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ORIGINAL ARTICLE

Observational Study

Epidemiology of work-related hand and wrist injuries in a referral center: A descriptive study

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Abstract

BACKGROUND

Occupational hand and wrist injuries (OHWIs) account for 25% of work-related accidents in low- and middle-income countries. In Colombia, more than 500000 occupational accidents occurred in 2021, and although the rate declined to less than 5% in 2020 and 2021, at least one in four accidents involved a hand or wrist injury.

AIM

To describe the OHWIs in workers seen at the emergency room at a second-level hospital in Colombia.

METHODS

An observational study was performed using data from workers who experienced OHWIs and attended a second-level hospital, between June, 2020 and May, 2021. The overall frequency of OHWIs, as well as their distribution by sociodemographic, clinical, and occupational variables, are described. Furthermore, association patterns between sex, anatomical area (fingers, hand, wrist), and type of job were analyzed by correspondence analysis (CA).

RESULTS

There were 2.101 workers treated for occupational accidents, 423 (20.3%) were cases of OHWIs, which mainly affected men (93.9%) with a median age of 31

years and who worked mainly in mining (75.9%). OHWIs were more common in the right upper extremity (55.3%) and comprised different types of injuries, such as contusion (42.1%), laceration (27.9%), fracture (18.7%), and crush injury (15.6%). They primarily affected the phalanges (95.2%), especially those of the first finger (25.7%). The CAs showed associations between the injured anatomical area and the worker's job that differed in men and women (explained variance > 90%).

CONCLUSION

One out of five workers who suffered occupational accidents in Cundinamarca, Columbia had an OHWI, affecting mainly males employed in mining. This occupational profile is likely to lead to prolonged rehabilitation, and permanent functional limitations. Our results might be useful for adjusting preventive measures in cluster risk groups.

Key Words: Accidents; Occupational; Epidemiology; Hand injuries; Wrist injuries; Occupational health

Core Tip: Colombia is a developing industrial country where most occupational activities are performed manually. Throughout 2021, one in four workers had occupational hand or wrist injuries, often resulting in injuries with a high probability of prolonged rehabilitation, and permanent sequelae. The findings of this research might be useful in improving preventive strategies in the groups with the highest occurrence.

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INTRODUCTION

Approximately 340 million work-related accidents occur annually, and 160 million victims develop an occupational disease worldwide[1]. The frequency of occupational hand or wrist injuries (OHWIs) that individuals experience ranges from 10% to 90%. This variability depends on the population at risk used as the denominator, *i.e.*, whether it refers to workers in general or workers with specific types of manual tasks[2-4].

In Colombia, the level of technological implementation in several industrial sector subcategories is lower than it is in other countries with a similar economic status. As a result, workers may be more exposed to occupational injuries, particularly injuries that affect the upper limbs-especially hands and wrists[5].

From 1990 to 2017, OHWIs accounted for 25% of work-related accidents in low- and middle-income countries and nearly half of the injured workers experienced a significant decline in wages. The average emergency room visit cost was estimated to be between US$ 394 and US$ 421 not to mention the medium and long-term financial impact on companies, and the effect on workers' quality of life and productivity[6-8].

In Colombia, more than 500,000 occupational accidents occurred in 2021. Although the rate declined to less than 5% in 2020 and 2021, at least one in four accidents involved a hand or wrist injury[9].

The aim of this research is to describe the sociodemographic, clinical, and occupational characteristics of workers who experienced OHWIs and were treated in the emergency department at a second-level hospital in Colombia. The results of this research may help to provide ways to prevent injuries and give workers with OHWIs timely and comprehensive care.

MATERIALS AND METHODS

Design and setting

A descriptive retrospective study was conducted using the medical records of workers treated for OHWIs in the Emergency Department of the El Salvador Hospital, a second-level institution, in Cundinamarca, Colombia between June 1, 2020 and May 29, 2021. Occupational accidents reported to the epidemiological surveillance program in occupational health (Sistema de Vigilancia de Salud Laboralacronym in Spanish, SIVISALA) during the study period were identified. They involved patients diagnosed at admission with International Classification of Diseases, version 10 (ICD-10) S60-S69 and T23. Patients treated for a complication, polytrauma, multiple trauma, or those attending a follow-up consultation were excluded[10,11].

