Prevalence of musculoskeletal disorders in the dental profession in Brunei Darussalam

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ABSTRACT

Introduction: Many health professionals, including those in the dental profession, suffer from work-related musculoskeletal disorders (WMSD). Literature reviews have reported on the high prevalence as well as the significant burden in this specific profession. However, we could not find data on the prevalence of the problem and its work-related health risk profiles in Brunei Darussalam. This cross-sectional study aims to determine the prevalence of musculoskeletal disorders (MSD) in the dental profession of the public sector, and identify their associated MSD risk profiles. **Materials and Methods:** A survey was carried out using a validated structured self-administered questionnaire among 155 dental personnel (57% response rate) employed by the Ministry of Health in Brunei Darussalam. Questions included data on demographics, general ergonomic risk, and self-reported musculoskeletal complaints. **Results:** The dental workforce was predominantly female (69.7%), with mean age of 39 (SD 9.87) years and mean employment duration of 13.9 (SD 8.71) years. The most commonly reported body regions for musculoskeletal problems experienced in the past year were shoulders (61.7%), lower back (59.3%), upper back (55.7%), wrists/hands (53.4%), and neck (53.3%). Significant work-related associated factors for MSD were glare for neck ($p<0.05$), elbows ($p<0.001$), wrists/hands ($p<0.001$) and upper back ($p<0.05$) regions; time spent per patient for shoulders ($p<0.05$), and wrists/hands ($p<0.05$) regions; dental group for shoulders ($p<0.05$), upper back ($p<0.05$), and lower back ($p<0.05$) regions; and gender for neck ($p<0.05$), elbows ($p<0.001$), wrists/hands ($p<0.001$), and upper back ($p<0.05$) regions. **Conclusion:** The prevalence of self-reported MSD among dental personnel is high. Several work-related factors have been identified to be associated with musculoskeletal symptoms in varying body regions. Preventive measures need to be implemented to reduce the significant burden of MSD in the dental profession.

Keywords: Dental profession, work-related musculoskeletal disorders, Brunei

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INTRODUCTION

Work-related musculoskeletal disorders (WMSD) make up an entity that has become increasingly common in most industries. It is

one of the most common occupational health issues causing injuries and illnesses that result in days away from work, job restrictions or job transfers among healthcare workers. This is most notable in the dental and nursing professions. [1] It is also a common cause of work-related disability among workers resulting in substantial financial consequences due to medical expenses and worker's compensation, as well as a burden to the employer from loss of staff productivity due to absenteeism and presenteeism. [2]

Studies have reported that the prevalence of WMSD in nurses over a 12-month period is as high as 85.5%. [3] A similar result is obtained from a systematic review of studies in dentists, dental hygienists and dental students which puts the prevalence in this profession between 64% and 93%. [4] As dental work demands high precision with intense hand-eye coordination that requires repetitive motion and excessive force often performed in awkward and static postures, it is not surprising to discover this. Back pain has often been cited as the most problematic chronic condition among dentists, dental hygienists and dental assistants. [5, 6] In another study, upper back pain prevalence among dentists was reported to be 72%. [7] While the occasional backache or neck pain is not a cause for alarm, frequent pain from cumulative physiological damage can lead to chronic injury or a career-ending disability. [8]

This alarmingly high prevalence has resulted in growing concerns among health care workers on related ergonomics issues and risk factors associated with WMSD. As there are no data on this health-related problem in Brunei Darussalam, we aimed to estimate the prevalence of musculoskeletal disorder (MSD) symptoms in the dental professionals in Brunei Darussalam, and to compare prevalence between the different groups of dental professionals, i.e. dentists, dental nurses, therapists and assistants, dental technicians and technologists. In addition, it was aimed to identify work-related associated factors of MSD for each body region.

