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Análise de prevalência dos distúrbios osteomusculares relacionados ao trabalho e dos questionários para distúrbios osteomusculares em dentistas. Uma revisão sistemática e de escopo

Governador Valadares
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Dissertação apresentada ao Programa de Pós-Graduação em Ciências Aplicadas à Saúde, da Universidade Federal de Juiz de Fora, Campus Governador Valadares, como requisito parcial à obtenção do título de Mestre em Ciências Aplicadas à Saúde, área de concentração Biociências.

Orientador(a): Prof. Dr. Cleidiel Aparecido de Araujo Lemos

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Dedico este trabalho à minha mãe Fátima e a minha irmã Mariana,
minhas duas metades separadas do meu corpo.

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RESUMO

Os distúrbios osteomusculares são a principal cauda de adoecimento em dentistas, além de dores e desconfortos, estes distúrbios podem causar queda na produtividade, piora na qualidade de vida e em casos mais graves a interrupção da prática odontológica. O objetivo desta pesquisa pesquisa foi atraves de uma revisão de escopo identificar e realizar um levantamento sobre quais questionários para avaliação de sintomas de DORT são mais utilizados, e por meio de uma revisão sistemática realizar o cálculo de prevalência de DORT nestes profissionais independente do país de atuação ou especialidade. Esta revisão de escopo seguindo as diretrizes do JBI e PRISMA-ScR onde foram selecionados 171 artigos para análise. Enquanto a revisão sistemática de acordo com o PRISMA 2020 utilizando 38 artigos para a revisão. Os resultados encontrados foram: O Questionário Nórdico de Sintomas Musculoesqueléticos emergiu como a ferramenta mais utilizada (41.71%) seguidos pelos questionários criados pelos próprios autores (34.67%). Notavelmente nenhum dos estudos reportou uma validação apropriada destes questionários criados pelos autores. Como cada questionário possui seus pontos fortes e pontos fracos, a combinação de questionários pode ajudar a complementar os resultados. A prevalência geral de DORT em dentistas foi cerca de 83% e as áreas mais afetadas foram o pescoço (58%), ombros (44%) e a lombar (50%). O continente africano foi o que teve os maiores indicies de prevalência (99%; CI: 96 to 100%) entretanto a quantidade de artigos (1) e o alto risco de viés encontrado não permitem uma conclusão acerca do continente. O continente asiático foi aquele com o maior numero de estudos selecionados (20) o que corrobora com estudos publicados previamente. Não foram encontradas diferenças significativas na prevalência de DORT observada nos diferentes continentes.

Palavras-chave: distúrbios osteomusculares relacionados ao trabalho; dentistas; prevalência; questionários.

ABSTRACT

Musculoskeletal disorders are the main cause of illness among dentists. In addition to pain and discomfort, these disorders can cause a drop in productivity, a worsening of quality of life and, in more serious cases, the interruption of dental practice. The aim of this research was through a scope review, identify and accomplish a data survey about which questionnaires to assess WMSD symptoms are most used, and through a systematic review, calculate the prevalence of WMSDs on those professionals regardless their country operation or specialization. This scope review followed the guidelines of the JBI and PRISMA-ScR where 171 articles were selected for analysis. While the systematic review followed PRISMA 2020 aimed to evaluate the prevalence of WRMSD on dentists worldwide using 38 articles to this review. The results found were: The Nordic Musculoskeletal Questionnaire (NMQ) emerged as the most prevalent tool (41.71%), followed by self-made questionnaires (34.67%). Notably, none of the studies reported appropriate validation of the proposed self-made questionnaire instrument. The combination of questionnaires may help to complemente the results as each questionnaire has its strengths and weaknesses. The overall prevalence of WRMSD on dentists was about 83% and the most affected areas was the neck region (58%), shoulders (44%), and lower back (50%). There were not significant difference in the prevalence of WMSD observed across the different continents. The African continent were the one with the highest prevalence rates (99%; CI: 96 to 100%). However, the number of articles (1) and the high risk of bias found do not allow a conclusion about the continent. The Asian continent was the one with the largest number of studies selected (20), which corroborates previously published studies. No significant differences were found in the prevalence of WMSDs observed on different continents.

Keywords: work-related musculoskeletal disorders; dentist; prevalence; questionnaire.

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1 INTRODUÇÃO

Apesar do trabalho laboral ser reconhecido como uma das causas dos transtornos de ordem osteomuscular desde o século XVIII, foi somente na década de 1970 em que o assunto começou a ser estudados e analisados através de trabalhos epidemiológicos Os Distúrbios Osteomusculares Relacionados ao Trabalho (DORT) são lesões, distúrbios ou disfunções que afetam, músculos, ossos, nervos, tendões, ligamentos, juntas cartilagens e discos espinhais (Niosh., 1997).

