employer; other; unknown); predominant type of noise (ininterrupted; intermittent; both); absence from work for treatment (yes; no); issuance of the Work Accident Report (Comunicação de Acidente de Trabalho - CAT) (yes; no; not applicable) and occupation, according to the classification of the Brazilian Classification of Occupations (Classificação Brasileira de Ocupações - CBO).

This study includes only NIHL notifications registered in SINAN, with the marker 'sex: female'. It is worth noting that the variable used refers to the biological sex reported in the notification system and not gender identity. Thus, the terms 'female workers' or 'women', when used throughout the text, refer to people registered as belonging to the female sex in the database. The absolute (n) and relative (%) frequencies of the variables of interest were analyzed. The data were tabulated in Microsoft® Excel spreadsheets and exported for statistical analysis in Stata 14 software. Since these are public domain data and there is no information about the identity of the participants, approval by the Human Research Ethics Committee was waived, as well as the signing of the Free and Informed Consent Form (FICF), in accordance with Resolution No. 510, of April 7, 2016, of the National Health Council.

RESULTS

Between 2007 and 2022, 1,080 NIHL cases in women were registered in SINAN. The sociodemographic profile revealed a higher occurrence of NIHL notification in women aged 50 to 59 years (30.7%) with white skin color/race (49.1%) and complete secondary education (17.5%). The Central-West Region presented the highest number of notifications (39.3%) (Table 1).

Table 2 describes the labor market situation of female workers, where 34.7% had a signed work contract, 15.5% were statutory public servants, and 10.7% were freelancers.

Table 1. Description of sociodemographic characteristics of workers notified of noise-induced hearing loss, Brazil, 2007-2022 (n=1,080)

| Variable | n | % |
|--------------------------------|-----|------|
| Age | | |
| 18 to 29 | 77 | 7.1 |
| 30 to 39 | 161 | 14.9 |
| 40 to 49 | 278 | 25.8 |
| 50 to 59 | 332 | 30.7 |
| 60 to 69 | 164 | 15.2 |
| 70 or over | 62 | 5.7 |
| Unknown | 6 | 0.6 |
| Race/Skin Color | | |
| White | 530 | 49.1 |
| Black | 53 | 4.9 |
| Asian complexion | 50 | 4.6 |
| Mixed-race complexion | 238 | 22.0 |
| Indigenous | 3 | 0.3 |
| Unknown Education | | |
| Illiterate | 5 | 0.5 |
| Incomplete 1st to 4th grade | 52 | 4.8 |
| Complete 4th grade | 51 | 4.7 |
| Incomplete 5th to 8th grade | 104 | 9.6 |
| Complete elementary school | 65 | 6.0 |
| Incomplete high school | 44 | 4.1 |
| Complete high school education | 189 | 17.5 |
| Incomplete higher education | 34 | 3.2 |
| Complete higher education | 116 | 10.7 |
| Unknown/Not applicable | 420 | 38.9 |
| Brazilian region | | |
| North | 3 | 0.3 |
| Northeast | 112 | 10.4 |
| Southeast | 409 | 37.9 |
| South | 130 | 12.0 |
| Midwest | 425 | 39.3 |
| Unknown | 1 | 0.1 |

Subtitle: n = absolute frequency; % = relative/percentage frequency

Regarding the predominant type of noise in the work environment, the category “both” (continuous and intermittent) was most common in the sample (38.3% of the total). It is also worth noting that 52.6% of women did not take a medical leave from work for treatment, and only 11.4% of the cases were reported in the Work Accident Report (CAT) (Table 2).

Figure 1 shows the occupations of female workers notified with NIHL in SINAN. The most common occupations were seamstress (13.2%), followed by telephone operator/teleoperator/telemarketing operator (9.1%), production line feeder (7.1%), domestic worker/cleaner (6.0%), and general cook/head chef/industrial or hospital cook (4.1%). It is also worth noting that a significant portion of cases were grouped into a single category called “other professions”, which, in total, corresponded to 44.3% of the total number of cases (Figure 1).

