

Ideal vs. Prolonged Standing Duration Influencing Musculoskeletal Disorders: Contextualizing Dental Professionals from Bangladesh

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Abstract

Background & objective:

Work-related musculoskeletal diseases (MSDs) are recognized as a serious occupational concern among dental professionals worldwide. Dentists are in the high-risk group for developing MSDs because dental surgeons often cannot avoid prolonged static postures during their work time. The purpose of this study was to investigate the insights of dental professionals who used to work in a standing position for prolonged periods of time.

Method:

This cross-sectional study was conducted among 110 dental professionals working in the capital city of Bangladesh. Data were obtained through a pre-tested and semi-structured questionnaire administered by an interviewer. A multivariate logistic regression model and Chi-square test were used for the analytical exploration. Adjusted and Unadjusted Odds Ratio with 95% confidence intervals were calculated for the specified setting indicators.

Result:

According to the study, dentists who were parents of 1–2 children (AOR/p = 4.90/<0.01), worked for 5–10 hours a day (AOR/p = 5.60/<0.01), lived in nuclear family (AOR/p = 2.8/0.07) with our any support and who had history of MSDs (AOR/p = 10.90/<0.01) used to stand for prolonged period while doing their dental procedures. Results also reveal that a higher proportion of dentists (63%; n = 69/76) who spent a significant amount of time standing throughout the day mostly experienced MSD. In addition, it was also observed that a significant (19%; n = 21/34) percentage of dentist who kept practicing ideal standing hours also developed MSD at some point in their practice.

Conclusion:

This means that in all aspects, dental professionals are at high risk and are more likely to develop MSD due to their perilous professional work patterns and reluctance to maintain a comfortable posture during their practice period.

Introduction

Dental therapists represent a vital component of the healthcare workforce and are routinely exposed to occupational risk factors that predispose them to musculoskeletal disorders (MSDs). Within dentistry, MSDs are among the most commonly reported occupational health problems, largely attributable to prolonged exposure to non-ergonomic working conditions. Musculoskeletal disorders are defined as

injuries or dysfunctions of muscles, tendons, ligaments, joints, nerves, or supporting structures that arise from acute trauma or cumulative occupational stress and adversely affect functional performance and quality of life. [1]

Inappropriate working posture is a major contributing factor to the development of MSDs across healthcare professions, including dental practice. Sustained non-neutral postures impose excessive static loads on the musculoskeletal system, leading to increased muscle tension, discomfort, fatigue, and work-related injuries, particularly involving the neck, shoulders, upper back, and lumbar region. Despite their professional dedication to patient care, dental practitioners frequently neglect ergonomic principles during clinical procedures. [2, 3, 4]

Dental ergonomics has gained increasing attention in recent years, particularly due to the high prevalence of work-related MSDs among dental professionals. Clinical intraoral examinations, one of the most commonly performed dental procedures, often require prolonged static and awkward postures. [5] To mitigate these risks, ergonomic dental chairs and operator stools have been introduced with the intention of promoting neutral spinal alignment, reducing muscular strain, and improving visual access to the operative field. [6, 7] However, evidence indicates that the adoption of seated working positions and ergonomic seating alone has not led to a substantial reduction in MSD prevalence. Conversely, some reports suggest that dental professionals who predominantly work in standing positions experience less severe low back pain, although the optimal working posture in dentistry remains controversial.

General dentists and dental therapists are considered high-risk groups for MSDs due to extended clinical sessions, repetitive hand–wrist movements, sustained static or incorrect body positioning, exposure to vibrating instruments, and high psychomotor demands. Previous studies have consistently demonstrated that repetitive movements and prolonged static postures are key contributors to occupation-related MSDs. [8, 9]

Although extensive literature has established the association between non-ergonomic dental postures and the development of MSDs, existing research has predominantly focused on seated working postures and general ergonomic risks. There is limited empirical evidence examining the specific occupational and individual risk factors associated with prolonged standing work among dental therapists. In particular, few studies have explored how prolonged standing during routine dental practice contributes to the onset and progression of work-related MSDs or have incorporated the perspectives and experiences of dental professionals who primarily work in standing positions.