Os locais do corpo mais comuns de se manifestarem algum tipo de DORT são o pescoço, ombros, região lombar (Moodley, Naidoo e Wyk., 2017) além de mãos e punhos de acordo com o National Institute for Occupational Safety & Health (NIOSH). Segundo um relatório constando as evidências pela NIOSH, diferentes condições de trabalhos podem causar a DORT dos quais podemos destacar levantamento rotineiro de objetos pesados, exposição diária a vibração de corpo inteiro, trabalho rotineiro acima da cabeça, trabalho com o pescoço em posição de flexão crônica ou execução de tarefas repetitivas vigorosas (Niosh., 1997).

Os DORT são considerados uma das doenças ocupacionais mais frequentes entre os profissionais odontológicos (Scepanovic et al., 2019) O dentista é propício ao surgimento de DORT devido a fatores de risco como: movimentos repetitivos, permanecer longos períodos com a postura estática na qual estes profissionais precisam se submeter afim de realizar as suas atividades (Bedi et al., 2015). Moodley Naidoo e Wyk (2018) em seu trabalho de revisão, agruparam diversos estudos a respeito da prevalência de DORT em dentistas, destacando o trabalho de Rafie et al.(2015) que constatou que 82.8% dos profissionais de odontologia sofriam um alto risco de desenvolver algum tipo de DORT, além de classificarem a profissão de dentista como a de mais alto risco para se desenvolver distúrbios de ordem musculoesquelética dentre os profissionais da área da saúde (Cherniak, Dussetschleger e Bjor., 2010). No trabalho de Rafeemanesh et al. (2013) foi observado que apesar de saberem de questões ergonômicas, cerca de 74% dos trabalhadores analisados reclamaram de distúrbios musculoesqueléticos.

Os DORT além de dores e desconforto pode resultar em baixa produtividade, piora significativa na qualidade de vida e problemas de saúde como tendinite, *burnout* ou até mesmo a interrupção da prática odontológica (Scepanovic et al. 2019; Bedi et al. 2015; Mulimani et al. 2018). Sendo assim como forma de prevenção, é necessário ter métodos

eficientes que auxiliem na identificação dos sintomas iniciais de adoecimento destes profissionais, como uma forma de evitar sequelas permanentes, e iniciar o tratamento o mais rápido o possível garantindo uma melhor recuperação.

Como forma de identificar os DORT capazes de avaliar dor, desconforto ou desabilidades de origem muscular diferentes instrumentos podem ser observados na literatura, como por exemplo o Nordic Musculoskeletal Questionnaire (NMQ) Disabilities of the Arm, Shoulder and Hand Outcome Measure (DASH) além do Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) recém traduzido para o português por Aleixo et al. (2021).

Com tamanha quantidade de constructos utilizados para medir, averiguar e constatar os DORT, surge então uma lacuna na literatura onde caberia revisões de escopo para estudar e compreender em quais situações cada instrumento deste está sendo utilizado, possíveis diferenças entre eles, as limitações juntamente com os pontos fortes de cada questionário quando empregado especificamente para cirurgiões dentistas. Diferente das revisões sistemáticas que tendem a responder perguntas muito específicas, as revisões de escopo tentam mapear os conceitos chaves e as evidências que sustentam um campo de pesquisa, encontra lacunas na literatura sobre o assunto, examinam como as pesquisas são conduzidas em determinado campo e esclarece os conceitos e definições utilizados na literatura, além de serem precursoras das revisões sistemáticas (JBI., 2020).

Além disso, um outro fator de grande importância no contexto acadêmico é verificar as taxas de prevalência dos DORT especificamente em cirurgiões dentistas. Estudos investigativos destacam a necessidade de educação profissional contínua, bem como a necessidade de melhorar os aspectos da prática clínica dos currículos de odontologia (Moodley, Naidoo e Wyk 2018). Neste contexto, uma revisão sistemática considerando a avaliação das informações disponíveis sobre os levantamentos epidemiológico de DORT em cirurgiões dentistas pode ser interessante com o fato de verificar as possíveis influências de diferentes variáveis em suas taxas, e consequentemente contribuir para uma ação mais efetiva nos públicos-alvo mais acometidos.

Sendo assim a seguinte pesquisa tem como objetivo realizar um levantamento dos instrumentos utilizados para avaliar os DORT em dentistas, verificar quais são as ferramentas mais utilizadas e tabelar estas ferramentas permitindo uma visualização mais ampla, sendo possível identificar quais áreas trabalhadas por cada ferramenta, as dimensões quando aplicáveis, o método de resposta, a quantidade de itens entre outras

informações relevantes que podem auxiliar a futuros pesquisadores a selecionar a ferramenta mais apropriada para o objetivo de sua pesquisa e por meio de uma revisão de escopo aliado com uma revisão sistemática com o intuito de calcular a prevalência dos DORT em dentistas do mundo todo, independente da área de especialidade, com a finalidade de descobrir quais são as áreas mais e menos afetadas, a prevalência dos DORT por continentes e se existem diferenças significativas entre as prevalências encontradas nos continentes avaliados.

2 ARTIGO CIENTÍFICO 1

Os artigos científicos foram enviados para publicação no periódico Musculoskeletal Science and Practice, qualis CAPES Interdisciplinar A2.A estruturação do artigo baseou-se nas instruções aos autores preconizadas pelo periódico (ANEXO 1).