Table 2. Description of sociodemographic characteristics of workers notified for noise-induced hearing loss, Brazil, 2007-2022 (n=1,080)

| Variable | n | % |
|-------------------------------------|-----|------|
| Labor market situation | | |
| Registered employee with a contract | 375 | 34.7 |
| Unregistered employee | 19 | 1.8 |
| Self-employed/Freelancer | 116 | 10.7 |
| Statutory public servant | 167 | 15.5 |
| Public servant under the CLT regime | 23 | 2.1 |
| Retired | 112 | 10.4 |
| Unemployed | 106 | 9.8 |
| Temporary worker | 3 | 0.3 |
| Cooperative member | 9 | 0.8 |
| Occasional worker | 4 | 0.4 |
| Employer | 2 | 0.2 |
| Other | 69 | 6.4 |
| Unknown | 75 | 6.9 |
| Predominant noise type | | |
| Ininterrupted | 339 | 31.4 |
| Intermittent | 179 | 16.6 |
| Both | 414 | 38.3 |
| Unknown | 148 | 13.7 |
| Time off work for treatment | | |
| Yes | 95 | 8.8 |
| No | 568 | 52.6 |
| Unknown | 417 | 38.6 |
| CAT Issuance | | |
| Yes | 123 | 11.4 |
| No | 397 | 36.8 |
| Not applicable | 103 | 9.5 |
| Unknown | 457 | 42.3 |

Subtitle: CAT = Report of Work Accident; n = absolute frequency; % = relative/percentage frequency

