



# Prevalence of Temporomandibular Disorders among Telemarketers: A Cross-sectional Study on Occupational Factors

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## Authors' contributions

*This work was carried out in collaboration among all authors. Author ACJS contributed to the concepts, design definition of intellectual content, did literature searches, data acquisition, prepared and reviewed the manuscript and gave final approval. Authors MIPV and LSF contributed to the literature searches, did data acquisition, and reviewed the manuscript. Author FASX reviewed the manuscript. Author CAFPG contributed to the concepts, design definition of intellectual content, and gave final approval. Author DABG contributed to concepts, design definition of intellectual content, did literature searches, data acquisition, statistical analysis, prepared and reviewed the manuscript and gave final approval All authors read and approved the final manuscript.*

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## ABSTRACT

**Purpose:** This study aimed to describe the prevalence of temporomandibular dysfunction (TMD) among telemarketers and identify factors associated with its occurrence, particularly those related to occupational conditions.

**Methods:** A cross-sectional study was conducted with 200 telemarketers from a call center in Brazil, utilizing interviews and physical examinations. Clinical, socio-demographic, occupational, and psychosocial aspects, including the Job content Questionnaire (JCQ) and the General Health Questionnaire (GHQ-12), were assessed. Signs, symptoms, and severity of TMD were determined using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) scale and the Temporomandibular Index (TMI), respectively. Descriptive analysis was performed, and odds ratios (OR) were calculated using unconditional logistic regression, with a 95% confidence interval (CI) as the criterion for identifying the associations.

**Results:** The prevalence of TMD among telemarketers was 40.50%, with low severity (IMR=0.08±0.02). Positive associations were found between TMD and length of service exceeding seven months (adjusted OR= 2.0; 95% CI: 1.1- 4.0), an average of more than 82 calls per day (adjusted OR= 2.1; 95% CI: 1.1- 3.9), and a high-stress level (adjusted OR= 2.1; 95% CI: 1.1- 4.4).

**Conclusion:** This study concludes that the prevalence of TMD among telemarketers in Brazil is 40.5%. The findings suggest an association between TMD and occupational factors such as prolonged job tenure, high daily call volume, and elevated stress levels in the studied population.

*Keywords: Temporomandibular dysfunction; TMD; telemarketing; occupational health; call center.*

## 1. INTRODUCTION

Disorders involving chronic orofacial pain are widespread in the general population, with temporomandibular dysfunction (TMD) being the most prevalent. In 1999, the American Academy of Orofacial Pain (De Leeuw 2008) defined TMD as “a collective term covering a wide range of clinical problems involving the masticatory muscles, the temporomandibular joints (TMJ) and their associated structures or all of these elements.” The pain associated with TMD may originate from the joint or muscle, with masticatory muscle pain (MMP) being the most common type (Fernandes et al. 2018).

Repetitive movements of the temporomandibular joint without adequate rest are considered to cause functional overload, which, when combined with stress, can trigger TMD (Dutra Dias et al. 2024). Such conditions are often observed in telework, characterized by prolonged, repetitive TMJ use without sufficient breaks coupled with constant stress (Santos et al. 2016; Toker and Güler 2022; Rabelo et al. 2018).

Telework, or teleservice, involves providing customer information primarily through voice communication, supported by information and communication technologies. This activity is performed in call centers, which are structured as workstations equipped with computers and telephones (Rabelo et al. 2018). In Brazil, there

are over 2,000 call centers, including 250 outsourced facilities, employing more than one million workers nationwide, according to the Brazilian Teleservices Association (ABT) (Araujo 2023).

However, teleworkers frequently report unfavorable working conditions, including strict productivity requirements and rigid time controls. These conditions pose significant public health concerns, as several studies have documented a high prevalence of complaints among call center workers, including anxiety (Rabelo et al. 2018; Araujo 2023; Sharifi et al. 2022; Juraś-Darowny et al. 2023; Silva et al. 2022; Oh et al. 2017) stress, fatigue (Enoki et al. 2017), visual and auditory issues (Rabelo et al. 2018), and musculoskeletal disorders (Santos et al. 2016; Rabelo et al. 2018; D’Errico et al. 2017; Costa and Costa 2018). A survey by the National Institute of Social Security (INSS), conducted at the request of the Superintendence of Labor and Employment (SRTE), revealed that 45% of absenteeism among teleworkers is due to musculoskeletal disorders (Rabelo et al. 2018).