Assessment questionnaires for work-related musculoskeletal disorders among dentists: A scoping review

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ABSTRACT

Early identification of symptoms of work-related musculoskeletal disorders (WMSD) is crucial to prevent permanent sequelae and disruptions in dental practice. To address this, the current study proposes a scoping review aimed at identifying and presenting the various questionnaires commonly used to evaluate WMSD in dentists. The review followed the guidelines of the JBI and PRISMA-ScR. The research question was: "What are the various questionnaires available for assessing work-related musculoskeletal disorders in dentists?". Searches were conducted in six databases, with articles published until June 2023. In total, 890 studies were identified through these searches, and after screening, 171 studies were included for mapping. Based on the collected data, 21 questionnaires were identified and used to evaluate WMSD in dentists. The Nordic Musculoskeletal Questionnaire (NMQ) emerged as the most prevalent tool (41.71%), followed by self-made questionnaires (34.67%). Notably, none of the studies reported appropriate validation of the proposed self-made questionnaire instrument. The questionnaires exhibited variation in terms of the number of items, subsets, evaluated areas, and methods of answering questions. Additionally, some included studies reported the use of more than one questionnaire to evaluate WMSD. Regarding the continents, the majority of included studies evaluated participants from Asia (48.74%). In conclusion, this scoping review underscores the wide variety of questionnaires available in the literature for assessing WMSD across different regions. Researchers should familiarize themselves with the available questionnaires and instruments to select the most suitable tool for evaluating WMSD according to their specific goals. Combining different instruments may enhance understanding of WMSD.

INTRODUCTION

Although labor has been recognized as one of the causes of musculoskeletal disorders since the 18th century, it was only in the 1970s that the subject began to be studied and analyzed by epidemiological research. Work-Related Musculoskeletal Disorders (WMSD) are injuries, disorders, or dysfunctions affecting muscles, bones, nerves, tendons, ligaments, joints, cartilage, and spinal discs (Bernard & Putz-Anderson, 1997). The most common body locations for the emergence of WMSD are the neck, shoulders, lower back regions (Moodley et al., 2018), hands, and wrists according to the National Institute for Occupational Safety & Health (NIOSH). According to a report

containing the evidence provided by NIOSH various work conditions may cause the WMSDs. These include routine lifting of heavy weights, daily exposure to full-body vibration, daily work above the shoulder line, work with a chronically flexed neck position, or performing repetitive vigorous tasks (Bernard & Putz-Anderson, 1997).

WMSDs are considered one of the most frequent occupational diseases among dental professionals (Scepanovic et al., 2019). Dentists are particularly susceptible to WMSDs due to exposure to risk factors such as repetitive movements and prolonged static postures required to perform their activities (Bedi et al., 2015). The dental profession is known to be the most at-risk among all healthcare professions for developing WMSDs (Cherniack et al., 2010). In addition to pain, WMSDs may cause a drop in productivity and, in more severe cases, the interruption of dental practice (Scepanovic et al., 2019, Bedi et al., 2015). Therefore, as a form of prevention, it is necessary to have efficient methods that assist in the identification of the primary symptoms of illness in these workers to avoid permanent sequelae and start treatment early to ensure a better recovery.

In a recent systematic review comprising 88 studies, the authors reported a 78.4% prevalence rate among dental healthcare providers (Chenna et al., 2022). The authors highlighted the need for future studies to use validated instruments for reporting WMSD (Chenna et al., 2022). Many of instruments have been developed and used to identify the WMSD symptoms (Aljanakh, 2024, Eyvazlou et al., 2021, Aljinovic et al., 2023, Algarni et al., 2020). These questionnaires are a very popular tool to assist cross sectional studies related to WMSD due to their ease of use and low production cost for implementation. The abundance of instruments used to measure and investigate WMSDs may lead to uncertainty about which questionnaire to use and what options are available, resulting in a gap in the literature.

Scoping reviews offer a valuable approach for providing a comprehensive mapping and overview of a particular topic. To the best of our knowledge, there are no published studies that have mapped and identified the various instruments frequently used to evaluate WMSDs in dentists. Therefore, this study aims to conduct a scoping review to assess the range of instruments utilized for identifying WMSDs among dentists. The goal is to identify key aspects, such as the most commonly used questionnaires, differences between instruments, and country/continent-specific usage. Additionally, the study will examine the types of research that have employed these questionnaires and determine if the necessary conditions for their application were met.

MATERIAL AND METHODS

Registration and Protocol

The protocol for this study was based on the structure proposed by Peters et al.[11] according to the Joana Brigs Institute (Peters et al., 2020). It also complies with the checklist proposed by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews - PRISMA-SCR (Tricco et al., 2018).

The methodological development protocol for this scoping review has been registered on the Open Science Framework and can be accessed via the following link: https://osf.io/bjht6/ - doi: DOI 10.17605/OSF.IO/BJHT6.