MATERIALS AND METHODS

Study design and Study Population: A cross-sectional study was conducted targeting dental personnel working in the public sector in Brunei Darussalam between January and March 2011. In the registry of government-employed health care workers with the Ministry of Health, Brunei Darussalam in 2011, there were 272 dental personnel including dentists (from specialist level to dental officers), dental therapists/ nurses, dental assistants, dental technologists, and dental technicians, who work at either specialist dental clinics or general dental clinics. These clinics are located in the four districts of Brunei Darussalam, and serve the general population's dental needs. The criterion for inclusion was having at least one year of employment in clinical practice. We excluded those who were pursuing long term overseas training during the period of study. We attempted to study all eligible dental personnel without sampling.

Data collection procedure: The Dental Research and Development Unit, Ministry of Health, Brunei Darussalam managed the collection of data. Trained personnel from the unit approached the eligible dental personnel individually and gave the option to participate in the study by filling in a consent and confidentiality form. The consented dental person-

nel were then given a validated structured self-administered questionnaire. They were given a choice to fill in the questionnaire in either the English or Malay version.

Validated self-administered questionnaire: The questionnaire had three major sections. The first section sought data on demographic information such as age, gender, level of education, hand dominance, height and weight, as well as individual lifestyle practices such as smoking, exercise, hobbies and sports. Other related questions included length of employment, work hours, rest break, length of time spent treating each patient, use of dental chairs, and working positions. The questionnaire used mostly a yes/no response format and point-scale format. The second section was designed for symptom survey on body parts and the third section was on ergonomic risk analysis. The questionnaire was developed by the research team through intensive literature searches and a series of discussion among the research team and stakeholders to ensure content validity. The second section (the symptom survey) and the third section (ergonomic risk analysis) were adapted from the standardised Nordic questionnaire and the validated NIOSH general ergonomic risk analysis checklist respectively. [9-11] The drafted questionnaire was pre-tested on a group of six dental personnel from different dental groups to ensure comprehensibility. The questionnaire was drafted and pretested in both English and Malay, and both versions were independently reviewed by two members of the research team who were well versed in both languages. All these procedures were done to ensure reliability and validity of the questionnaire.

Statistical analysis: Statistical analyses were done using STATA version 12.0 for Windows. Descriptive statistics such as frequency, percentage, mean and standard deviation (SD) were used to describe demographic and work-related characteristics of the study population. The prevalence of MSD for each body region was estimated with 95% confidence intervals (CIs). Chi-squared test was used to compare prevalence of MSD between subgroups of the study sample. The associated factors of MSD for each body region were identified by using generalised linear regression for binomial family with log link to obtain prevalence ratios (PRs) with their 95% CIs. In all hypothesis tests, two sided tests were used and $p<0.05$ was considered statistically significant.

Ethical consideration: The study protocol was approved by the Medical and Health Research Ethics Committee (MHREC), Ministry of Health, Brunei Darussalam.

RESULTS

A total of 155 valid responses were received; giving a response rate of 57%. Among respondents, 47.2% were from the National Dental Centre, 20.8% from Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital (a tertiary centre), and 26.4% were based at dental clinics affiliated with health centres throughout the four districts. Dental therapists, nurses and assistants made up the majority of the workforce (64.6%), followed by dentists (22.4%), and dental technicians and technologists (12.9%). Table 1 shows the demographic characteristics of the study population.

The participants were predominantly females (69.7%), with age ranging from 20 to

Table 1: Demographic characteristics of the study population by gender.

Characteristics	Female (*n*=108)		Male (*n*=47)	
	Mean (SD)	***n* (%)**	**Mean (SD)**	***n* (%)**
Age (year)	39.1 (9.87)		36.7 (11.23)	
Body mass index (kg/m^2)	26.7 (5.34)		27.4 (8.49)	
23-27.4		31 (35.6)		16 (41.0)
>27.4		34 (39.1)		13 (33.3)
Duration of employment (years)	13.9 (8.71)		15.2 (11.21)	
Marital status				
Married		73 (67.6)		33 (70.2)
Not married		35 (32.4)		14 (29.8)
Education				
Graduate degree		58 (53.7)		18 (40.0)
Non-degree		50 (46.3)		27 (60.0)
Dominant hand				
Right		97 (92.4)		36 (85.7)
Left		8 (7.6)		6 (14.3)
Current illness				
Joint disease		9 (30.0)		5 (31.3)
Non-joint disease		21 (70.0)		11 (68.8)

SD: Standard deviation

61 years. The majority of both females and males were right hand dominant. There were also similar findings for both females and males for employment duration and presence of joint diseases. The majority of the dental personnel in both genders were in the over-weight and obese categories.