Despite the broad range of health impacts associated with telework, TMD remains an underexplored issue in this population. This study aims to address this gap by identifying the prevalence of TMD and the factors associated with its occurrence among teleworkers, particularly those related to occupational conditions.

## 2. MATERIALS AND METHODS

### 2.1 Study Design

This cross-sectional, exploratory study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Vandenbroucke et al. 2007). It was performed with telemarketers at a telemarketing company, in Salvador, Bahia, Brazil.

### 2.2 Sample Characterization

A convenience sample was drawn from a call center, with 400 individuals aged 18–49 initially recruited. Of these, 200 met the eligibility criteria.

### 2.3 Eligibility Criteria

All call center agents were invited to participate voluntarily. Exclusion criteria included a history of facial trauma, systemic diseases, or previous temporomandibular joint surgery.

### 2.4 Evaluations

Primary data collection occurred from August to October 2007, following extensive communication to ensure participant awareness. Assessments included a structured questionnaire and a physical examination.

### 2.5 Questionnaire

The questionnaire contained six thematic sections:

- 1) Socio-Demographic Data: Age, sex, skin color (as per IBGE criteria), marital status, educational level (high school, incomplete/complete college), and family income (in minimum wages).
- 2) Clinical Aspects: Signs and symptoms of TMD, such as pain, clicking, jaw movement incoordination, and reduced range of motion.
- 3) Occupational Aspects: Length of service (in months), average daily call volume, and average service time (in minutes).
- 4) Psychosocial Aspects: Job demand-control categories, classifying individuals based on workplace demands.
- 5) Minor Mental Disorders: Assessed using the Self-Report Questionnaire (SRQ-20), with  $\geq 7$  positive responses indicating potential mental disorders.

- 6) Mental Stress: Measured via SRQ-20, categorizing stress as low (below average) or high (above average), based on established cutoff values (Pasquali et al. 1994).

### 2.6 Physical Examination

The physical examination and TMD diagnosis were conducted following the RDC/TMD Axis I protocol (Dworkin and LeResche 1992). Intra-examiner reliability for RDC/TMD application was assessed by re-examining 10% of the sample. Palpation pressure was standardized using an electronic scale, and pachymetry measurements were obtained with a Digimess digital pachymeter.

### 2.7 Statistical Analysis

Descriptive analyses were conducted to calculate frequencies for categorical variables and measures of central tendency and dispersion for continuous variables. Intra-examiner reliability for TMD diagnosis and severity was assessed using the Kappa statistic.

The prevalence of TMD was analyzed across variables of interest, with differences between categories evaluated using the Chi-square test. Crude associations between TMD and predictor variables were estimated using Prevalence Ratios (PR) and 95% Confidence Intervals via the Mantel-Haenszel Method. Variables with  $p$ -values  $\leq 0.05$  were included in multivariate analysis using non-conditional logistic regression.

All statistical analyses were performed using Epi-Info version 6.03 (Rothman, 1986) and SPSS version 25.

## 3. RESULTS

A total of 200 telemarketers were enrolled in this study (Fig. 1). At baseline, 40.50% ( $n=81$ ) were diagnosed with TMD, with 88.89% of these cases classified as masticatory muscle pain (MMP). TMD was more prevalent among women (44.22%), separated/divorced individuals (50.00%), Black participants (44.23%), and those aged over 24 years (41.75%). Participants ranged in age from 18 to 49 years (mean  $\pm$  SD:  $24 \pm 4.6$ ). TMD was also more common among individuals with a university degree (52.78%) and family incomes ranging from 1 to 3 minimum wages (14.50%) (Table 1).

