

## Article

# Occupational Conditions in Brazilian Modern Rural Slave Labour

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**Abstract:** Work in rural properties in conditions similar to slavery remains a reality in many countries, including Brazil. The Brazilian State characterises contemporary slave labour as a condition of freedom restriction for paying off debt, served by intensive working hours or inadequate working conditions related to Occupational Safety and Health. This study highlights the working conditions in rural slavery in Brazil, based on the Occupational Safety and Health perspective. The study was carried out based on a sample of Inspection Reports of the Governmental Authority to Combat Modern Slavery. A random sample of 42 reports was collected and analysed, describing the working conditions of 392 rural workers characterised as labour analogous to slavery. The analysis strategy was carried out from an Occupational Safety and Health standpoint. Data sets were identified and selected, grouped into five categories: Work routine; General health conditions; Manual machines and tools; Environmental conditions. Widespread exposure of Neo-enclaved workers to stressful working hours was found, in addition to severe Occupational Safety and Health problems. The occurrence of all these characteristics simultaneously was the most observed phenomenon among the sample, which demonstrates that it is possible to identify cases of modern slavery from an Occupational Safety and Health perspective.

**Keywords:** agricultural activities; contemporary slavery; human rights; Occupational Safety and Health; occupational risks



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## 1. Introduction

Comparing the 18th and 19th centuries with the second half of the 20th century and the 21st century, working conditions have been improving on a social and economic level, particularly in Occupational Safety and Health (OHS). However, the worst working conditions, characterised as labour analogous to slavery, persist in many countries, more than a hundred years after the universal abolition of slavery [1].

Neo-enclaved people suffer daily accidents and acquire occupational diseases without any control from the OHS authorities, mainly due to this type of bond's current coverup. Workers are exposed to the occupational risks specific to each activity, combined with risks aggravated by the poor working and living conditions in which these activities are carried out, adding to long and exhaustive working hours.

Slave labour is characterised as a severe violation of human rights by international treaties, declarations, and principles. In general, all national governments refuse this act [2]. However, the International Labour Organization (ILO) estimates the current number of enslaved people worldwide at more than 40 million [3].

Brazil prohibits slavery in its constitution and the law [4]. According to Brazilian law, there are four aggravating factors that, alone or together, can lead to the characterisation of the condition “labour analogous to slavery”: (i) forced labour; (ii) exhaustive working

days; (iii) terrible (degrading) working conditions; (iv) restriction of circulation, by any means, due to debt contracted with the employer or his representative. In addition to these four circumstances that characterise Neo-slave labour, working in degrading conditions for human safety, health and dignity, as well as extended hours, is directly related to OHS conditions.

Studies on contemporary slave labour [5–9] generally focus on sociocultural and history spheres, often from a human rights perspective. These studies contribute to clarifying the causes and consequences of contemporary slavery. However, they do not intend to find objective means to identify this form of labour exploitation on the ground.

However, in the specific case of agricultural work, when asked about the precise classification of contemporary slave labour by labour inspectors, the answer is not easy. The question then arises: Is it possible to identify cases of slavery from an OHS perspective? Suppose this approach is possible, once these inspection technicians travel and understand the terrain. In that case, this can help identify many of these situations. Thus, this work aims to contribute to understand and identify rural workers' OHS conditions, mainly focusing on contemporary slavery in Brazil. It is also expected that this work will help raise awareness to highlight this problem in different corners of the world where these practices are still a reality.

## 2. Materials and Methods

For this study, an Inspection Reports sample on combating slave labour, prepared by the Inspection Division for the Eradication of Slave Labour (DETRA), of the Brazilian Ministry of Labour was used.

The sample consists of a random selection of 42 reports with the characterisation of slave-like work produced between 2007 and 2017 in rural activities in different geographical regions of the country [10].

The reports were prepared by 113 different inspectors in teams consisting of up to 6 members in due diligence, carried out in all Brazilian regions, and contain a sample of workers who reach the desired levels of confidence and error. The sample does not contain reports with formal fulfilment problems. Out of the 648 workers covered in the 42 reports, 392 were considered by DETRA to be under working conditions characterised as condition labour analogous to slavery for “exhausting work” and/or “terrible working conditions” (Brazilian legal classification) by the inspection technicians' division mentioned above.