The present study aims to explore the experiences and insights of dental therapists who routinely practice in prolonged standing positions during clinical care. Specifically, this study seeks to identify occupational, ergonomic, and individual factors associated with prolonged standing work that may contribute to the development of work-related musculoskeletal disorders, thereby providing evidence to inform targeted ergonomic interventions and preventive strategies in dental practice.

Method

Study design

This was a descriptive type of cross-sectional study followed by a quantitative approach. Semi-structured data were collected in this study from January to April 2022. Information on ideal vs. prolonged standing duration per day and history of musculoskeletal disorders, including different characteristics related to service and demography were extracted from Bangladeshi dental professionals.

Study participants, sample size, and sampling

This study included a total of 110 dental professionals working in Dhaka city, Bangladesh. Quantitative information of this study was collected from the respondents' signified active dental surgeons with at least a Bachelor of Dental Surgery (BDS) degree and were practicing in the selected hospitals of Dhaka city.

Initially, it was assumed that a potential standard sample size of 384 would be taken by using the formula " $n = \frac{Z^2 pq}{d^2}$ " where Z (standard normal deviate) was considered as 1.96; p (the proportion was assumed as 50% considering the chance of occurrence of MSD due to prolonged standing hours per day) [10] was considered as 0.50 and margin of error was considered as 0.05. However, the calculated samples were directed to 115 by deducted 30% considering medium to high exposure to MSD among dentists in Bangladesh [11]. After data cleaning and initial management, the final samples were fixed at 110.

A systematic random sampling technique was used for this study. Considering the greatest availability of dental professionals in Dhaka city, the study was conducted in two of the top and largest hubs of dental professionals, i.e., Dhaka Dental College and Hospital (DDCH) and Bangabandhu Sheikh Mujib Medical University (BSMMU) of Dhaka, Bangladesh. 110 samples were selected randomly from the list collected from the authorities of both hospitals.

Data collection

A pre-tested and semi-structured questionnaire was used to gather data from the dental professionals using an interviewer-administered method. Respondents were recruited in January 2022 in this study and accessed primarily through phone calls, and later, they were interviewed according to their convenience. The survey took only 10 to 15 minutes for the interviewer to complete. All authors had access to the collection and preserving participant's information during or after data collection. The Bengali language is used for data collection, supported by the hospital's authority.

Ethical considerations

This study was approved by the Ethical Review Committee of the Department of Public Health of Northern University Bangladesh (NUB/DPH/EC/2022/14) and conformed to the Declaration of Helsinki. The respondents were chosen anonymously and voluntarily. Informed consent was obtained from the survey, and participants could withdraw from the survey at any time.

Questionnaire design

The questionnaire was pre-validated by two independent reviewers and pre-tested among five respondents. The questionnaire was pre-tested to check the quality. The questionnaire comprised several segments: (i) Identification of ideal and prolonged standing duration along with MSD status; (ii) Demography and organizational information of the dental professionals: age, gender, education, marital status, religion, family type, family size, number of children, monthly income (BDT), organization type, and working duration per day.

Data analysis

We used the Statistical Package for the Social Sciences (SPSS) software for data checking and analysis. Study characteristics were subjected to descriptive statistics (frequency and proportions) for summarizing the obtained data. A multinomial logistic regression analysis was performed, followed by a modeling procedure considering a backward elimination process, including pre-specified confounders, i.e., age, gender, education, marital status, religion, family type, family size, number of children, monthly income (BDT), organization type, and working duration per day. Odds Ratios with 95% confidence intervals concerning ideal and prolonged standing duration per day were calculated for the specified exposures.

Results

3.1 Participant's characteristics

A total of 110 dental surgeons were recruited in this study, and their data were analyzed to reveal the practice of standing duration during work time, as well as significant characteristics associated with prolonged standing time that cause the occurrence of Musculoskeletal Disorder (MSD) among them. Most of the study subjects were 68.2% of dentists married, and nearly half (47.3%) of them had 1–2 children belonging to a nuclear family (73.6%). By education, more than half (56.4%) of the respondents had post-graduate degrees, while 43.6% were only graduates. The study also found that 70.9% of dentists work on an average of 5–10 hours per day.