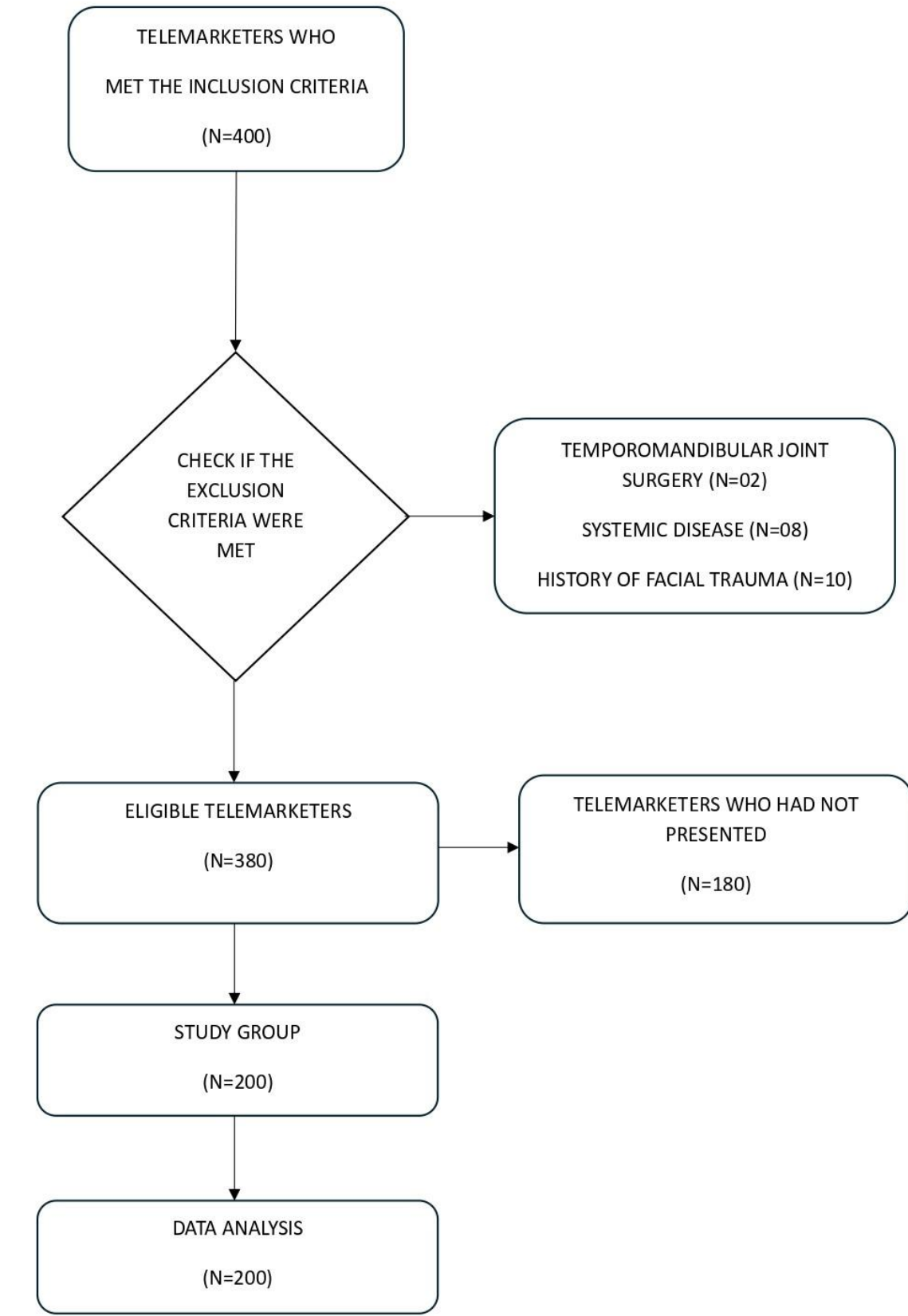


Fig. 1. The flowchart of the study

**Table 1. Prevalence of Temporomandibular Disorder (TMD) according to social and demographic characteristics of the studied population (n= 200)**

Variable	TMD (81)		p - $\chi^2$
	n	%	
<b>Age (Years)</b>			
< 24	38	39.18	0.71
≥24	43	41.75	
<b>Sex</b>			
Female	65	44.22	0.08
Male	16	30.19	
<b>Level of schooling</b>			
High School	25	32.05	0.16
Complete University Education	19	52.78	
Incomplete University Education	37	43.02	
<b>Family income<sup>a</sup></b>			
From 1 to 3 minimum wage	29	14.50	0.07
>3 e ≤ 5 minimum wage	23	11.50	
>5 e ≤ 7 minimum wage	11	05.50	
>7 e ≤ 9 minimum wage	09	04.50	
>9 minimum wage	09	04.50	
<b>Marital Status</b>			
Single	67	39.88	0.65
Married	13	43.33	
Separated/Divorced	01	50.00	
<b>Ethnicity</b>			
White	12	38.71	0.51
Mixed-ethnicity	21	35.59	
Black	46	44.23	
Yellow	02	33.33	