Eligibility criteria

The research question designed for the literature mapping was: "What are the various questionnaires available and utilized for assessing work-related musculoskeletal disorders in dentistry?". All types of studies available in the literature that performed a survey questionnaire in dentists were considered. This scoping review aimed identifying the instrument used to calculate the frequency and percentage of these instruments used by the published studies. The inclusion criteria for this research were as follows: all articles that employed questionnaires to assess WMSD in dentists, without language or publication period restriction. The exclusion criteria comprised literature and systematic reviews, articles that did not utilize questionnaires or used questionnaires not used for assessing WMSD, studies that include the evaluation of WMSD in dental students or dental auxiliar/dental hygienists. In cases where articles were not found, contact was made via email or ResearchGate to obtain the work.

Information sources and Search Strategy:

The searches will be conducted the searches in six databases (PubMed/MEDLINE, Web of Science, Scopus, SciELO, Embase, and ProQuest as grey literature) using the specified strategy for each database (Table 1). Two reviewers (L.P.G. and T.P.) independently conducted the searches after exporting the results from the databases into the reference manager Rayyan QCRI. The searches will be performed for articles published until June 2023.

Table 1. Search strategies used for the included databases.

MEDLINE/PubMed	
#1	((("Dentists") OR ("Dentist")) OR ("Dentistry")) NOT ("Student*")
#2	((((("Musculoskeletal Pain") OR ("Musculoskeletal Diseases")) OR ("Musculoskeletal Disorders")) OR ("Musculoskeletal Discomfort")) OR ("Work-related musculoskeletal disorders")
#3	((((("Surveys and Questionnaires") OR ("Survey")) OR ("Surveys")) OR ("Questionnaires")) OR ("Questionnaire")
#4	#1 AND #2 AND #3
Web of Science	
#1	(((ALL=("Dentists")) OR ALL=("Dentist")) OR ALL=("Dentistry")) NOT ALL=(Student*)
#2	((((ALL=("Musculoskeletal Pain")) OR ALL=("Musculoskeletal Diseases")) OR ALL=("Musculoskeletal Disorders")) OR ALL=("Musculoskeletal Discomfort")) OR ALL=("Work-related musculoskeletal disorders")
#3	((((ALL=("Survey")) OR ALL=("Surveys")) OR ALL=("Questionnaires")) OR ALL=("Questionnaire")) OR ALL=("Surveys and Questionnaires")
#4	#1 AND #2 AND #3
Scopus	
#1	TITLE-ABS-KEY ("Dentists") OR TITLE-ABS-KEY ("Dentist") OR TITLE-ABS-KEY ("Dentistry") NOT TITLE-ABS-KEY ("Student*")
#2	TITLE-ABS-KEY (" Musculoskeletal Pain ") OR TITLE-ABS-KEY (" Musculoskeletal Diseases") OR TITLE-ABS-KEY (" Musculoskeletal Disorders") OR TITLE-ABS-KEY (" Musculoskeletal Discomfort ") OR TITLE-ABS-KEY (" Work-related musculoskeletal disorders ")
#3	TITLE-ABS-KEY ("Survey") OR TITLE-ABS-KEY ("Surveys") OR TITLE-ABS-KEY ("Questionnaires") OR TITLE-ABS-KEY ("Questionnaire") OR TITLE-ABS-KEY ("Surveys and Questionnaires")
#4	#1 AND #2 AND #3
Embase	
#1	('dentists'/exp OR 'dentists' OR 'dentist'/exp OR 'dentist' OR 'dentistry'/exp OR 'dentistry') NOT 'student*'
#2	'musculoskeletal pain' OR 'musculoskeletal diseases' OR 'musculoskeletal disorders' OR 'musculoskeletal discomfort' OR 'work-related musculoskeletal disorders'
#3	'survey' OR 'surveys' OR 'questionnaires' OR 'questionnaire' OR 'surveys and questionnaires'
#4	#1 AND #2 AND #3
SciELO	
#1	(((TS=("Dentists")) OR TS=("Dentist")) OR TS=("Dentistry")) NOT TS=(Student*)
#2	((((TS=("Musculoskeletal Pain")) OR TS=("Musculoskeletal Diseases")) OR TS=("Musculoskeletal Disorders")) OR TS=("Musculoskeletal Discomfort")) OR TS=("Work-related musculoskeletal disorders")
#3	((((TS=("Survey")) OR TS=("Surveys")) OR TS=("Questionnaires")) OR TS=("Questionnaire")) OR TS=("Surveys and Questionnaires")
#4	#1 AND #2 AND #3
ProQuest	

#1	noft("Dentists" OR "Dentist" OR "Dentistry" NOT "Student*") AND noft("Musculoskeletal Pain" OR "Musculoskeletal Diseases" OR "Musculoskeletal Disorders" OR "Musculoskeletal Discomfort" OR "Work-related musculoskeletal disorders") AND noft("Survey" OR "Surveys" OR "Questionnaires" OR "Questionnaire" OR "Surveys and Questionnaires")

Data Items and Synthesis

The selected articles were tabulated by one author (L.P.G) using Microsoft Excel 2010 (Office 10) through a standardized pilot data extraction form. Data from the articles were extracted, considering the following topics: Questionnaires, Total, Cumulated total, Cumulated percentage. A second table was created indicating the characteristics of the questionnaire use (creation, number of items, subsets, evaluated areas of WMSD, and main considerations). This information was considered for included studies that performed questionnaire, except for self-made questionnaires without validation. A cumulative proportion was considered for each questionnaire to calculate the prevalence of use for evaluation WMSD. The data was also tabulated according to region of use (continent or country) and tables and map were designed to indicate the regions with higher proportion. Finally, a graph was performed to identify the number of studies that indicated the validation of instrument (all or self-made).