3.2 Status of MSD associated with standing duration during work time:

According to the study, a significant proportion of dental surgeons (69%; $n = 76/110$) practiced prolonged standing duration, while only 31% ($n = 34$) maintained an ideal standing time during their professional

work. Highlighting the status of MSD, it was found that among dentists, prolonged standing work time is significantly associated with the presence of MSD. The majority of study subjects who practiced prolonged standing work time (69%; n = 76/110) were suffering from MSD (63%; n = 69/76). It indicates that the risky professional work pattern tends to cause the subjects to suffer from MSD. (Fig. 1)

3.2 Insight characteristics of the respondents with the prolonged standing duration during their professional work time:

Multivariate (cross-table) analysis of this study revealed significant background characteristics of the respondents associated with the status of prolonged standing work time. It is observed that respondent's marital status (married: 51.8%, 57/110; p = 0.02), family type (nuclear family: 54.5%, 60/110; p = 0.05), parity (1–2 children: 35.5%, 39/110; >2: 16.4%, 18/110; p = 0.03), educational qualification (post-graduate degree: 43.6%, 48/110; p = 0.02), and working hour per day (5–10 hours/day: 53.6%, 59/110; p = 0.05) were prime features which was associated with prolonged standing work time behavior (Table 1).

Table 1
Characteristics of the respondents associated with ideal vs. prolonged standing duration per day (n = 110)

Characteristics	Number of participants, n (%)	Ideal standing per day, n (%)	Prolonged standing per day, n (%)	p-value (≤ 0.05)
Education				
Graduate (BDS)	48 (43.6)	20 (18.2)	28 (25.5)	0.02
Post-graduate	62 (56.4)	14 (12.7)	48 (43.6)	
Marital Status				
Unmarried	35 (31.8)	16 (14.5)	19 (17.3)	0.02
Married	75 (68.2%)	18 (16.4)	57 (51.8)	
Family type				
Nuclear family	81 (73.6)	21 (19.1)	60 (54.5)	0.05
Extended family	29 (26.4)	13 (11.8)	16 (14.5)	
Religion				
Muslim	92 (83.6)	32 (29.1)	60 (54.5)	0.03
Non-Muslim	18 (16.4)	2 (1.8)	16 (14.5)	
Parity				
1–2	52 (47.3)	13 (11.8)	39 (35.5)	0.03
> 2	22 (20)	4 (3.6)	18 (16.4)	
No children	36 (32.7)	17 (15.5)	19 (17.3)	
Working hours/ day (hour)				
< 5	27 (24.5)	13 (11.8)	14 (12.7)	0.05
5–10	78 (70.9)	19 (17.3)	59 (53.6)	
> 10	5 (4.5)	2 (1.8)	3 (2.7)	

Data are presented as frequency (n), percentage (%); *Statistical significance at p value ≤ 0.05 . Chi-square test was used to observe the association.

3.4 Insight characteristics of respondents (COR & AOR) with prolonged standing duration per day (n = 110). This is the Fig. 2 .1 legend.

More specifically, according to the regression analysis of this study, odds of prolonged standing work time found significantly higher among the married (COR/p = 2.66/0.02; 95% CI:1.13–6.24) respondents who belonged to a nuclear family (COR/p = 2.32/0.06; 95% CI:0.95–5.62) having 1–2 and > 2 children (1–2 children: COR/p = 2.68/0.03; 95% CI: 1.08–6.64; >2 children: COR/p = 4.02/0.03; 95% CI: 1.13–14.27). In addition, significantly higher odds of long-standing work duration were observed among those professionals who were postgraduates (COR/p = 2.44/0.03; 95% CI:1.07–5.59) and worked for an average of 5–10 hours/day (COR/p = 2.88/0.02; 95% CI:1.15–7.19), which made them sufferer for MSD (COR/p = 6.10/<0.01; 95% CI:2.15–17.27). This outcome indicates that those with more professional qualifications and working experience tend to have a more prolonged working duration in a standing manner due to their higher workload. In addition, because of responsibilities towards married life and children, this habit of prolonged standing seems also to be well practiced at their homes. (Fig. 2.1). Therefore, these Musculoskeletal sufferings can be termed as work-related MSD caused by prolonged professional standing.