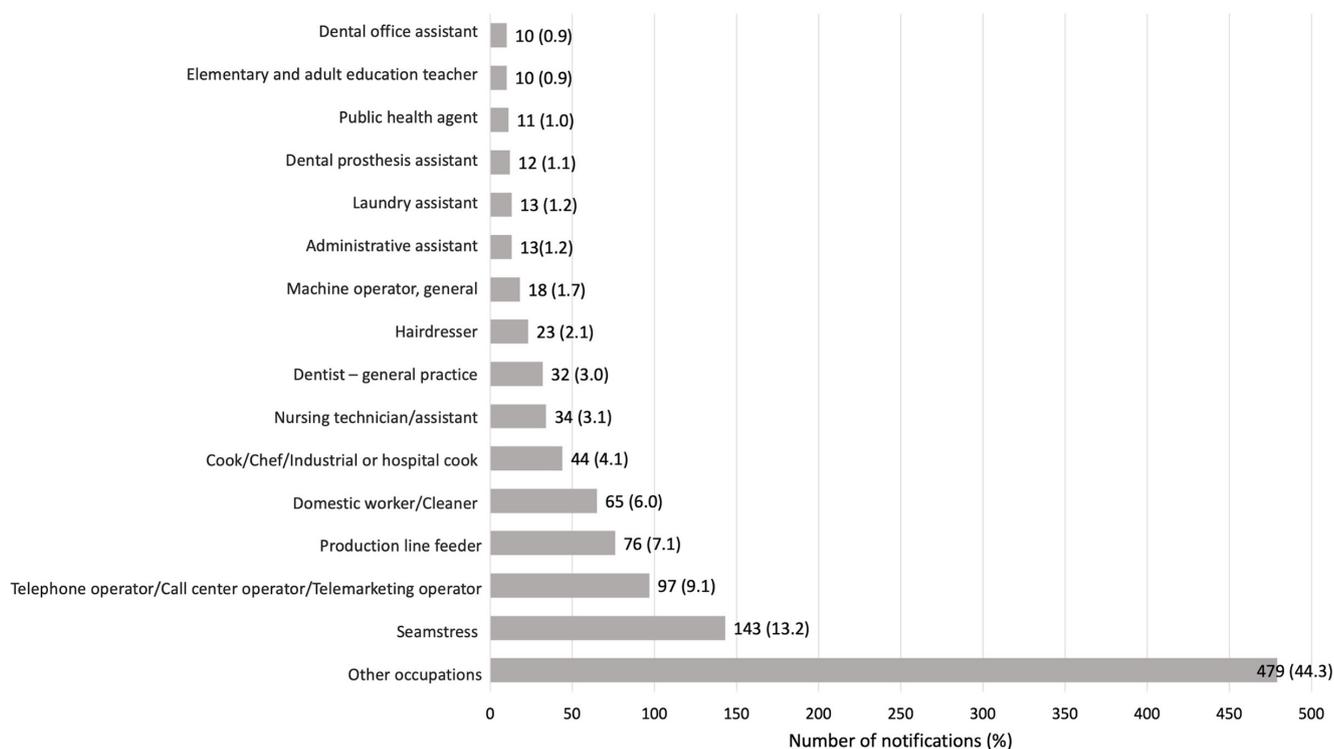


Figure 1. Description of female occupations reported in the Notifiable Diseases Information System (SINAN), Brazil, 2007-2022

DISCUSSION

The present study identified 1,080 notifications of NIHL in female workers during the analyzed period. There was a higher frequency of notifications among women in the 50- to 59-year-old age group, white skin color/race, and complete secondary education. The Brazilian region with the highest number of notifications was the Central-West, followed by the Southeast. Furthermore, the majority of female workers notified with NIHL were employed under a formal contract, exposed simultaneously to both uninterrupted and intermittent noise, did not take time off work to treat the condition, and did not have a CAT issued. Among the professions performed by these women, that of seamstress stood out the most.

No studies on NIHL notifications specifically in female workers were found in the literature. Thus, the results of this study will be discussed in relation to general studies on NIHL notification, regardless of sex, as well as other articles that have analyzed work-related injuries in women.

The number of 1,080 NIHL notifications in female workers in the period analyzed was considered small, even for females, indicating a general scenario of underreporting due to the prevalence of the condition and demonstrating the need for continued education and training of health professionals on health-related conditions, work accidents, and compulsory notification⁽²¹⁾.

Most female workers notified of NIHL were in the 50- to 59-year age group. A survey that analyzed sociodemographic and labor aspects of Brazilian workers reported for NIHL between 2006 and 2019⁽⁶⁾ and another that analyzed ten years of NIHL notifications, according to the Brazilian Classification of Occupations⁽²²⁾, found the same age range, despite their

samples covering both sexes. A study revealed different aspects in research that described the factors related to dizziness in male and female workers reported to suffer from NIHL in Brazil, in which the age group 60 years or older prevailed (27.8%)⁽²³⁾; in a study that described the epidemiological profile of the state of Goiás on NIHL covering both sexes, with a prevalence in the age group of 35 to 49 years (43.1%)⁽²⁴⁾, and in a third study, which analyzed only female workers with carpal tunnel syndrome and found an average age of 40 years and 6 months⁽²⁵⁾.

The highest occurrence of NIHL notification related to skin color/race was among white individuals, which was also observed in other studies that reported values of 24.9%, 59.1%, and 45.4%, respectively^(6,22,23). However, a survey revealed an occurrence of 63.3% for the “non-white” category⁽²⁴⁾.

Regarding education, a higher percentage was observed for the “unknown” category, followed by “complete secondary education”. A study analyzing the notification of NIHL according to the Brazilian Classification of Occupations between 2012 and 2021 yielded a result similar to that of the present study, considering workers in group 7, which includes workers in the production of industrial goods and services (56.4%)⁽²²⁾. Furthermore, a Brazilian study analyzing the prevalence of occupational noise exposure also found similar results to those of the current study⁽²⁶⁾. These findings may be related to the increasing level of education among the Brazilian population. The 2023 Continuous National Household Sample Survey (Pesquisa Nacional por Amostra de Domicílios Contínua - PNAD Contínua) of the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE) found that 54.4% of the population aged 25 or over had completed at least secondary education⁽²⁷⁾. However, another study found the highest occurrence in the category “up to complete elementary school”⁽²⁴⁾.