Table 2 gives a breakdown of the three dental groups. Dental therapists/ nurses/ assistants made up the largest proportion of the dental workforce (64.6%) with the least proportion being dental technologists/ technicians. There were more female dentists and dental therapists/ nurses/ assistants than there were female dental technologists/ technicians. The age distribution was similar in the three groups.

Fifty percent of dentists were found to have existing joint problems whereas only one quarter or less in the other two groups shared similar complaints. Dental therapists/ nurses/ assistants had the longest mean duration of employment (15.3 years) compared to the other two groups. Among the three dental groups, the majority of dentists took rest breaks in between seeing patients whilst most of the dental personnel in the other two groups did not.

The overall prevalence of MSD in the past 12 months was highest in the shoulder region (61.7%) and it was significantly higher in the group of dental therapists/ nurses/ assistants and dental technologists/ technicians than dentists. The overall prevalence of MSD in the lower back stood out as the second highest (59.3%) followed by upper back (55.7%). In both these body regions, the highest prevalence was in the group of dental therapists/ nurses/ assistants. Although statistically not significant, the group of dental therapists/ nurses/ assistants had the highest or one of the highest MSD prevalence compared to the other two groups for all other body

Table 2: Demographic and work-related characteristics of study population by categories of dental personnel.

Characteristics	Dentist (*n*=33)		Dental therapists/ nurses/ assistants (*n*=95)		Dental technologists/ technicians (*n*=19)	
	Mean (SD)	*n* (%)	Mean (SD)	*n* (%)	Mean (SD)	*n* (%)
Age (year)	38.2 (10.57)		37.3 (8.89)		35.6 (16.44)	
Body mass index (kg/m^2)	25.5 (3.67)		27.2 (5.34)		29.1 (6.54)	
23-27.4		14 (45.2)		16 (30.2)		14 (37.8)
>27.4		8 (25.8)		25 (47.2)		14 (37.8)
Duration of employment (year)	13.3 (9.78)		15.3 (8.66)		12.8 (12.88)	
Gender						
Female		18 (54.5)		74 (77.9)		9 (47.4)
Male		15 (45.5)		21 (22.1)		10 (52.6)
Marital status						
Married		24 (72.7)		66 (69.5)		10 (52.6)
Not married		9 (27.3)		29 (30.5)		9 (47.4)
Education						
Graduate degree		33 (100)		31 (33.0)		8 (44.4)
Non-degree		0 (0)		63 (67.0)		10 (55.6)
Dominant hand						
Right		30 (96.8)		82 (89.1)		15 (88.2)
Left		1 (3.2)		10 (10.9)		2 (11.8)
Current illness						
Joint disease		6 (50.0)		7 (25.0)		1 (16.7)
Non-joint disease		6 (50.0)		21 (75.0)		5 (83.3)
Rest breaks between seeing patients/dental task						
Yes		25 (92.6)		16 (20.0)		1 (33.3)
No		2 (7.4)		64 (80.0)		2 (66.7)
Time spent per patient						
≤30 mins		16 (55.2)		30 (35.7)		0 (0)
>30 mins		13 (44.8)		54 (64.3)		0 (0)

regions. Detailed overall prevalence and their CIs and comparison among the three dental groups are presented in Table 3.

The association of work-related factors with MSD in the different body regions is shown in Table 4. Glare from lighting was seen to be significantly associated with symptomatic MSD in the neck, elbows, wrists/ hands, and upper back regions. Other factors that were observed to have statistically significant associations with varying body regions

Table 3: Prevalence of self-reported musculoskeletal disorder symptoms in the past 12 months by body region.