The sample used for the statistical analysis was the data from the 392 workers that were identified as being in slavery-like conditions. The defined population was based on an estimated 369,000 enslaved people [11] in Brazil in 2018. The level of confidence was set at 95%, and the margin of error is 4.95%.

The equation defined the sample:

$$n = \frac{NZ^2p(1-p)}{(N-1)e^2 + Z^2p(1-p)} \quad (1)$$

where  $n$ : sample size to be calculated;  $N$ : the population's size;  $Z$ : level of confidence chosen, expressed as the number of standard deviations;  $p$ : proportion expected to be found;  $e$ : maximum tolerated margin of error.

For control, the data found were compared with the statistics presented by other studies based on the Inspection Reports [12,13].

The collected data were stratified by groups:

- Labour Routine and sociodemographic—sociodemographic and administrative data related to the management methods of enslaved human resources;
- General OHS conditions and individual protection—data directly related to the protection of the workers' health;
- Manual machines, tools and collective protections—data that are related to the risks caused by exposure to machines and tools;

- Environmental working conditions—data that refer to the occupational hygiene of the activities performed by workers and the physical and sanitary structures of the place of accommodation.

These data are in accordance with the inspection recommendations that include indicators of extended hours and terrible working conditions [4,13–16].

Data collection was based on selecting technical information from the analysed group, directly registered into a database, implemented in Microsoft Excel 365.

A univariate descriptive analysis was performed (Table 1), using different statistical measures, especially the measures of central tendency (mean) and data frequency (percentage) for quantitative data, and frequency table (percentage) for qualitative data.

**Table 1.** Data analysed in the Inspection Reports results.

Labour Routine and Sociodemography	General OHS Conditions and Personal Protection	Manual Machines, Tools and Collective Protections	Environmental Working Conditions
Daily working hours	Occupational accidents/illnesses	Machine protections	Physical risks
Workweek	PPE	Use of manual tools	Chemical hazards
Sex	Health checks		Biological risks
Age	First aid		Mechanical risks
Time of submission to Neo-slavery			
Work activities			

Supplementary to the sample analysed, the following databases on contemporary slavery were referred to as a theoretical reference and paradigm: DETRAE, Pastoral Land Commission (CPT), International Labour Organization (ILO), Walk Free Foundation, 50 for Freedom, Friends of the Earth—Brazilian Amazon, NGO Reporter Brasil and Free the Slaves.

### 3. Results

#### 3.1. The Labour Routine and Sociodemography

##### 3.1.1. Subsubsection Developed Activities

From the 392 workers in the sample, 60.20% worked in activities related to the “cutting of bushes and trees” (Table 2). It was also verified that they could develop one or more tasks. The activity fields described include the maintenance of pastures for cattle, cutting shrubs and trees that grew in the middle of the pasture over time. Generally, this activity is performed using manual tools such as scythes and axes, sometimes supported by chainsaws. In addition to these activities, the cutting of firewood and the felling of reforestation trees are added.

**Table 2.** Distribution of workers in the activity fields.

Activity Groups	Quantities	% of Workers
Cutting of scrub and trees	236	60.20%
Agricultural activities	145	36.99%
Livestock activities	70	17.86%
Charcoal	41	10.46%
Pesticide application	36	9.18%
Construction of wooden structures	29	7.40%
Mining works	15	3.83%

The second most recurrent set of activities is “agricultural activities”, with 36.99% of the workers involved in these tasks that include planting and or harvesting activities in the most diverse agricultural activities.

Next comes “livestock activities”, with activities related to the handling, feeding, vaccination and cleaning of animals such as oxen and pigs, and “charcoal”, which deals with charcoal production from firewood, often extracted directly from forests.

With little involvement, below 10%, there is the “application of pesticides”, with the use of handheld sprayers; the “construction of wooden structures”, with the construction of fences, corrals or woodcutting; and “mining”, with the artisanal extraction of minerals directly from the soil, that is a secondary activity in some rural properties.