<sup>a</sup>Note: Minimum wage in Salvador, Bahia, Brazil is USD 230 per month

**Table 2. Prevalence of Temporomandibular Disorder (TMD) according to occupational characteristics of the studied population (n= 200)**

Variable	TMD (81)		p - $\chi^2$
	N	%	
<b>Length of service</b>			
≥7 months	58	51.79	0.0003
<7 months	23	26.14	
<b>Average number of calls per day</b>			
≥81 calls per day	45	54.88	0.0006
<81 calls per day	36	30.51	
<b>Average service time (AST)</b>			
≥3 min per call	78	40.21	0.63
<3 min per call	03	50.00	
<b>Relationship between symptoms and work</b>			
Yes	41	51.25	0.01
No	40	33.33	
<b>Stress activity</b>			
Yes	61	44.85	0.06
No	20	31.25	
<b>Demand</b>			
Low	38	35.51	0.12
High	43	46.24	
<b>Control</b>			
Low	36	34.29	0.06
High	45	47.37	

**Table 3. The severity of TMD among call center attendants according to the temporomandibular index (TMI) and their sub-indexes functional index (FI), muscular index (MI), and articular index (AI) (n=81)**

Index	Descriptive Measures			
	Minimum	Maximum	Median	Mean
<b>TMI</b>	0.0	0.62	0.08±0.02	0.12±0.13
<b>FI</b>	0.0	0.83	0.08±0.52	0.17±0.23
<b>MI</b>	0.0	0.90	0.10±0.02	0.14±0.16
<b>AI</b>	0.0	0.63	0.06±0.13	0.00±0.16

**Table 4. Prevalence Ratios (PR) and 95% Confidence Intervals (95% CI) for the association between TMD and the independent variables, obtained through bivariate analysis**

Variable	PR	95% CI
<b>Sex</b>		
Male	1.0	
Female	1.2	(1.0 – 1.4)
<b>Length of service</b>		
< 7 months	1.0	
≥ 7 months	1.6	(1.2 – 2.0)
<b>Average call per day</b>		
< 81 calls per day	1.0	
≥ 81 calls per day	1.8	(1.3 – 2.5)
<b>Stress level</b>		
Low	1.0	
Hjgh	2.1	(1.2 – 3.6)

**Table 5. Final Logistic Regression analysis model for the occurrence of TMD among call center attendants**

Model <sup>a</sup>	Odds Ratio	95% CI <sup>b</sup>
<b>Length of activity</b>		
< 7 meses	1.0	
≥ 7 meses	<b>2.0</b>	<b>(1.1 – 4.0)</b>
<b>Average calls per day</b>		
< 81 calls per day	1.0	
≥ 81 calls per day	<b>2.1</b>	<b>(1.1 – 3.9)</b>
<b>Stress level</b>		
Low	1.0	
High	<b>2.1</b>	<b>(1.1 – 4.4)</b>

<sup>a</sup> Stepwise backward method<sup>b</sup> 95% Confidence Interval\*Hierarchical multiple logistic regression with level of significance  $p < 0,05$ ; interval with 95% confidence

### 3.1 Occupational Characteristics

According to occupational data (Table 2), telemarketers with TMD had predominantly worked in this activity for over seven months (51.79%), handled more than 82 calls per day (54.88%), and had an average service time (AST) of less than three minutes per call (50.00%). Higher TMD prevalence was also observed among participants who perceived their job as stressful (44.85%), classified their work as high demand (47.37%), and described it as high control (47.37%).

### 3.2 Severity of TMD

The severity of TMD was assessed using the functional index (FI:  $0.08 \pm 0.52$ ), muscular index (MI:  $0.10 \pm 0.02$ ), and articular index (AI:  $0.06 \pm 0.13$ ), with the total temporomandibular index (TMI) recorded as  $0.08 \pm 0.02$  (Table 3). Intra-examiner reliability for TMD diagnosis and severity was excellent, with a Kappa index of 0.93 (95% CI: 0.86-1.00).