Body region	Dentists (*n*=33) (%)	Dental therapists/ nurses/ assistants (*n*=95) (%)	Dental technologists/ technicians (*n*=19) (%)	Overall (*n*=147) (%) (CI)	*p* value[a]
Neck	42.4	57.6	52.9	53.3 (45.2; 61.4)	0.330
Shoulders	38.7	68.6	68.8	61.7 (53.8; 69.6)	0.011[b]
Elbows	12.9	19.0	12.5	16.8 (10.8; 22.8)	0.653
Wrists/Hands	45.2	60.0	35.3	53.4 (45.3; 61.5)	0.102
Upper back	28.1	65.9	58.8	55.7 (47.7; 63.7)	<0.001[b]
Lower back	42.4	69.4	41.2	59.3 (51.4; 67.2)	0.007[b]

CI=Confidence Interval [a] chi-square test for independence [b] statistically significant

were time spent for each patient, job and gender. A breakdown of the results is presented in Table 4.

DISCUSSION

Health care work is recognised as a high risk job for MSD; however most of the studies have been carried out in specific groups of healthcare professionals such as dentists and dental hygienists, nurses, radiologists, ophthalmologists, and physiotherapists. [3, 4, 12-14] As such, there remains lack of research on this increasing burden in other fields of the healthcare sector. The dental profession however has one of the highest prevalence for WMSD, and hence forms the basis for our research. This is the first study to be conducted on the prevalence of self-reported MSD in the dental profession in Brunei Darussalam. The high frequency of neck complaints in our study is similar to that found in previous studies. [6, 15] Their work posture with flexion and rotation of the cervical spine is a probable explanation for neck MSD. A previous study concluded that dentists have a high prevalence of cervical spondylosis, even if the relation between cervical symptoms and radiographic cervical spondylosis is indistinct. [16] Workstations with insufficient lighting or incorrect lighting positions that result in dental professionals assuming an unbalanced positioning of the body and uncomfortable viewing due to shadowing, specular reflection and glare have been reported to be a risk factor for developing MSD. [17] Our study reflects this finding. Glare is seen to be associated with the occurrence of MSD in all body regions studied in this survey, most notably in the neck [PR 1.37 (95% CI: 1.00; 1.88 p<0.05)], elbows [PR 3.53 (95% CI: 1.70; 7.36 p<0.001)], wrists/

Table 4: Factors associated with self-reported musculoskeletal disorder symptoms for each body region.

Factors	Prevalence Ratio (Confidence Interval)[b]					
	Neck	**Shoulders**	**Elbows**	**Wrists/ Hands**	**Upper back**	**Lower back**
Presence of glare						
Yes	1.37 (1.00;1.88)*	1.30 (0.99;1.71)	3.53 (1.70;7.36)**	1.59 (1.20;2.10)**	1.42 (1.06;1.90)*	1.08 (0.79;1.48)
No[a]						
Time spent per patient						
>30 min	1.40 (0.96;2.04)	1.59 (1.13;2.23)*	1.18 (0.50;2.77)	1.56 (1.09;2.23)*	1.29 (0.91;1.84)	1.11 (0.81;1.52)
≤30 min[a]						
Taken rest break						
Yes	0.56 (0.28;1.10)	0.75 (0.46;1.21)	1.01 (0.32;3.18)	0.63 (0.35;1.14)	1.07 (0.71;1.62)	0.78 (0.48;1.27)
No[a]						
Age (year)						
≥ 40	0.90 (0.62;1.29)	1.16 (0.87;1.56)	2.51 (1.00;6.30)*	0.90 (0.65;1.23)	1.13 (0.83;1.56)	1.07 (0.80;1.43)
< 40[a]						
Job						
Dental therapists/ nurses/ assistants	1.35 (0.87;2.01)	1.77 (1.11;2.83)*	1.53 (0.55;4.24)	1.32 (0.86;2.03)	2.39 (1.34;4.25)*	1.65 (1.08;2.52)*
Others[a]						
Gender						
Female	1.37 (1.00;1.88)*	1.30 (0.99;1.71)	3.53 (1.70;7.36)**	1.59 (1.20;2.10)**	1.42 (1.06;1.90)*	1.08 (0.79;1.48)
Male[a]						

*p value <0.05; **p value <0.001, [a] Reference category
[b] Generalised linear regression for binomial family with log link (outcome as presence of MSD symptom in the past 12 months in a specific body region)

hands [PR 1.59 (95% CI: 1.20; 2.10 $p<0.001$)], and upper back [PR 1.42 (95% CI: 1.06; 1.90 $p<0.05$)].