Finally, the adjusted model in regression analysis eliminated the confounders and revealed all statistically significant determinants of the study subjects associated with prolonged standing time during the work period. Finally, study showed higher odds of prolonged standing working time among dentists who had children (1–2 children: AOR/p = 4.90/<0.01; 95% CI: 1.5–15.9; >2 children: AOR/p = 3.30/0.10; 95% CI: 0.77–13.9) and resides in nuclear family (AOR/p = 2.8/0.07; 95% CI: 0.9–8.60) without any helping hand. In addition, long working duration per day, 5–10 hours (AOR/p = 5.60/<0.01; 95% CI: 1.6–19.6) and > 10 hours (AOR/p = 4.9/0.18; 95% CI: 0.46–53.6) showed more than three times higher odds on prolonged standing time during the work period. With greater odds, dentists with MSD (AOR/p = 10.90/<0.01; 95% CI: 2.5–47.6) were identified as a significant predictor for prolonged standing duration. After this finding, it can be said that a married dentist with kids and who already has a history of MSD does not maintain an ideal working posture while practicing in their chamber; rather, they practice for a more prolonged working duration in a standing manner (Fig. 2.2).

Discussions

Dental surgeons are very prone to developing Musculoskeletal Disorders due to their nature of work, which results in a high prevalence of MSDs among dental professionals, as evidenced in various studies. Therefore, this study aimed to explore the insights of dental professionals who used to work in standing positions for prolonged periods of time.

The study revealed that among the dental surgeons, 83.6% were Muslim, 68.2% were married, and 73.6% were belonging a nuclear family. Another research conducted in Dhaka city reported slightly greater percentages of these socio-demographic factors, including 91.9% Muslim and 88.4% married respondents.¹¹ This variance can result from the sampling procedure.

The current study observed that the maximum (63%; n = 69/76) portion of the study subjects with prolonged standing work time were suffering from MSD, and a significant (19%; n = 21/34) portion who

maintained ideal standing work time also suffered from MSD. There are studies regarding the prevalence and related factors of MSDs among dental surgeons, but no study was found regarding the effects of ideal vs. prolonged standing time among dental surgeons. However, a study in India found musculoskeletal pain was significantly prevalent among dental surgeons who worked in standing positions.¹⁸ However, there is a study that found evidence of associations between prolonged standing and musculoskeletal symptoms in other professionals.¹² Also, another study in Australia among Physical Therapists found similar results.¹⁶

According to the regression analysis of this study, the odds of prolonged standing work time were found significantly higher among the married, who belonged to a nuclear family, and those having 1–2 and > 2 children. A study in Dhaka city found that a similarly significant relationship exists between some other socio-demographic characteristics and MSDs in a chi-square test.^{13, 17} This may be due to variations in the choice of variables.

In addition, significantly higher odds of long-standing work duration were observed among dental professionals who had post-graduate degrees and who worked for 5–10 hours/day. A study in Dhaka found a relationship between personal characteristics (like physical activity and work status) and MSDs in a chi-square test.¹³ Another study on Korean dentists found that psychosocial stress has a significant influence on MSDs.¹⁷

This Study revealed that most (69%; n = 76/110) dental surgeons were used to engaging with their professional work for a prolonged duration, which leads them to suffer more from MSDs. The result is consistent with a study done by Batham C in Bhopal, India.¹⁴

Finally, adjusted model in regression analysis eliminated the confounders and showed that higher odds of prolonged standing time among those respondents who came from a nuclear family (AOR/p = 2.8/0.07; 95% CI: 0.9–8.60) and had children (1–2 children: AOR/p = 4.90/<0.01; 95% CI: 1.5–15.9; >2 children: AOR/p = 3.30/0.10; 95% CI: 0.77–13.9) with them. However, no study was found regarding this.