Variables

The variables studied were age, sex; day, weekend *vs* weekdays, and month; history of OHWI; job, employment injury insurance (EII); type of injury (burn, crush injury, contusion, dislocation, fracture, laceration, puncture, amputation), laterality of the affected limb, injured anatomical area (hand, wrist, fingers), injured anatomical region (phalanges, carpus, metacarpus), injured finger (first, second, third, fourth, fifth, multiple), anatomic characteristics (fracture, nerve, tendon and/or vascular involvement), X-ray findings, care by an orthopedist or plastic surgeon, time to specialist care, medical-surgical treatment or intervention, sick leave, and ICD-10 code.

Data analysis

Data analysis was summarized with descriptive statistics. Variables were described as counts, proportions, and medians (25th and 75th percentiles) using the RStudio® (Version 2022.07.2). We calculated the injury frequency *per* anatomical region (%), describing whether it occurred exclusively in the wrist or hand area (isolated injuries). The frequency of lesions in men and women by anatomical area and type of lesion was represented with Sankey plots [Sankey MATIC (BETA)]. Bar plots were used to show the monthly distribution of lesions. Associations between case frequency and sex, type of work, and anatomical area affected were evaluated by correspondence analysis (CA) using the orange (Data Mining and Fruitful Fun® software, V.3.32). The statistical methods used in this study were reviewed by Aníbal A Teherán, MD, Epidemiologist, MSc-Biostatistics from Fundación Universitaria Juan N. Corpas.

RESULTS

General characteristics

During the study period, 2101 occupational accidents were reported to the SIVISALA. Most of these cases were excluded from the investigation as they were assigned ICD-10 codes other than those for hand and wrist trauma or they involved follow-up of trauma or treatment of a medical complication. Finally, 423 individuals who suffered occupational accidents resulting in hand or wrist injuries (coded according to ICD-10) were included in the study (Figure 1).

Clinical records that met the eligibility criteria (423/2021; 20.1% 95%CI: 18.2%–22.0%) were analyzed. The median age of individuals with OHWIs was 31 years (min = 19, max = 66), most were males and worked in mining, and more than 95% had an EII. They received medical care mainly during daytime; at least one in ten received medical care during the night, and one in four during the weekend (Table 1, Supplementary Figure 1).

Clinical features of the injured workers

Table 2 describes the clinical characteristics of the workers with OHWIs. The right hand and wrist were the most frequently affected anatomical areas; fewer than 1% of the individuals had bilateral trauma, and fewer than 10% had a history of trauma to the hand or wrist. Eight types of injuries were identified, the most frequent being contusions, lacerations, fractures, and crush injuries. One in ten workers had fractures which coincided with amputations, contusions, crush injuries, or lacerations.

The injuries mainly affected skin, connective tissue, and phalanges; in fewer than 5%, there was nerve, tendon, joint, or vascular involvement. One in four workers had an injury of the first finger, and this was the most commonly injured finger, followed by the second finger.

Most patients had X-rays taken. One in four individuals with an OHWI required suturing, and one in five required closed reduction or immobilization. In addition, fewer than 20% of the injured individuals were seen by an orthopedist. A minority required surgical management, plastic surgery, or referral to a high complexity hospital (Table 2).

Fingers were the most affected anatomical area, followed by hand injuries without finger involvement (Figure 2). A significant relationship was observed between the anatomical area injured and the type of injury in the male group (χ^2 = 43.802; *P* value = 0.002). Contusion was the most prevalent injury in the three anatomical areas analyzed, especially in the wrists and in the male group. Lacerations and crush injuries were also frequent among men with isolated hand or finger injuries or concurrent hand and wrist injuries. Similarly, fractures were most common in isolated hand or finger injury cases but not in cases of isolated wrist injuries.