### 3.1.2. Daily Working Hours

The average workload found was 9.52 h of work per day, in activities developed almost entirely of heavy work; that is, with high physical demands ISO 7243/2017 [17].

Only 20% of the workers in the sample performed their usual duties within 8 h per day; all the remaining 80% exceeded this workload (Table 3). It is noteworthy that almost 40% of the sample worked at least 10 h per day in activities that require heavy or very heavy physical effort [17].

**Table 3.** Distribution of workers according to their daily hours.

Daily Working Hours	Quant.	%	Total (%)
8 h	47	11.99%	11.99%
>8 h	7	1.79%	13.78%
≥9 h	92	23.47%	37.24%
≥10 h	80	20.41%	57.65%
≥12 h	8	2.04%	59.69%
No Information (N/A)	158	40.31%	100.00%

In addition to the activities related to the functions developed on the farms described as working hours in the reports, workers also had an extra day to carry out various activities with moderate physical effort [17].

Average daily activities were calculated as:

9.5 h of working activity;

1 h walk to get to and from work;

2 h for meals (breakfast, lunch and dinner);

2 h for various activities (described above);

9.5 h to rest or sleep.

### 3.1.3. Workweek

The average workweek of the sample of workers was 6.23 effective days of work per week, with 44% of them not being allowed the right to enjoy weekly rest, and 28% worked six full days a week (Table 4).

**Table 4.** Distribution of workers according to their weekly shift.

Workweek	Quant.	%	Total (%)
5 days	11	2.81%	2.81%
>5 days	47	11.99%	14.80%
6 days	58	14.80%	29.59%
>6 days	91	23.21%	52.81%
No Information (N/A)	185	47.19%	100.00%

### 3.1.4. Age of the Workers

It was not possible to obtain age records for all workers. From the 392 subjects of the sample analysed, 11.48% have no age-related information in the reports (Table 5). Excluding these, the percentage of workers under 45 is 76.66%, and only 0.29% are over 65 years.

**Table 5.** Age distribution of workers

Age	Quant.	%	Total (%)
Until 16 years	9	2.30%	2.30%
16 until 18 years	17	4.34%	6.63%
18 until 24 years	72	18.37%	25.00%
25 until 34 years	87	22.19%	47.19%
35 until 44 years	81	20.66%	67.86%
45 until 54 years	64	16.33%	84.18%
55 until 65 years	16	4.08%	88.27%
Older than 65 years	1	0.26%	88.52%
No Information (N/A)	45	11.48%	100.00%

### 3.1.5. Sex

Besides the concentration in young adults, the sample shows a high concentration among male workers, with 92.09% of the sample, compared to much lower participation of women with 7.91%.

### 3.1.6. Time of Submission to Neo-Slave

From these Neo-enslaved men and women who make up the sample, most (81.36%) were subjected to Neo-slavery less than three months earlier when released by official inspection (Table 6). Another 9.97% were more than three and less than six months old, which totals 91.34% of the sample submitted to Neo-slavery. It was not possible to specify the working time of 2.81% of the sample.

**Table 6.** Distribution of workers by the time of submission to Neo-slavery.

Working Time	Quant	%	Total (%)
≤1 Month	142	36.22%	36.22%
≤2 Months	97	24.74%	60.96%
≤3 Months	71	18.11%	79.07%
≤6 Months	38	9.69%	88.76%
≤1 year	19	4.85%	93.61%
≤5 years	10	2.55%	96.16%
>5 years	4	1.02%	97.18%
No Information (N/A)	11	2.81%	100.00%

## 3.2. Work Environment

Environmental working conditions were indirectly assessed through an individual and detailed analysis of the activities carried out by workers in each of the 42 reports in the sample. The main environmental risks explained in the reports were documented, evaluated and stratified between physical, chemical, biological or mechanical risks/accidents within each group of rural activities in which it relates.

Thus, the identified risks were arranged in tables, with the first combining the occupational risks common to all activity groups (Table 7) and the rest of the tables combining specific risks of each activity group.