In addition, long working duration per day as 5–10 hours (AOR/p = 5.60/<0.01; 95% CI: 1.6–19.6) and > 10 hours (AOR/p = 4.9/0.18; 95% CI: 0.46–53.6) showed two times higher odd on prolonged standing time of the respondents on working period and MSD significantly (AOR/p = 10.90/<0.01; 95% CI: 2.5–47.6) shows greater. A study also found prolonged periods of standing were identified as risk factors for low back pain.¹⁵ Another study among dentists in Iran found no significant differences in practice per day (work vs. hours).¹⁹

Responses were received from the capital city only, which limits the generalization of the whole country's population-based outcome. It was due to a shortage of resources, funding, time constraints, and the pandemic situation. Despite limitations, our data were from a densely populated capital city, where most of the dental professionals' practices are, which gives a close enough image with a realistic idea. The

findings may guide future researchers for further large-scale studies among this important professional group of the population.

Conclusion

The study found a significant association between prolonged standing work time and the status of MSD among dentists. It indicates that the risky professional work pattern in their chamber tends to cause subjects to suffer from MSD. A better planned long-term study, eliminating limitations of the current study and using a mixed method approach, will give a more accurate estimate of Ideal vs. prolonged standing duration among dentists, and thereby a better means to accurately recommend and implement policies and strategies to combat this serious issue. So, we can conclude from the study that the existence of a significant relationship between standing time during work and MSDs among dental surgeons should be tackled in the right way so that dental professionals will be able to adopt ideal standing time and take remedial measures to fight against this chaos.

Declarations

Acknowledgment

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Declaration of Interest Statement The authors have declared that no competing interests exist.