Supplementary Figure 2 shows the distribution of OHWIs based on the anatomical areas affected and the month of accident occurrence. When grouped by sex, a significant relationship was identified between the anatomical area injured and the month of accident occurrence χ^2 = 57.195; *P* value = 0.004). OHWIs occurred in all anatomical areas described during the last half of 2020, but isolated wrist injuries were only seen in September and October. Similarly, isolated hand injuries in the male group occurred in June, July, September, and October. Concurrent hand and wrist injuries, in turn, were only observed in the male group during the first half of 2021 and isolated hand injuries during January, April, and May.

Finally, a relationship between the injured anatomical area and the worker's job was noted in the male group (χ^2 = 22.204; *P* value = 0.026). Therefore, CAs were carried out to identify possible statistical associations between these variables in men and women separately (Figure 3). In both sexes, the cumulative percentage of variance explained by the CAs was > 90%; the first component explained 77% and 68% of the variance in males and females, respectively. In the male group, an association was found between isolated finger or hand (without finger involvement) injuries and mining.

Concurrent hand and wrist injuries, in turn, were associated with farming, hunting, and personal services (hairdressing, manicure, pedicure, massaging, and other similar jobs). In contrast, in the female group, an association was observed between isolated hand injuries and work in the manufacturing industry. Similarly, there was an association

Table 1 General characteristics of the patients with occupational hand and wrist injuries, *n* (%)/median (25th and 75th percentiles)

Variables	Number (*n* = 423)
Age (years)	31 (25-39)
Sex	
Male	397 (93.9)
Female	26 (6.1)
Type of job	
Mining	321 (75.9)
Personal service[1] personal	57 (13.5)
Manufacturing industries	17 (4.0)
Agriculture, livestock, and hunting	15 (3.5)
Other[2]	13 (3.1)
Employment Injury Insurance	409 (96.7)
Time of day	
Day (7:00 to 18:59)	361 (85.3)
Night (19:00 to 6:59)	62 (14.7)
Day of the week	
Monday	59 (13.9)
Tuesday	73 (17.3)
Wednesday	90 (21.3)
Thursday	80 (18.9)
Friday	69 (16.3)
Saturday	44 (10.4)
Sunday	8 (1.9)

[1]Personal service: Hairdressing, manicure, pedicure, massaging, and other similar jobs.
[2]Other: Other economic activities, including wholesale and retail trade, repair of motor vehicles and motorcycles, accommodation and food services, financial and insurance activities, professional scientific and technical activities, construction, transportation, and warehousing.

between finger lesions or concurrent hand and wrist injuries with farming and hunting.

DISCUSSION

This research described the frequency of OHWIs in workers seen at a referral hospital in Cundinamarca, Colombia, during a 12-month period between 2020 and 2021, thus facilitating the identification of injury patterns related to sociodemographic features.

It is well known that OHWIs and occupational diseases occur in most jobs; however, the annual frequency of hand and wrist injuries has risen in low-income or industrially developing countries. This rise has been attributed to several factors associated with industrial globalization that may expose workers to new occupational hazards (new industrial tasks, persistence of manufacturing), poor preventive education, and deficiencies in the provision of safety equipment or the application of international standards on risk prevention[6,12-14].

In Colombia, one in four workers (26.1%) (insured and uninsured) suffered an OHWI in 2021, and one of the effects of health insurance is the promotion of safe work environments and working conditions to prevent accidents[9]. In comparison, in the present study OHWIs were found to occur in one out of five (20.1%) work-related accidents. The difference between these values is significant (P value < 0.001; data not shown) and could be attributed to the fact that more than 95% of the workers in the present study were insured individuals[15].

The type of work and the main economic activity in the geographic region could explain the frequency and distribution of OHWIs observed in this research. Previous investigations that included patients from urban and rural areas showed differences in the economic and social activities of workers as well as in the characteristics of the injuries they suffered[1-3,6,16].