### 3.3 Crude Associations

Crude associations TMD and variables of interest were examined. Gender (PR=1.2, 95% CI=1.0-1.4), length of service (PR=1.6, 95% CI=1.3-2.5), average number of calls per day (PR=1.8, 95% CI=1.3-2.5), and stress level (PR=2.1, 95% CI=1.2-3.6) were all significantly associated with TMD and selected for modeling (Table 4).

### 3.4 Multivariate Analysis

In the multivariate analysis, after simultaneous adjustment, the following variables remained significantly associated with TMD:

- **Length of service over seven months** (OR=2.0, 95% CI=1.1–4.0,  $p=0.03$ ),
- **Average number of calls above 81 per day** (OR=2.1, 95% CI=1.1–3.9,  $p=0.02$ ),
- **High stress level** (OR=2.1, 95% CI=1.1–4.4,  $p=0.05$ ).

While gender was positively associated with TMD, the association was not statistically significant in the adjusted model (Table 5).

## 4. DISCUSSION

This study aimed to identify the prevalence of TMD among telemarketers and examine the factors associated with its occurrence, particularly occupational factors. The findings

revealed that TMD occurrence among telemarketers was significantly associated with working for more than seven months, handling more than 82 calls per day, and experiencing high-stress levels. Intra-examiner reliability for TMD diagnosis and severity was nearly perfect, as indicated by the Kappa test. Crude associations between TMD and variables such as gender, working hours, average number of calls per day, and stress level were observed. In the multivariate analysis, after simultaneous adjustment, working for over seven months (OR=2.0; 95% CI=1.1–4.0;  $p=0.03$ ), handling over 82 calls daily (OR=2.1; 95% CI=1.1–3.9;  $p=0.02$ ), and experiencing high stress levels (OR=2.1; 95% CI=1.1–4.4;  $p=0.05$ ) remained positively associated with TMD. While gender showed a positive association, it was not statistically significant.

The prevalence of TMD in this population, compared to other occupations, was notable but of low severity (TMI =  $0.08 \pm 0.02$ ) on a scale from 0 to 1, where 1 represents maximum severity. This finding may be attributed to the high turnover in telemarketing, with most workers remaining in their roles for less than a year. Comparisons with other professions—such as dental surgeons, nurses, military personnel, IT professionals, and musicians—show variations in TMD prevalence, likely due to differing occupational characteristics (Aranha et al. 2021; Gayathri et al. 2019; Van Selms et al. 2019). For instance, TMD prevalence was 24.7% among military personnel (Tay et al. 2019), and 69% among nurses (Amalina et al. 2018), highlighting disparities related to job demands and stressors. Among musicians who use wind instruments and professional singers, they found that although the incidence is like that of the general population, the symptoms start and increase during training and performances (Van Selms et al. 2019; Glória et al. 2018). These differences may be due to the inherent characteristics of each occupation.

Another contributing factor to variability in reported TMD prevalence is the lack of standardized diagnostic criteria. This study utilized the RDC/TMD protocol, which provides clear, precise parameters for data collection and diagnosis (Manfredini et al. 2011) and expands a taxonomy standardized worldwide (Manfredini and Guarda-Nardini 2010), being translated and validated in numerous languages, including Brazilian Portuguese. Previous studies using this scale have identified occurrences of around 10% (Manfredini et al. 2011; Manfredini and Guarda-



Nardini 2010; Almeida et al. 2024; Valesan et al. 2021), which aligns with the results presented in this study.

Among telemarketers, the highest occurrence of TMD was observed in the muscle diagnosis group, specifically the group with myofascial pain without amplitude limitation, followed by myofascial pain with amplitude limitation, as well as other investigations (Valesan et al. 2021; Szyszka-Sommerfeld et al. 2023; Kuć et al. 2021; Carapinha et al. 2024; Mendes and Barreto 2020). This condition, classified as masticatory muscle pain (MMP), is associated with muscle overuse or ischemia caused by muscle hyperactivity (Szyszka-Sommerfeld et al. 2023). This is also observed in telecare, which is characterized by repetitive movements of the TMJ for hours, without adequate breaks (Santos et al. 2016; Toker and Güler 2022), which likely contributes to the high prevalence observed in this study compared to other works published involving call centers or even other occupational activities, such as dental surgeons, analysts, TV station employees, military personnel, nurses, information technology (IT) professionals and violinists (Aranha et al. 2021).