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Figures

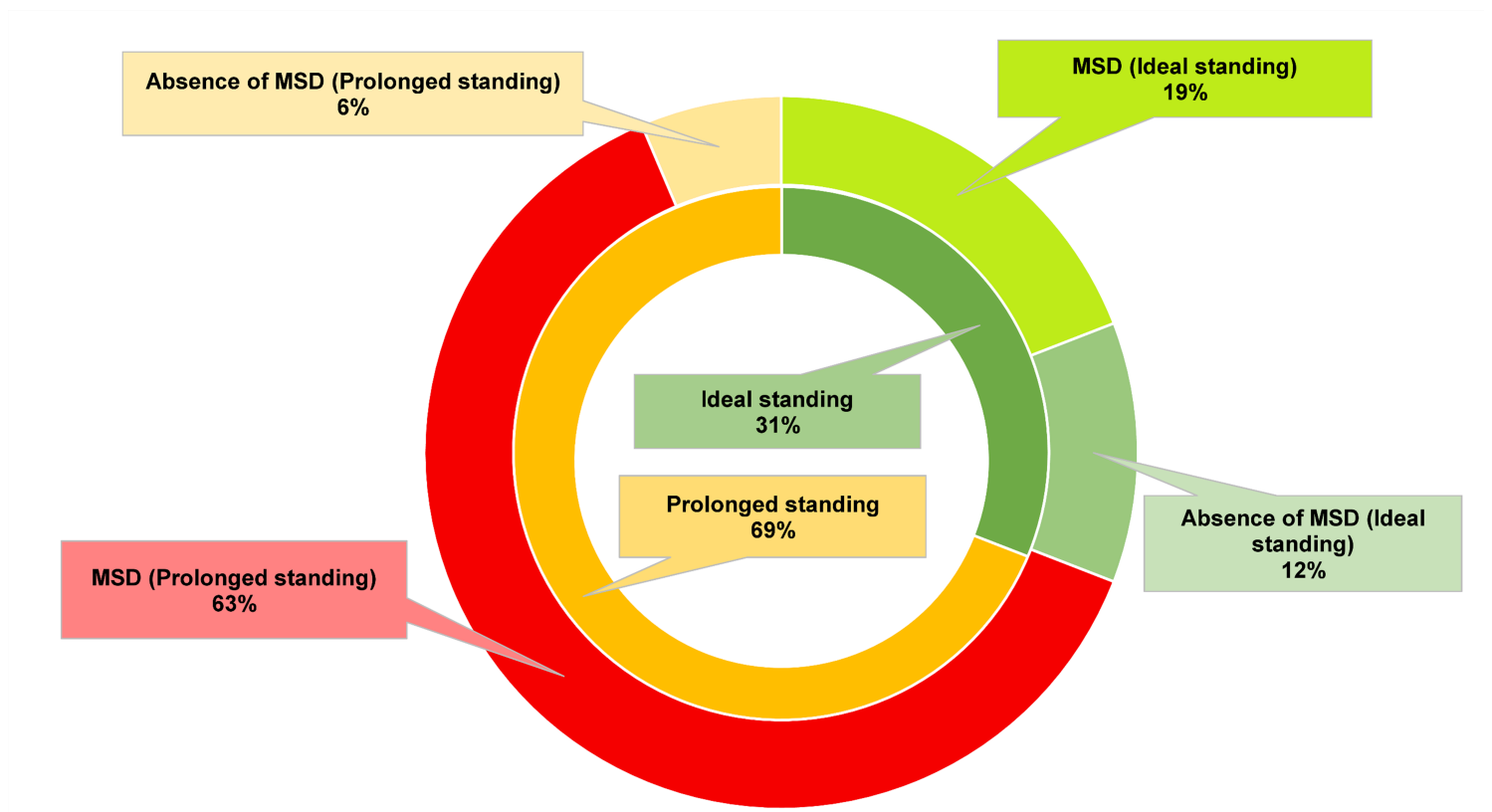


Figure 1

Ideal and prolonged standing duration per day along with MSD status of respondents (n=110). This is the Fig 1 legend.