**Table 7.** Similar occupational risks in all activity groups.

Type of Risk *	Source	Risks	Consequences
M	Tools and machines	Contact or proximity to machines or materials at high temperatures	Burn
Ph	Tools and machines	Exposure to noise from using machines	Noise-induced hearing loss; Headache; Tiredness; Stress
M	Tools and machines	Use of equipment with low maintenance, without maintenance or lack of training	Cut; Burn; Eye injury; Amputation; Electrocutation; Death
M	Tools and machines	Use of sharp, defective or untrained manual tools	Cut; Lesion; Amputation
M	Fieldwork	Eye accidents with tree branches	Eye injury; Vision loss
M	Fieldwork	Wild animal attack	Lesion; Infection; Death
B	Fieldwork	Contact with wild flora—skin, eyes, ingestion	Irritation; Allergic shock
M	Fieldwork	Crushing by landslides or rolling rocks/trees or by falling trees	Lesion; Amputation; Death
M	Fieldwork	Electrocutation by lightning (lightning)	Burn; Cardiac arrest; Death
Ph	Fieldwork	Exposure to bad weather	Burn; Hypothermia; Dehydration; Heat stress
Ph	Fieldwork	Exposure to solar radiation (ultraviolet)	Burn; Insolation; Skin cancer
M	Fieldwork	Strenuous activity or weight-bearing overload	Spinal cord distention; Musculoskeletal disorders
M	Fieldwork	Falls at the same level or from a height	Lesion; Dislocation; Fracture; Death
B	Fieldwork	Insect and reptile bites or stings	Skin irritation; Allergic reaction; Infection; Poisoning; Death
M	Fieldwork	Human violence	Injuries; Death
C	Fieldwork	Exposure to mineral or vegetable dust	Allergic reaction; Pneumoconiosis

\* Ph—Physical; C—Chemical; B—Biological; M—Mechanical/ Accident.

The tables present only the risks recorded in the content of the reports that make up the sample. It is possible that other existing risks have not been referred to or identified. However, this risk recognition serves to list the main occupational risks on farms that use Neo-slave labour.

Table 7 shows the occupational risks common to all activities evaluated in the sample. The 16 common risks arise from working conditions with various similarities, classified mainly as mechanical risks (10 occurrences). The other similar risks were distributed as follows: three physical, two biological, one chemical. The specific risks for each group of activities were distributed according to Table 8. Several risks can be found in more than one activity group, but not at the same time. The activity groups presented specific risks distributed as follows (Tables 9–15).

**Table 8.** Number of specific risks by activity group.

Activity Groups	Specific Risks	% of Sample
Cutting of bushes and trees (Table 10)	4	60.20%
Agricultural activities (Table 11)	3	36.99%
Livestock activities (Table 12)	5	17.86%
charcoal (Table 13)	6	10.46%
Pesticide application (Table 14)	2	9.18%
Construction of wooden structures (Table 15)	4	7.40%
Gold mining (Table 16)	5	3.83%

**Table 9.** Occupational risks specific to the “general cultivation” activity group.

Type of Risk *	Source	Risks	Consequences
C	Fieldwork	Contact with fertilisers (spraying, harvest)	Skin irritation; Dermatitis; Allergies; Chocking
M	Fieldwork	Exposure to fire (controlled fires)	Choking; Burns; Death
M	Fieldwork	Fire	Choking; Burns; Death

\* C—Chemical; M—Mechanical / Accident.

**Table 10.** Occupational risks specific to the activity group “cutting of bushes and trees”.

Type of Risk *	Source	Risks	Consequences
Ph	Tools and machines	Exposure to chainsaw vibration	Raynaud’s disease; White finger syndrome; Carpal tunnel syndrome
Ph	Tools and machines	Exposure to whole-body vibrations—use of heavy machinery	Nervous system disorders; Musculoskeletal disorders
M	Tools and machines	Chainsaw kick	Lesion; Dislocation
M	Fieldwork	Fire	Asphyxia; Burns; Death

\* Ph—Physical; M—Mechanical / Accident.