RESULTS

Search Strategy

A total of 890 articles were identified through the database search and imported into Rayaan. After removing duplicates, 547 articles were evaluated. During the first phase, reviewers independently assessed the titles and abstracts against the eligibility criteria. Any discrepancies were resolved through consensus between the reviewers.

Following the review of titles and abstracts, 201 articles were selected for full-text reading. Among these, 30 articles were excluded for the following reasons: unavailability through electronic means, the inclusion of dental studies or dental auxiliaries/hygienists instead of dentists, absence of dentists in the sample population, irrelevant content regarding WMSD, duplication, and inclusion in systematic reviews. Consequently, 171 articles were included for data extraction and analysis (Figure 1). Detailed information regarding the references of included and excluded studies, along with reasons for exclusion, can be found in Supplemental File 1.

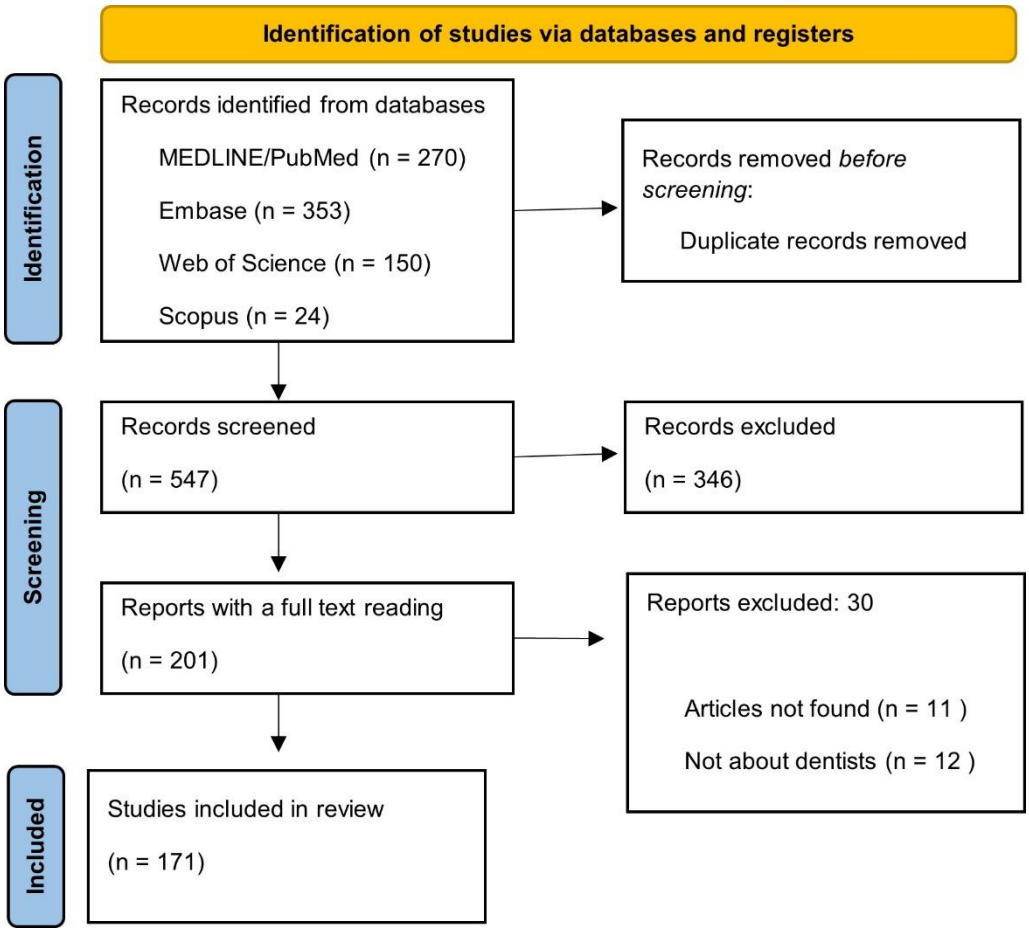


Figure 1. Flowchart of search strategy

Characteristics of included studies

One hundred and two of the included studies reported using 21 established questionnaires, while an additional 69 studies utilized self-made questionnaires. The Nordic Musculoskeletal Questionnaire (NMQ) emerged as the most employed tool, being utilized in 83 studies (41.71%). Following closely, self-made questionnaires were reported in 69 of the included studies (34.67%). Other questionnaires used by the included studies included the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ), Rapid Upper Limbs assessment (RULA), Rapid Entire Body Assessment (REBA),Quick Exposure Check (QEC), Neck Disability Index (NDI), Disability of the Arm, Shoulder, and Hand (DASH), Pain Disability Questionnaire (PDQ), Dutch Musculoskeletal Questionnaire (DMQ), Visual Analogue Scale (VAS), McGill Pain Questionnaire (MPQ), Health Survey (SF-36), Boston Carpal Tunnel Syndrome Questionnaire (BCTQ), Orebro Musculoskeletal Pain Screening Questionnaire (OMPSQ), Chinese Musculoskeletal Questionnaire (CMQ), Health Assessment Questionnaire (HADQ), and

Musculoskeletal Disorder Rating Scale (MDRS), Baseline Risk Identification of Ergonomics Factor (BRIEF), Assessment of Repetitive Tasks (ART), Severity Pain Scale (SPC). The prevalence of each questionnaire is presented in Table 2. It is important to highlight that some studies used more than one questionnaire what caused the number of questionnaires to be greater than the number of articles included.

Table 2. Total number and percentage of questionnaires of included studies.