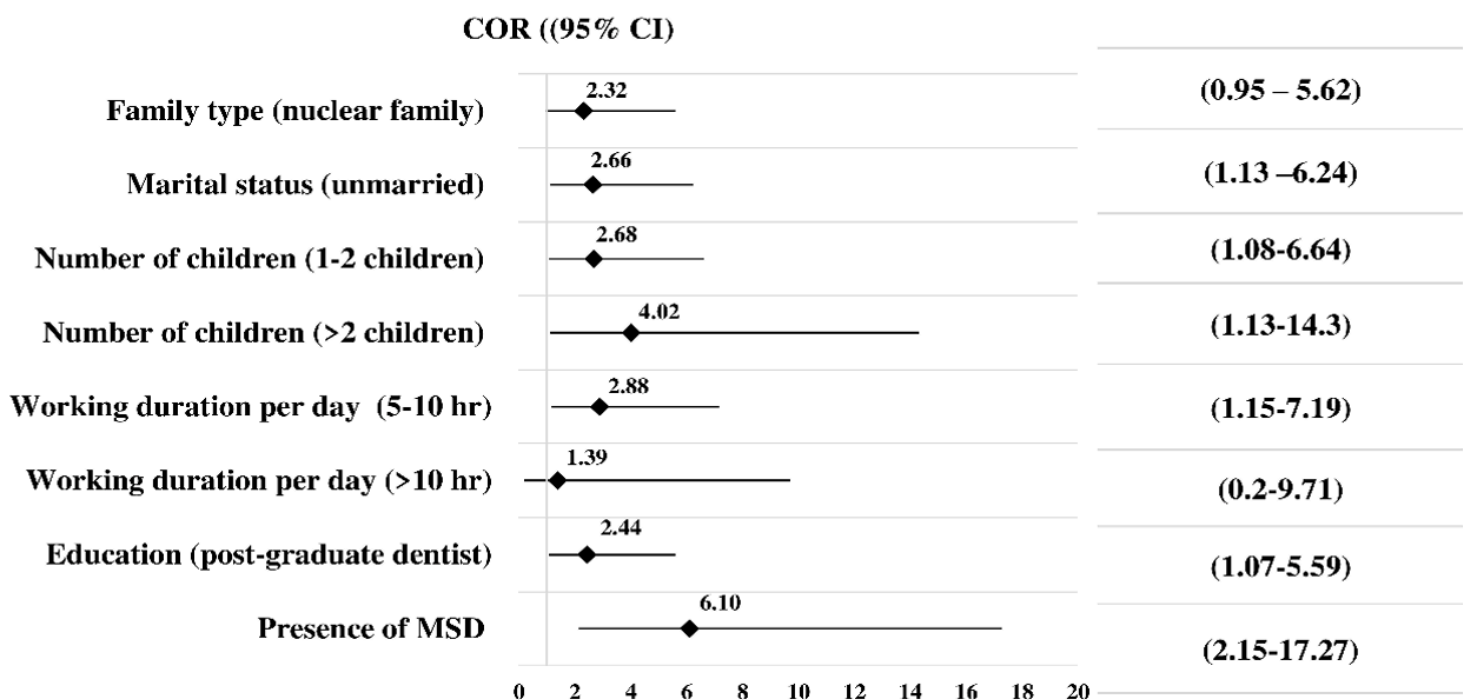


Figure 2

Figure 2.1: Insight characteristics of respondents (COR) with prolonged standing duration per day (n=110)

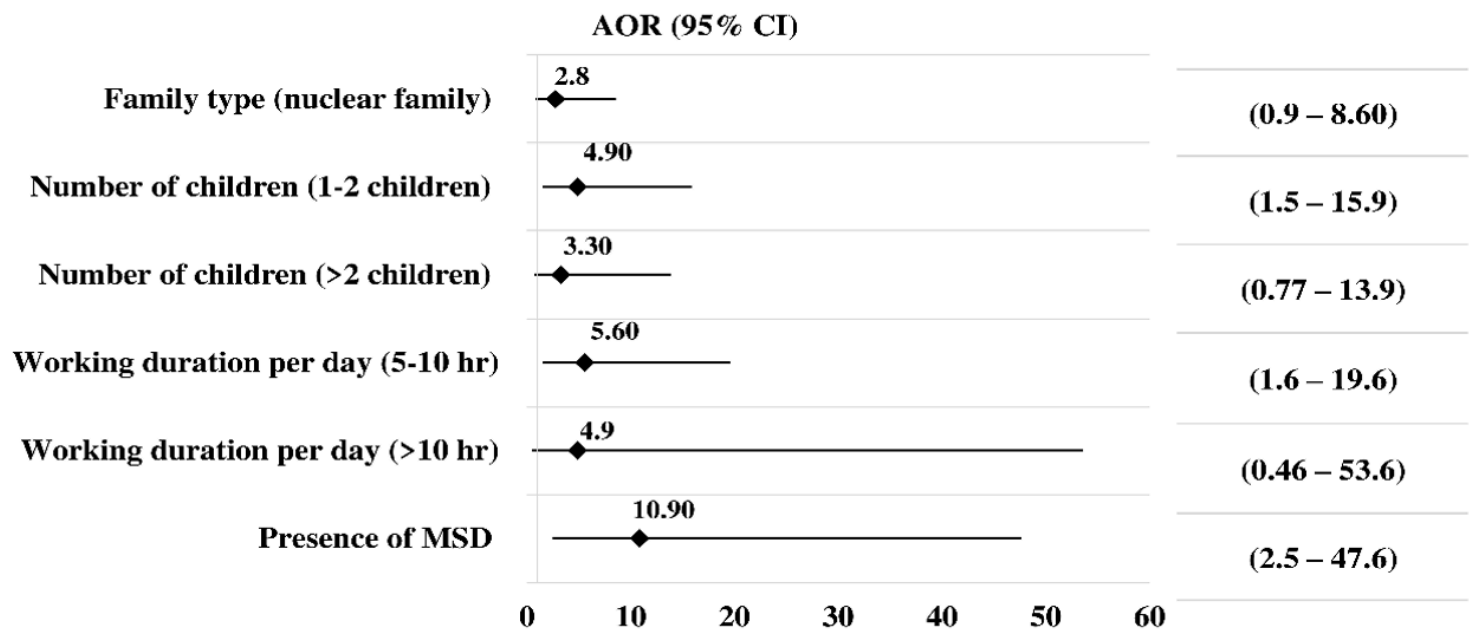


Figure 3

Figure 2.2: Insight characteristics of respondents (AOR) with prolonged standing duration per day (n=110)

Supplementary Files

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- [MSDdataset.sav](#)