Table 2 Clinical characteristics of the patients with occupational hand and wrist injuries, *n* (%)/median (25th and 75th percentiles)

Clinical variables	Number (*n* = 423)
Sick leave (days)	5 (3-8)
History of OHWI	39 (9.2)
Laterality of injury	
Right	234 (55.3)
Left	186 (44.0)
Bilateral	3 (0.7)
Type of injury Anatomical features	
Contusion	178 (42.1)
Laceration	118 (27.9)
Fracture	79 (18.7)
Crush	66 (15.6)
Dislocation/Luxation	9 (2.1)
Amputation	5 (1.2)
Burn	5 (1.2)
Puncture	5 (1.2)
Fracture and other injury(s)	43 (10.1)
Anatomical features	
Skin/Connective tissue injuries	306/315 (97.1)
Bone	313/423 (74.0)
Nerve injury[1]	5/100 (5.0)
Tendon injury[1]	3/133 (2.3)
Vascular injury[1]	5/235 (2.1)
Joint injury	9/208 (4.3)
Two or more	233/423 (55.1)
Injured anatomical region	
Phalanges[1]	315/331 (95.2)
Metacarpus[1]	14/331 (4.2)
Carpus[1]	2/331 (0.6)
Injured finger	
First[1]	81/315 (25.7)
Second[1]	60/315 (14.2)
Third[1]	52/315 (12.3)
Fourth[1]	39/315 (9.2)
Fifth[1]	45/315 (10.6)
Multiple[1]	38/315 (9.0)
Procedures in the ED (diagnosis, interventions)	
X-ray	379 (89.6)
Suture	111 (26.2)
Closed reduction/Immobilization	89 (21.0)
Orthopedic consultation	74 (17.5)

Surgery	25 (5.9)
Plastic surgery consultation	20 (4.7)
Referral to a higher-level ED	3 (0.7)

[1]The denominator used to calculate proportions differed for each variable as data were not available or not applicable.
ED: Emergency department; OHWI: Occupational hand or wrist injury.

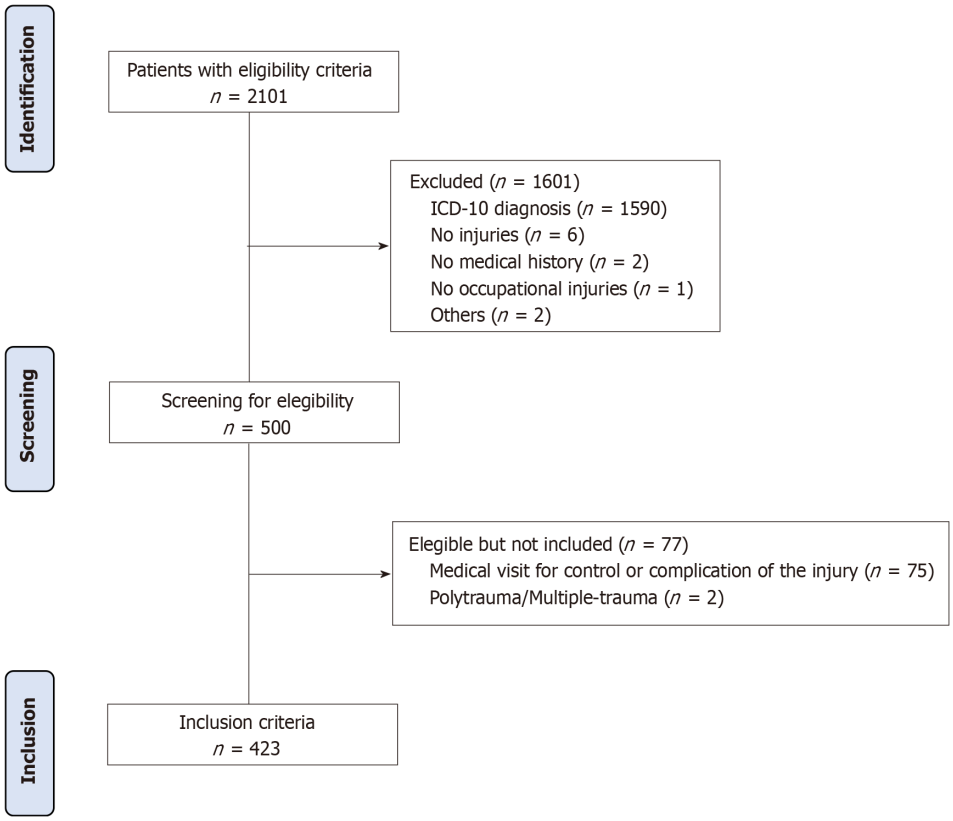

Figure 1 Patient selection flowchart. This flowchart was adjusted to STROBE guidelines. ICD-10: International Classification of Diseases, version 10.