One aspect that deserves to be highlighted, related to the variable of education and others, concerns the incorrect completion of notification forms. This problem was also verified by a study that analyzed, in SINAN, work-related COVID-19 notifications, leading the authors to consider that missing data compromises the analysis and interpretation of the results, making it essential that the notifier pay greater attention when filling in the information⁽⁷⁾.

Regarding regions, the Central-West and Southeast demonstrated the highest number of notifications of NIHL in female workers. The same regions were observed in another study, which the authors explain can be attributed to the large economy of the Southeast Region, as well as its significant involvement in the development of programs and initiatives related to worker health⁽⁶⁾. Furthermore, the Central-West region is also recognized for its economic significance, as it holds a 10% share in the national gross domestic product (GDP), and it has consistently demonstrated the best economic performance among Brazilian macro-regions over the last four decades⁽²⁸⁾.

Regarding the situation in the labor market, the highest number of NIHL notifications was observed in workers with a formal employment contract, a result also found in another national survey⁽⁶⁾. These findings were reported in 2015 by the IBGE's National Household Sample Survey (Pesquisa Nacional por Amostra de Domicílios - PNAD), which showed that 64% of the population over 10 years old was employed with a formal employment contract, with 62.2% of workers having a formal employment relationship⁽²⁹⁾.

The predominant noise categories to which female workers were exposed were "intermittent and uninterrupted", differing from other studies that found greater exposure to uninterrupted noise, at 41.1%⁽⁶⁾ and 33%⁽²²⁾, and increased exposure to intermittent noise at 51.3%⁽²⁴⁾.

Most female workers did not take time off work to treat the condition, a result that aligns with findings from three other studies: 92.6%⁽⁶⁾, 46.2%⁽²⁴⁾, and 61.5%⁽²²⁾.

The issuance of the Work Accident Report (CAT), in the present study, presented the highest scores for the "ignored" category, which, as previously explained, impacts the reflection and discussion of the data, as well as the problem surrounding the injury. The non-issuance of the CAT was observed for the majority of workers in this study, as in other studies: 60.6%⁽⁶⁾, 83.1%⁽²⁴⁾, and 43.2%⁽²²⁾.

Regarding the occupations performed by these workers, seamstresses stood out, in addition to the category labeled "other professions", which accounted for almost half of the reported cases. The occupation of seamstress is associated with an occupational environment in which noise is present, thus representing a potential risk to hearing health⁽³⁰⁾. A Brazilian study found that workers in the industrial goods and services production group had the highest number of NIHL notifications between 2012 and 2021. The occupation of seamstress is part of this group, specifically within the "workers in the textile, tanning, clothing, and graphic arts industries" category⁽²²⁾.

It is noteworthy that this study presents some limitations regarding the use of secondary data, which have a direct influence on the quality of the form completion, ranging from incompleteness to incorrect filling of variables, as well as underreporting. The persistence of this scenario directly implies understanding the real epidemiological context of the disease, planning, reviewing, and executing actions related to worker health. It is also essential to emphasize the importance of developing more inclusive protocols and forms based on the

principles of equity, thereby ensuring the production of more reliable data. The NIHL notification form does not include information on gender identity, which limits more in-depth analyses of populations considered more vulnerable.

Regarding its potential, the research is unique in describing the sociodemographic and occupational profiles of Brazilian female workers reported to have NIHL in Brazil, contributing to reflection on public policies and health actions aimed at female workers. Furthermore, by establishing a sociodemographic profile of a category, the way is opened for conducting new research involving various analyses.

CONCLUSION

By characterizing the sociodemographic and occupational profiles of Brazilian female workers notified to suffer from NIHL in SINAN from 2007 to 2022, this study reveals a need for a better understanding and management of the condition in this population, taking into account the observed characteristics, such as the main occupations, the formal employment relationship, and the low indicators of CAT issuance. It is essential to encourage reflection on the importance of public policies and actions aimed at prevention, monitoring, and assistance in hearing health to address the problem of NIHL, considering the specificities of sex in the occupational health context.

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