Questionnaires	**Year**	**Total**	**%**	**Cumulated %**
Nordic Musculoskeletal Questionnaire (NMQ)	1987	83	41.71	41.71
Selfmade Questionnaires	-	69	34.67	76.38
Rapid Upper Limbs assessment (RULA)	1993	7	3.52	79.90
Rapid Entire Body Assessment (REBA)	2000	6	3.02	82.92
Cornell Musculoskeletal Discomfort Questionnaire (CMDQ)	1999	6	3.02	85.94
Quick Exposure Check (QEC)	2008	6	3.02	88.96
Neck Disability Index (NDI)	1991	3	1.51	90.47
Disability of the arm, shoulder and hand (DASH)	1996	3	1.51	91.98
Pain disabilyty questionnaire (PDQ)	2004	2	1.01	99.99
Dutch Musculoskeletal Questionnaire (DMQ)	2001	2	1.01	94.00
Visual Annalogue Scale (VAS)	1921	2	1.00	95.00
McGill Pain Questionnaire (MPQ)	1975	1	0.50	95.50
Health Survey (SF-36)	1992	1	0.50	96.00
Bostom Carpal Tunnel Syndrome Questionnaire (BCTQ)	1993	1	0.50	96.50
Orebro Musculoskeletal Pain Screening Questionnaire (OMPSQ)	2003	1	0.50	97.00
Chinese Musculoskeletal Questionnaire (CMQ)	2011	1	0.50	97.50
Health Assessment Questionnaire (HADQ)	-	1	0.50	98.00
Musculosketal Disorder Rating Scale (MDRS)	-	1	0.50	98.50
Baseline Risk Identification of Ergonomics Factor (BRIEF)	-	1	0.50	99.00
Assessment of Repetitive Tasks (ART)	-	1	0.50	99.50
Severity Pain Scale (SPC)	1999	1	0.50	100
Total		**199**	**100**	

Of the 69 self-made questionnaires, a sub-analysis was conducted to determine how many of them were appropriately validated to measure WMSD. The results revealed that 54 of the self-made questionnaires did not mention validation or cross-cultural adaptation for a specific population, accounting for 78.3% of the questionnaires. In

contrast, a total of 15 questionnaires (21.7%) mentioned validation without providing detailed information about the validation process.

Details about the included instruments

Differences can be observed among the included instruments. The number of items in the questionnaires ranged from 3 to 54. Some instruments included dimensions or subsets for the evaluation of specific items, while others did not categorize them in this way. Additionally, some instruments covered a broad range of areas for evaluation, while others focused on specific areas. Most of the included questionnaires utilized Likert scales for responses, while others employed dichotomous answers (Yes or No), and some used image illustrations to assign scores. Two questionnaires, SPC and VAS, were used for pain evaluation, with responses ranging from 0-10 or 0-100 after participants provided subjective answers. Further details about each questionnaire used in the included studies are provided in Table 3.

Table 3. Details about the questionnaires used by included studies.