Mining in Colombia generated 350000 direct jobs and 1000000 indirect jobs in 2020 and 237858 direct jobs in the first quarter of 2022[17]. In the department of Cundinamarca, coal mining and the extraction of other subsoil products, such as emeralds, generate more than 18000 jobs *per* year. This study found that three out of every four workers treated for an OHWI worked in mining[18].

Our results on the demographic characteristics of the injured workers showed an interquartile range of age similar to the age interval of the economically active Colombian population. However, it should be noted that mining was also the most frequent type of work, even among workers aged 50 years or older (23/33; data not shown). The majority of workers with OHWIs (> 90%) were men. Additionally, this observation could be a confounding factor as, since 2010, the overall male participation rate in the Colombian rural market has been predominant. Many of the jobs described in this research correspond to jobs traditionally performed by men[18,19].

Moreover, hospital stay, sick leave duration, and risk of death have been shown to be higher in workers who receive care for acute occupational injuries during dead time[20,21]. However, no relationship was observed between sick leave and caring for individuals with OHWI either at night (15%) or on weekends (30%) (data not shown). It should be noted that this investigation excluded patients with polytrauma and those who died, and that more than 80% of the injured individuals were treated by general practitioners. These factors may have modified the mean duration of sick leave.

Distribution of the most frequent injuries (contusions, lacerations, fractures, crush injuries), anatomical areas affected, and the occupational categories showed differential patterns for both sexes. Our findings are consistent with previous studies that identified a higher risk of OHWIs in women resulting in wrist injuries for those working in agriculture or hunting, and finger injuries for those who work in the manufacturing industry[22,23].

In contrast, crush injuries, lacerations, amputations, and burns to wrists, hands, and fingers were more frequent in men, possibly due to direct manual exposure in activities with higher potential and kinetic energy, such as industrial mechanics, electricity, and mining[12-14,16,22].