**Table 11.** Occupational risks specific to the “livestock activities” activity group.

Type of Risk *	Source	Risks	Consequences
C	Fieldwork	Inhalation of gases resulting from the decomposition of organic matter	Choking; Breathing problems; Death
C	Fieldwork	Exposure to pesticides or veterinary drugs	Intoxication; Death
M	Fieldwork	Crushing resulting from falling structures	Lesion; Fracture; Death
M	Fieldwork	Animal attack	Lesion; Infection; Death
B	Fieldwork	Contact with animal waste or secretions	Zoonoses; Infection

\* C—Chemical; B—Biological; M—Mechanical / Accident.



**Table 12.** Occupational risks specific to the “charcoal” activity group.

Type of Risk *	Source	Risks	Consequences
Ph	Tools and machines	Exposure to chainsaw vibration	Raynaud’s disease; White finger syndrome; Carpal tunnel syndrome
Ph	Tools and machines	Exposure to whole-body vibrations—heavy machine use	Nervous system disorders; Musculoskeletal disorders
M	Fieldwork	Crushing by stacked materials	Fracture; Concussion; Death
M	Fieldwork	Exposure to fire	Choking; Burns; Death
M	Fieldwork	Chainsaw kick	Lesion; Dislocation
M	Fieldwork	Fire	Burns; Choking; Death

\* Ph—Physical; M—Mechanical / Accident.

**Table 13.** Occupational risks specific to the “pesticide application” activity group.

Type of Risk *	Source	Risks	Consequences
M	Tools and machines	Use of backpack sprayer pump	Muscle strains; Back pain
C	Fieldwork	Contact, inhalation or ingestion of pesticides during mixing, loading, application, among others.	Burns on the skin; Intoxication; Breathing problems; Vision loss; Death

\* C—Chemical; M—Mechanical / Accident.

**Table 14.** Occupational risks specific to the “wood construction” activity group.

Type of Risk *	Source	Risks	Consequences
Ph	Tools and machines	Exposure to manual machine vibration	Raynaud’s disease; White finger syndrome; Carpal tunnel syndrome
M	Fieldwork	Fire	Choking; Burns; Death
C	Fieldwork	Exposure to paints, solvents, glues, cleaning products (skin, eyes, inhalation)	Skin irritation; Allergic reaction; Intoxication
M	Fieldwork	Crushing resulting from falling structures	Lesion; Amputation; Death

\* Ph—Physical; C—Chemical; M—Mechanical / Accident.

**Table 15.** Occupational risks specific to the “mining” activity group.

Type of Risk *	Source	Risks	Consequences
Ph	Tools and machines	Exposure to manual machine vibration	Raynaud’s disease; White finger syndrome; Carpal tunnel syndrome
Ph	Tools and machines	Exposure to whole-body vibrations—use of heavy machinery	Nervous system disorders; Musculoskeletal disorders
Ph	Fieldwork	Exposure to moisture	Skin diseases; Respiratory diseases
C	Fieldwork	Exposure to flammable gases during excavations	Burns; Choking; Death

\* Ph—Physical; C—Chemical.

### 3.3. Machines, Manual Tools and Collective Protections

The work activities of 89.54% of the sample of Neo-enclaved workers were performed using manual tools such as sickles, axes and machetes (Table 16). In second place, but also significantly present in the reports, are motorised machines, especially chainsaws with 27.30% and agricultural tractors with 24.74%. Other machines and implements, motorised and nonmotorised, account for 18.62% of the sample, and with a lower occurrence is the costal pump for pesticide application, used by 9.18% of the sample. It was impossible



to measure each tool or machine quantities due to the analysed reports' lack of detail. Likewise, it was impossible to relate to each worker the most used work tool.

**Table 16.** Use of machines and manual tools.

Machine and Tools	% of Workers
Manual tools	89.54%
Chainsaw	27.30%
Farm tractor	24.74%
Other machines or implements	18.62%
Hand pump for pesticides	9.18%

### 3.4. General OHS and Personal Protection Conditions

None of the 392 Neo-enclaved workers in the sample underwent any type of health check before starting work or had access to first aid materials. There was also no evidence of supplying personal protective equipment (PPE) suitable for the activities performed.

Out of the 42 reports, only eight reports were accidents or illnesses described. The remaining 34 did not report any injury or harm related to workers' health.