Item	References	Number of items	Subsets/ Dimensions	Evaluated areas	Answers	Main considerations
NMQ	(Kuorinka et al., 1987)	36	-	Neck, Shoulders, Upper back, Elbows, Wrists/Hands, Lower back, Hips/Thighs, Knees, Ankles/Feet	Dichotomic (Yes or No)	Evaluate the impact on the routine activities during the last 12 months
CMDQ	(Hedge et al., 1999)	54	-	Neck, Shoulders, Upper Back, Upper Arm, Lower Back, Fore arm, Wrists, Hips, Thigs, Knee	Likert 1-5 for frequency of discomfort Likert 1-3 for intensity discomfort Likert 1-3 for interference on ability to work	Evaluate the impact on the routine activities during the last 7 days Has a version only focused on hand and wrists
NDI	(Vernon & Mior, 1991)	10	-	Pain intensity, Personal care, Lifting, Reading, Headaches, Concentration, Work, Driving, Sleeping and Recreation.	Likert 1 - 6	Widely used assessment tool to measure disability due to acute and chronic neck pain or neck injury.
DASH	(Hudak et al., 1996)	30	Difficulty on routine activities; Symptoms of musculoskeletal illness; Confidence and Pain intensity	-	Likert 1 - 5	Evaluate specific activities requiring the arm, shoulder or hand and symptoms of musculoskeletal disorders also has a short version with 11 items
PDQ	(Anagnostis et al., 2004)	15	Functional Condition; Psychosocial aspects	Work, Personal care, Mobility, Ability to stay sitting or still, Lifting Objects, Walking or running, Self medicate, medical consultations, Social life, Leisure, Help in performing tasks and Emotional state[3]	Likert 1 - 10	Evaluates the effect of pain on everyday life
DMQ	(Hildebrandt et al., 2001)	55	Forced applied, Dynamic loads, Static loads, Repetitive loads,	-	Dichotomic (Yes or No)	It is used to measure self-report musculoskeletal workload,

			Ergonomic environment, Vibration and Atmosphere conditions[4]			dangerous conditions, and related symptoms.
MPQ	(Melzack, 1975)	25	What Does Your Pain Feel Like? How Does Your Pain Change with Time? How Strong is Your Pain?	-	Does not apply, every item has words that the patience has to choose	It stands out for measure subjective pain experience
SF-36	(Ware & Sherbourne, 1992)	36	Physical, Role limitation due to physical, Health, Bodily pain, General health perception, Vitality, Social functioning, Role limitation due to emotional, Problems, Perceived mental health[6]	-	Likert 1 – 5: sessions 1, 2, 6, 8, 10 and 11 Likert 1 – 3: Session 3 Dichotomic (Yes or No) sessions 4 and 5 Likert 1 – 6: Sessions 7 and 9	Is a quality of life questionnaire that measures physical and mental health
BCTQ	(Levine et al., 1993)	19	Symptom severity and Functional Status	-	Likert 1 - 5	Evaluate the Carpal Tunnel Syndrome measuring the paresthesia and pain in the hands and wrists
OMPSQ	(Linton & Boersma, 2003)	25	Pain; Coping Strategy; Distress; Work return expectancy; Fear-avoidance beliefs; Function	-	Likert 1 - 10	Evaluates the risk of developing work disability due the persistent pains
CMQ	(Wu et al., 2011)	34[9]	Individual demographic information; work-related factors; musculoskeletal symptoms	Neck; shoulders; upper back; lower back; elbows; wrists/hands; hips/thighs; knees; and ankles/feet		Based on NMQ
HADQ		10	-	-	Likert 1 - 4	it is questioned on the last 30 days the duration of the musculoskeletal pains, the absenteeism, the presenteeism and how many years exerting the profession the responder has.
MDRS			Demographic parameters; pain; stiffness and grip force.	-	-	-
REBA	(Hignett & McAtamney, 2000)	6	-	Trunk; Legs; Neck; Upper arms; Lower arms; Wrists	With images to illustrate the positions and angles made by the trunk; legs; neck; upper	Was made to be Sensitive to the type of unpredictable working postures

					arms; lower arms; rists, every position and angle has a score	found in health care and other service industries.
RULA	(McAtamney & Nigel Corlett, 1993)	3	-	Arms; Forearms and Wrists	With images to illustrate the positions and angles made by the arm, forearm and wrists, every position and angle has a score	Is a survey method developed for use in ergonomics investigations of workplaces where work-related upper limb disorders are reported.
QEC	(David et al., 2008)	16	Observer assessment and Worker Assessment	Back; Shoulder/arm; Wrist/Hand; Neck	The answer for each item is given by a matrix correlating the observer with worker answers	Brings together the practitioner and the worker to make the assessment, thereby encouraging participative ergonomics.
ART		12	Frequency and repetition; Force; Awkward postures; Additional factors	Head/Neck; Back; Arms; Wrists; Hand/Fingers	Every answer has a different score to be add to the final result	The tool is designed to helps to assess tasks that require repetitive moving of the upper limbs. It helps you to assess some of the common risk factors in repetitive work that contribute to the development of upper limb disorders
SPC	(McCaffery & Pasero, 1999)	NA	-	-	Likert 1-10	Is a numeric pain rating scale from 0 (no pain) to 10 (worst pain possible)
VAS	(Hayes & Patterson, 1921)	NA	-	-	-	Traditionally it consists of a line anchored by two statements representing the extreme ends

Questionnaires and continents

A specific analysis was conducted to examine the influence of each questionnaire in relation to the continent of the authors of published studies. Asia had the highest number of articles published, followed by Europe, America, Africa, and Oceania. The NMQ instrument was predominantly used across most continents, except in Europe where the number of self-made questionnaires exceeded the use of NMQ. Further details about the frequency of questionnaire usage and their association with continents are presented in Table 4. Additionally, a figure illustrating the distribution of continents is available in Figure 2.