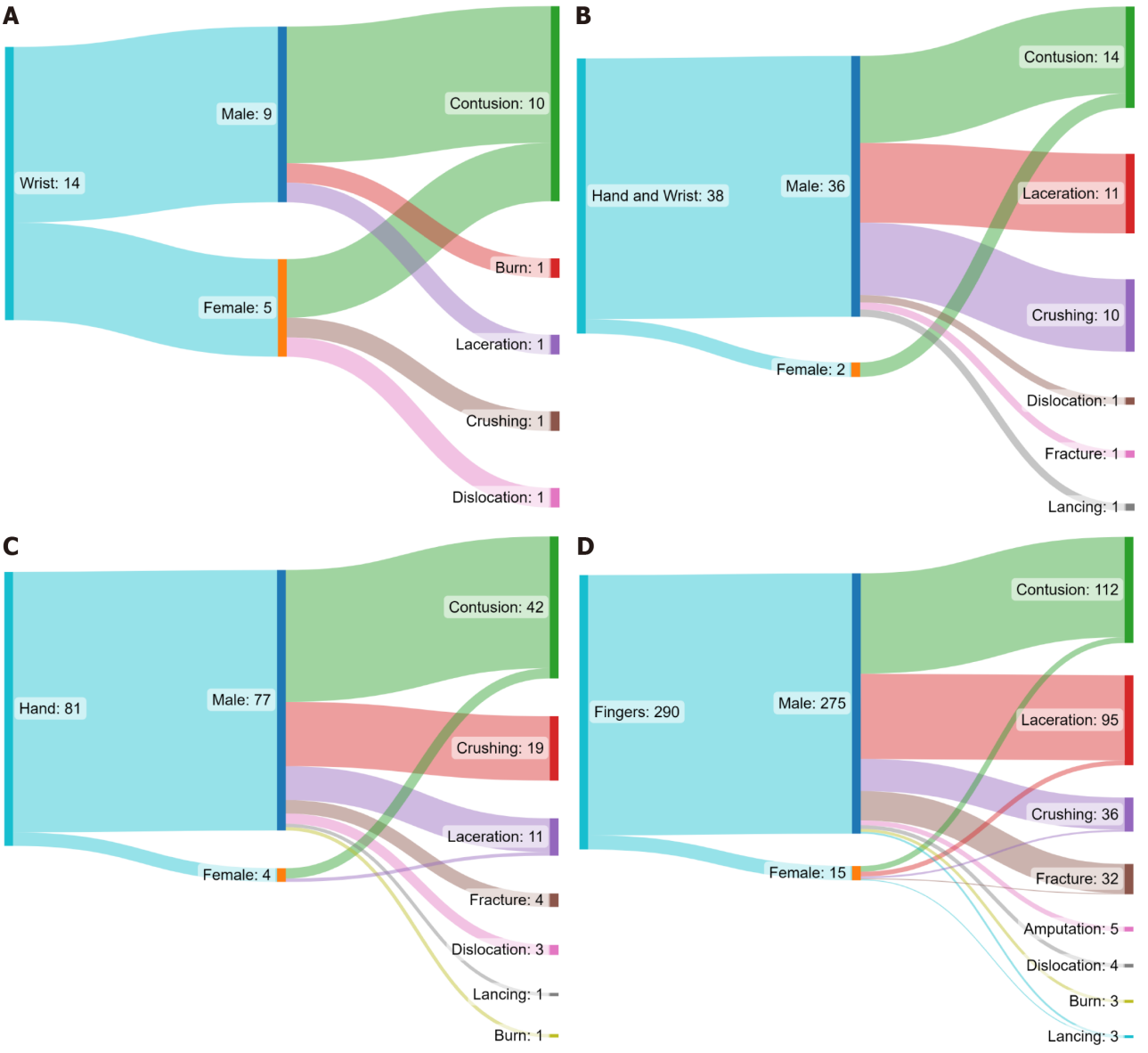

Figure 2 Sankey plot diagram shows the distribution (number of cases) of occupational hand and wrist injuries by sex and type of injury in the anatomical areas affected. A: Wrist; B: Hand; C: Hand and wrist; D: Fingers.

In addition, we observed that one in four workers had a first finger injury. This type of injury is a relevant indicator among OHWIs as it harmfully impacts rehabilitation by temporarily or permanently limiting grip function and other job-related tasks[6,8].

The results of this research can be extrapolated mainly to men and workers employed in mining. However, the study is subject to the limitations of a retrospective design based on clinical registry data. These studies are prone to reporting bias and confounding, have low statistical power, and are limited to establishing causal relationships and for analysis using specific statistical tests[24,25].

OHWIs can simultaneously affect two or more anatomical regions (phalanges, metacarpus, carpus); however, information was only collected from each region separately. Furthermore, although the laterality of the trauma is relevant and was reported, it should be complemented with the dominant laterality of the worker. Finally, simultaneous associations between sex, job, and anatomical area were not explored by multiple CA, given the high probability of a type II error.

CONCLUSION

Hand and wrist injuries occurred in 20% of the workers seen for occupational accidents at El Salvador Hospital in Ubaté, Cundinamarca, during a 12-month period between 2020 and 2021. OHWIs occurred mainly in adult men employed in mining. Patterns of association between sex, type of injury, and type of job were identified. The above findings can help to provide ways to prevent occupational accidents, by implementing measures such as educational campaigns, expanding