Numerous studies have investigated the relationship between stress and TMD (Costa and Costa 2018; Van Selms et al. 2019; Mendes and Barreto 2020; Mori et al. 2024; Jwaid 2024; Yap et al. 2022). According to Dutra et al. (2024), emotional stress is a systemic alteration that can influence masticatory function by increasing muscle tone. Aranha et al. (2021) identified absence due to TMD according to occupation, according to professions that involved exacerbated stress conditions, such as nursing technicians. Similarly, Ton et al. (2020) reported that the highest frequency of TMD among university students was observed in those with higher levels of stress and anxiety. According to Emodi et al. (2015), occupation can be a triggering factor for TMD when associated with stress. Moreover, among telemarketers, the occurrence of TMD was also higher among those with a higher stress level, according to the General Health Questionnaire 12 (GHQ 12).

The activity of telephone answering involves determining stress factors such as time pressure, insufficient breaks, strong demands on memory and attention, stimuli for competition, and recording and monitoring of calls (Toker and Güler 2022; Rabelo et al. 2018; Araujo 2023; Sharifi et al. 2022; Juraś-Darowny et al. 2023;

Silva et al. 2022; Oh et al. 2017; Enoki et al. 2017). This is the portrait of Toyotism, which illustrates the adaptation of production to demand, increased outsourcing and working in "islands," intensifying the pace of work, increasing pressure in the workplace, and the consequent risk of acquiring cardiovascular diseases, diseases of the musculoskeletal system, depression and stress (Rabelo et al. 2018; Sharifi et al. 2022; Enoki et al. 2017).

The greater the demands placed on workers and the less latitude they have to control them, the greater the risk to their health (Emodi Perelman et al. 2015). Although telemarketing is typically described as a high-demand, low-control occupation (Rabelo et al. 2018; Sharifi et al. 2022; Juraś-Darowny et al. 2023; Oh et al. 2017; Enoki et al. 2017; Grebner et al. 2023), this study found a higher prevalence of TMD among high-demand, high-control workers. This discrepancy may be due to the specific nature of this telemarketing company, where call durations exceeded three minutes, contrary to typical averages of 28 seconds in other companies. A higher call volume was positively associated with TMD, suggesting that shorter calls necessitate a greater number of daily interactions, increasing the risk of TMD. However, there was a positive association between the average number of calls above 82, suggesting that those with a average service time (AST) of less than three minutes make more calls and are consequently more prone to TMD. Similar results were found in a study that investigated TMD among 124 call center employees, showing statistical significance among those who made a higher number of calls (Saruhanoglu et al. 2016).

The cumulative effects of prolonged telemarketing work are evident. This study observed significant associations between longer job tenure (>7 months), high call volumes (>82 per day), and elevated stress levels with TMD. While no prior studies have explicitly linked telemarketing to TMD, the psychological burden of the profession, described since 1956 by the psychiatrist Lê Guillant (Araujo 2023) contributes to the emergence of occupational pathologies, many of which remain unrecognized.

A population-based study conducted in Ferrara, Italy (Mobilio et al. 2011) using telephone interviews rather than physical examinations, reported similar findings regarding gender and age. The investigation of TMD among non-patients and in specific occupations is an

advance in knowledge; however, as this is an exploratory cross-sectional study, all the findings should be interpreted cautiously. Longitudinal studies are needed to confirm these results and better understand occupational risk factors for TMD (Dean et al. 1994).

Public health policies are essential to address TMD in the workplace. Preventive measures should include reducing working hours, increasing rest breaks, and eliminating average service time metrics. Replacing current performance evaluations and prioritizing adherence to prescribed scripts with problem-solving criteria may also help mitigate occupational stress and its health consequences (Dutheil et al. 2020).

## 5. CONCLUSION

This study concludes that the prevalence of TMD among telemarketers in Brazil is 40.5%, and it is significantly associated with working for more than seven months, making an average of over 82 calls per day, and experiencing a high level of stress.

## CONSENT AND ETHICAL APPROVAL

This study adhered to the guidelines of Resolution 466/2012 for research involving human subjects and received approval from the University's Research Ethics Committee (CAAE: 0603090078590). All participants provided written informed consent prior to their inclusion in the study.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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