## 4. Discussion

### 4.1. Labour Routine and Sociodemography

#### 4.1.1. Work Activities

The most recurrent work activities in rural Neo-slavery require low professional qualifications and high physical effort. Secondly, activities that require more technical knowledge occur, such as the operation of chainsaws, tractors and other machinery. However, workers who carry out these activities do so without having been qualified to operate with these motorised machines, which exposes them to unsafe situations in an aggravating way.

It is common to carry out several types of activities concomitantly, depending on the rural property's needs where they are working. These activities can be quite diverse, such as cutting firewood with a manual tool, driving a tractor or cooking. It is also common for workers to carry out activities, making it impossible to separate workers by function effectively. However, being exposed to the same environment and similar working conditions, it was decided to join them in groups corresponding to the main activities.

#### 4.1.2. Daily Working Hours

The average working hours of the workers registered by the Brazilian inspection technicians to combat slavery are 9.5 h of daily work in the field, generally ranging from 8 to 12 h of daily work and more approximately 2 h of different activities.

This 2 h of work is composed of daily routines necessary for workers' survival. They are diverse activities, often far from the accommodations that put them at risk if they are not carried out. Among these, the activities necessary to supply firewood and water can be highlighted, in addition to hunting, fishing or collecting fruit to complement meals.

Necessary domestic activities such as preparing meals and personal asepsis and accommodation were also carried out with more time and physical effort than usual due to the lack of minimally adequate household needs.

This Neo-enclaved person's average workload is significantly longer than the maximum daily workload of 8 h recommended by the ILO and legally determined for Brazilian workers [15,18].

In Neo-slavery, because it is usually kept on the low, it is common for workers not to be fully aware of their diminution to this social situation [19]. Most Neo-slaves are only subjected to drudgery and unauthorised work.

#### 4.1.3. Workweek

The average workweek is longer than six full days, usually from Monday to Saturday, or longer, with the demand for work being recurrent on Sunday.

#### 4.1.4. Age of Workers

Submission to Neo-slavery, which is illegal under any circumstance and age group, can have a considerable effect when the victims are people in physical and mental development, that is, children and adolescents [20].

In the analysed sample, the total workers under 18 years old are 7.5% of the total. However, the probable reason for this age group's lower representativeness is the ease of obtaining adult workers, with greater physical strength and, consequently, higher financial income. Another vital aspect is fighting against child labour in Brazil, having a widespread and more comprehensive inspection network than the fight against modern slave labour. Furthermore, it is a reinforcement of the network of Guardian Councils that is represented in all Brazilian municipalities [21,22]. As a result, it is assumed that the avoidance of child labour is a way to minimise the possibility of getting caught by the official inspection.

The other 92.5% of the sample are adults, mainly between 18 and 44 years old, which corresponds to 69.16%. When the age is extended to 54 years, the total will become 87.61% of the sample.

The reason for focusing on the younger age groups seems to be once again the easiness to get workers with the peak of physical strength, excluding the older weaker ones.

#### 4.1.5. Sex

The concentration of Neo-slavery among male workers (92.09%) validates the hypothesis of searching for physically stronger workers. It is also repeated when considering urban Neo-slavery data, representing 95% of Neo-slavery workers [13].

#### 4.1.6. Time of Submission to Neo-Slavery

When analysing the time of sufficient submission to Neo-slavery between the beginning of the activity until the rescue by the inspection group, a period of days or months was observed; in general, workers in the sample were exploited during the periods of the year when there is the greatest need for labour on the farms. They were released after that, like in regular temporary work.

The Brazilian Neo-enslaved people are attracted by promises of work for some temporary need in rural properties [5,6], being easily employed by recruiters due to the tremendous social vulnerability of wide-ranging Brazilian society levels [5,6]. Furthermore, some states in Brazil's most impoverished regions end up exporting Neo-slave labour to the wealthiest states [23].

It is cheaper to repeat this recruitment seasonally whenever there is a need for labour than to guarantee the subsistence (food, clothing, housing, among others) of each worker throughout the year, as was the classical rule of slavery. The practice of slavery for seasons allows, additionally, to reduce the risk of being discovered by the inspection.