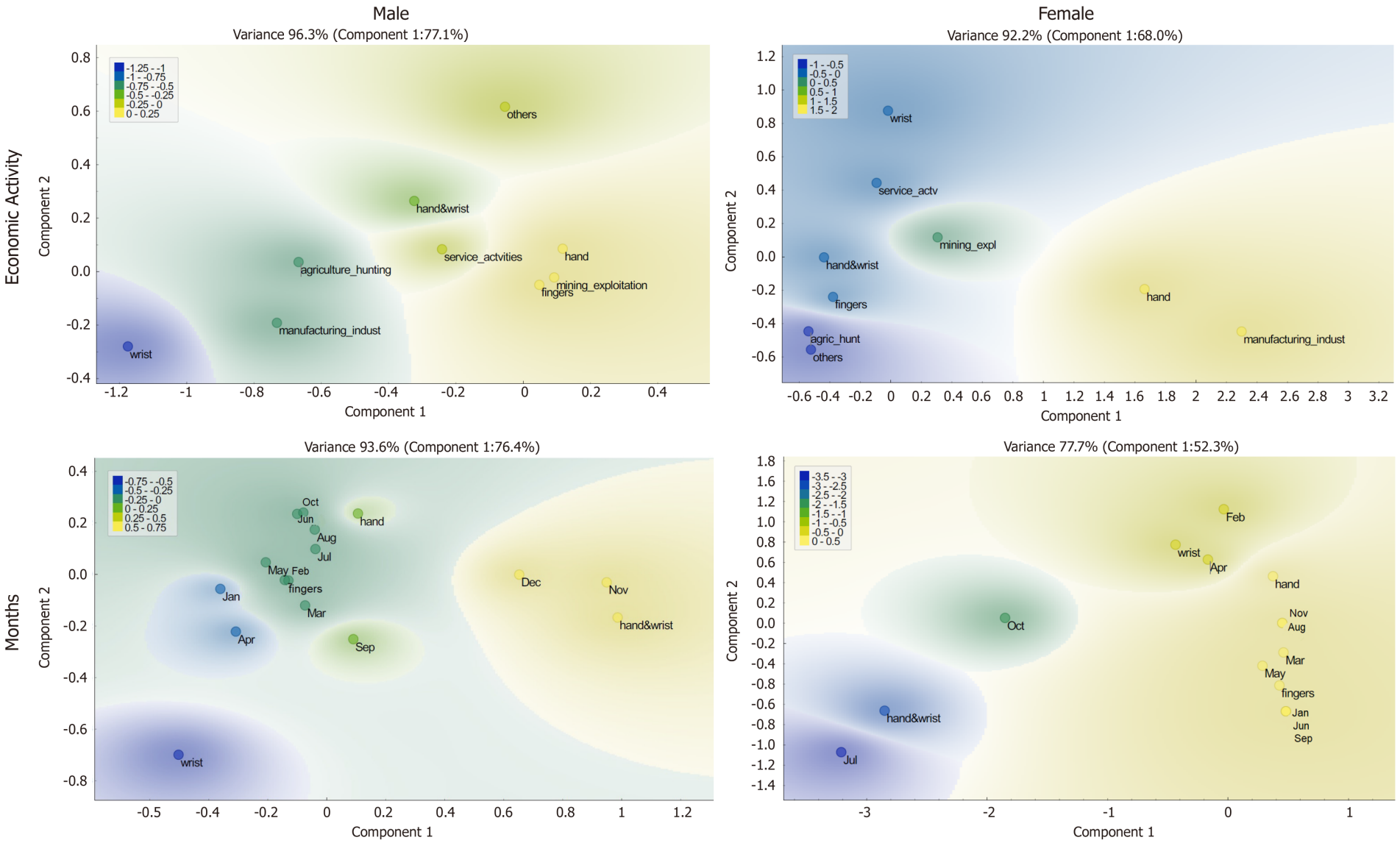

Figure 3 Correspondence analysis between job and injured anatomical area variables when grouping by sex. Men (upper panel); women (lower panel). The color scale corresponds to the value of the first component for the categories that compose the type of job and the anatomical area injured.

health-insurance coverage, providing high-quality work-tools according to engineering standards to diminish injury risk, and monitoring the mandatory use of protective equipment, especially among mining workers in Colombia and other developing countries[26]. In these regions, mining generates an increasing or at least constant number of jobs each year. Future research should determine the probability or risk of different hand or wrist injuries according to sex and job because it could substantially modify insurance policies and strategic prevention plans.

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FOOTNOTES

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Institutional review board statement: As the database was anonymized and data were obtained retrospectively, this research was classified as "without-risk" and approved by the local ethical regulation in force (notice number OFC-GHSU-227-2023).

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