In the gender strata, females were found to have a higher risk of self-reported MSD complaints than males. This is similar to other reports. [7, 18-20] Another important aspect is the recovery period of MSD for females. Females often shoulder the main responsibility for household duties and childcare, thus their total workload (at work and outside of work) is more than males, hence placing them at higher risk of developing chronic MSD. Some reports have also postulated that females have a lower threshold for musculoskeletal pain than males, leading them to experience pain at very low intensity. [21]

The length of time spent on each patient or task has been reported to be associated with an increased risk of MSD. [22, 23] Our study results reflect this for dental professionals who spend more than half an hour treating each patient or work on each dental task. The characteristics of clinical work of dental professionals which involve repetitive motions, unsupported forearms and use of vibrating instruments are the basis for static neck position, extended neck flexion and poor posture, resulting in musculoskeletal complaints. [4]

Of the three groups surveyed, dental therapists/ nurses/ assistants reported the highest prevalence for musculoskeletal symptoms of the neck, shoulders, elbows, wrists/ hands, upper back and lower back. Statistical tests of associations for shoulder MSD, upper back MSD and lower back MSD were also found to be significant in this occupational group. This finding is in keeping with most other studies. Dental therapists and nurses often have their own list of patients, and frequently perform clinical dental procedures such as scaling, polishing, and basic monitoring of dental hygiene. In order to get clear access to the oral cavity within the limited space available and impaired visibility within the patient's oral cavity, they often adopt stressful body positions in prolonged static postures which may contribute to musculoskeletal problems. [24] Dental therapists and nurses see a higher number of patients than dentists, and the majority do not take any rest breaks in between seeing patients. The reasons for this were not explored in the survey; however we (the authors) opine that dentists have a shorter list of patients due to their specialist referral cases which are generally more complex and therefore take longer to treat compared to patients seen by dental therapists and nurses. As dental therapists and nurses have a longer list of patients and often work on patient scheduled times, they may forgo rest breaks so that patients are seen and treated within their allotted times. The abovementioned findings, coupled with their longer mean employment years, therefore place dental therapists and nurses at a high risk of developing work-related MSD.

There were limitations in this study. The low response rate of 57% may not be representative of the dental population in Brunei Darussalam although every effort was attempted to minimise non-response while maintaining a high standard of ethical conduct. Furthermore, a number of dental personnel who were on overseas training and those in the private sector were not captured in this study. The study population size may also have been insufficient to obtain statisti-

significant associations when analysing some of the commonly reported work-related factors. The cross-sectional study design also meant that causation of MSD in the dental professionals could not be demonstrated, nor could we study the temporality between work-related associated factors and occurrence of MSD. Use of self-reported MSD may have introduced reporting bias. A confirmed diagnosis of MSD can be obtained by further clinical assessment among the dental groups. There may be other contributing factors for work-related MSD, such as psychosocial factors and housework, which were not surveyed in this study. Data from this comprehensive questionnaire survey can be further analysed to study the associations between mechanical-ergonomic factors, non-work related factors such as hobbies or sports activities, absenteeism and/ or presenteeism and their impact on the development of work-related MSD.

In conclusion, the prevalence of self-reported MSD in different body regions among dental personnel range from 17%-62%. The body regions commonly affected are the neck, shoulders, elbows, wrists/hands, upper back and lower back. Several factors that were identified to be strongly associated with MSD were presence of glare, time spent on each patient or dental task, rest break, dental group, and gender. Our study yielded results that are comparable with other similar studies, and most importantly the outcomes have enabled us to identify associated factors and the most vulnerable dental group. This will help us to pursue further focused studies and implement preventive measures, thereby reducing the impact of MSD among dental professionals.

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