### 4.2. Work Environment

#### 4.2.1. Physical and Machine-Related Activities

Physical risks (or accidents) are the most found in the sample due to the human body's wide use as a driving force in carrying out activities. For example, there is the cutting of small trees and shrubs for cleaning pastures for cattle breeding, which is carried out mainly with large scythes [5,6].

The use of motorised agricultural machines and equipment is mentioned in the sample but with fewer occurrences. Chainsaws are the most common, as primary or secondary equipment, supporting the use of cutting tools such as sickles, brush cutters, axes and machetes. Chainsaws are characterised by the ability to cause severe injuries to the user and, for this reason, require careful maintenance and training [24,25]. The chainsaw ends up

being an aggravated source of mechanical risks for the enslaved. Its use without adequate and mandatory training and without consistently maintaining this equipment. Moreover, the chainsaw was being used without the necessary PPE. The most severe accident detected is when the chain of the chainsaw breaks.

Failure to undergo training and constant maintenance for the equipment and the lack of use for the PPE is noticed to be reoccurring repeatedly when it comes to the use of machines and equipment with unprotected moving parts, which increases the number of serious injuries, especially amputation or death of the worker [26,27].

#### 4.2.2. Dust and Smoke

In the field activities, each worker from the sample was exposed to dust, identifying it as a chemical risk. The types of dust identified qualitatively in the reports are as follows: uncomfortable (inert) mineral dust, which causes pneumoconiosis by accumulation, and fibrogenic dust, if retained in the lungs can impair the lungs' ability to function correctly. Unprotected exposure to organic dust can cause severe damage to the respiratory system [28–30]. Organic dust is attained in most activities related to cutting forest trees, charcoal, or agricultural activities.

As a worldwide example of this type of exposure, cotton ginning operations in small agroindustry in developing countries using roller mills can be mentioned [31]. On average, workers of these mills are exposed to inhalable dust concentrations of cotton fibres between 2 and 5 mg·m<sup>-3</sup> [31–33], exceeding the maximum exposure limit of 0.2 to 2 mg·m<sup>-3</sup> suggested by the American Conference of Governmental Industrial Hygienists (ACGIH), British Occupational Hygiene Society, and Occupational Safety and Health Administration (OSHA).

Another activity commonly carried out by Neo-slaves is the controlled burning of forest areas to open new agricultural fields or planting areas to facilitate the harvesting of sugar cane [34]. The burning of sugarcane, which consists of burning the leaves of the sugarcane before the beginning of the harvest, is particularly harmful since the smoke generated in the process is mostly (~96% by weight) within the respirable fraction (diameter aerodynamic < 4 µm) [35]. After the burning process, the cane's stem without leaves remains, more comfortable to be harvested through machete blows.

Exposure to smoke from burning wood is less harmful in terms of the respirable fraction (average of 1.3% in volume) than the smoke from sugarcane leaves [35]. However, forest fires still present very high exposure average values to fine particulate matter (PM<sub>2.5</sub>) and carbon monoxide (CO) for those dealing with their extermination or control [36,37].

#### 4.3. Machines, Manual Tools and Collective Protections

The analysed data show a predominance in the use of manual tools, predominantly cutting tools such as sickles and axes, used in most of the Neo-enslaved activities, with emphasis on the swidden, agricultural activities, livestock activities, charcoal and construction of wooden structures.

The low mechanisation of the manual tools used by Neo-enslaved workers contributes to an increase in the number of injuries during the activities compared to the improved and modern tools.

In the activities developed by the enslaved individuals in the sample, the use of chainsaws and tractors was around 25%, indicating a low percentage of usage, regardless of the evident improvement in productivity, resulting from the modernisation of tools. In these cases, the number of Neo-slave labourers is a determining factor for the low number of mechanical tools. Investing in advanced machines certainly increases productivity, but it requires a considerable amount of investment.

Existing machines on farms that use Neo-slave labour are usually cheaper. They are not guaranteed to have the appropriate protection features. Among these, chainsaws that can often be operated without training and PPE contributes to the high accident rates and injuries [24].

Rural activities with a low number of advanced mechanical equipment indicate that hand tools and machines are among the leading causes of injuries, such as amputations of hands and fingers among workers [38–40].

#### *4.4. General OHS Conditions and Personal Protection*

##### *4.4.1. Prevention and Care*

In the sample, no medical examination was investigated to assess the workers' physical condition and if the activities assigned to them are suitable, consequently leading to elevating the risks or illness levels if they were in an inappropriate working field.

The same results were found for the supply of PPE, where no Neo-enslaved labour received PPE appropriate to the activities performed. Furthermore, when PPE is present in the reports, the worker himself was the one purchasing them.

##### *4.4.2. Accidents and Illnesses*

Despite the lack of PPE, only 8 out of the 42 reports presented cases of accidents or illnesses. The low injury occurrences are due to the time spent on the farms since the working period is up to three months for most enslaved people (81.36% of the sample). Thus, there is no time for the development of most chronic illnesses. The return to residence probably allows some recovery or detoxification by the body.

Only acute cases of illness or accidents were reported in the reports: injuries and cuts by manual tools; various abrasions; scorpion bites; foot fracture; cramps; limb and back pain; intestinal infection; pesticide poisoning.

Of all cases, medical assistance was reported in only one. All other cases were not aided, and the worker had to rely on other workers' assistance during their recuperation period.

The case in which there was medical help was too severe, with a massive injury to the workers' face, caused by a chainsaw breaking chain. This injury must have motivated the foreman to request an ambulance from the public health service. The injured worker got ten stitches on his face and was hospitalised for two days, returning to the farm after only one week of recovery.

It is assumed that many accidents and illnesses of low severity have not been reported to the inspectors since the workers had to be without work for some time, which is regularly unpaid.

The absence of PPE and first aid kits justifies the neglect of the Neo-slave labourer's life. Moreover, the working activities mainly occur in isolated rural areas or the middle of the forests, contributing to the absence of medical support in those areas, making the working conditions even worse.

#### *4.5. General Discussion*

Modern rural slavery in Brazil proved to be mostly seasonal, with socially vulnerable workers' annual enticement during periods of greatest need for labour on rural properties.

The seasonality of rural labour is a worldwide phenomenon that can be observed, even in developed countries. These workers, often migrants, tend to be subject to worse general working and accommodation conditions and longer working hours than native workers [41–44]. However, even though they are deficient, the working conditions of legalised seasonal workers seem to be quite different from those observed in workers subjected to contemporary slavery.

The studied sample indicates that enslaved rural workers have, in general, very limited or even nonexistent access to training, individual or collective protection equipment, first aid material and medical examinations. They also work long and exhausting journeys, often in isolated locations. They still have to work more hours on activities necessary for energy replenishment and hydration. Thus, the working conditions of current slaves in Brazil are much worse than that of legalised seasonal rural workers, both in Brazil and in more developed countries on other continents.

## 5. Conclusions

This study is based on a sample of 392 Neo-enclaved workers in Brazilian rural properties, included in 42 Inspection Reports of the Governmental Authority to Combat Modern Slavery. It was possible to identify the OHS conditions to which these workers were submitted in a comprehensive and detailed way.

The activities performed are mainly those with low technical qualification requirements and significant physical effort demand, requiring long daily and weekly working hours, consequently leading to workers' physical exhaustion.

The lack of PPE supply places workers at high risk from environmental exposures, even in severe exposure cases. Therefore, it tends to be aggravated by not carrying out admission to medical examinations and lack of access to first aid kits.

The sample analysis points to the widespread exposure of Neo-enclaved workers to stressful working hours, serious OHS problems and deplorable housing conditions. The occurrence of these factors simultaneously is commonly observed in the sample analysed, emphasising the situation's seriousness.

The results can also be used as a basis for broader studies on rural workers' working conditions and to support public policies to combat contemporary slavery.

Finally, as for the research question presented earlier, it is possible to identify cases of modern slavery from an OHS perspective, and this approach may help inspectors' technicians identify many of these situations. It is hoped that this work will help to raise awareness in identifying and combating this human rights problem in different countries.

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