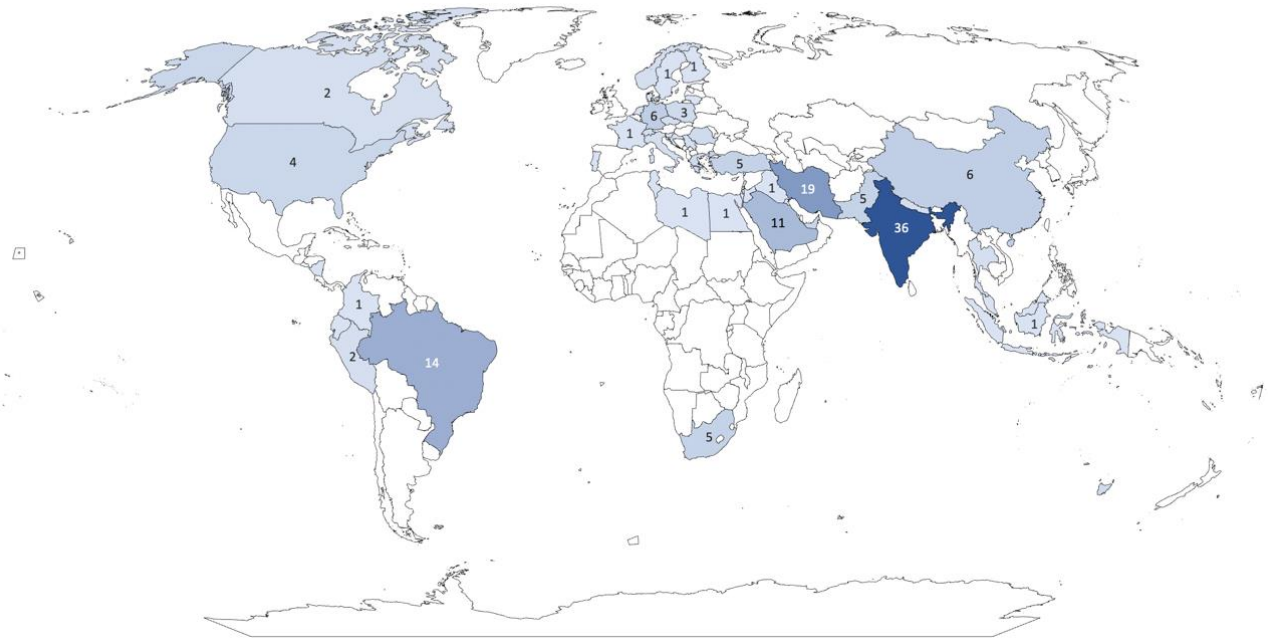


Figure 2. Incidence of included studies according to continent.

Table 4. The American Continent and the questionnaires found.

America	**Total**	**%**	**Cumulated Total**	**Cumulated %**
Nordic Musculoskeletal Questionnaire (NMQ)	12	46.15	12	46.15
Selfmade Questionnaires (SMQ)	10	38.46	22	84.61
Pain disabilyty questionnaire (PDQ)	2	7.69	24	92.30
Musculosketal Disorder Rating Scale (MDRS)	1	3.85	25	96.15
Disability of the arm, shoulder and hand (DASH)	1	3.85	26	100
Total			**26**	**100**
Europe	**Total**	**%**	**Cumulated Total**	**Cumulated %**

Nordic Musculoskeletal Questionnaire (NMQ)	13	36.10	13	36.10
Selfmade Questionnaires (SMQ)	17	47.22	30	83.32
Cornell Musculoskeletal Discomfort Questionnaire (CMDQ)	2	5.56	32	88.88
Disability of the arm, shoulder and hand (DASH)	2	5.56	34	94.44
Musculosketal Disorder Rating Scale (MDRS)	1	2.78	35	97.22
Rapid Upper Limbs assessment (RULA)	1	2.78	36	100
Total			**36**	**100**
Asia	**Total**	**%**	**Cumulated Total**	**Cumulated %**
Nordic Musculoskeletal Questionnaire (NMQ)	52	42.62	52	42.62
Selfmade Questionnaires (SMQ)	36	29.51	88	72.13
Rapid Upper Limbs assessment (RULA)	6	4.92	94	77.05
Rapid Entire Body Assessment (REBA)	6	4.92	100	81.97
Quick Espossure Check (QEC)	6	4.92	106	88.89
Cornell Musculoskeletal Discomfort Questionnaire (CMDQ)	4	3.28	110	90.17
Neck Disability Index (NDI)	3	2.46	113	92.63
Visual Annalogue Scale (VAS)	2	1.64	115	94.27
McGill Pain Questionnaire (MPQ)	1	0.82	116	95.09
Health Survey (SF-36)	1	0.82	117	95.91
Bostom Carpal Tunnel Syndrome Questionnaire (BCTQ)	1	0.82	118	96.73
Chinese Musculoskeletal Questionnaire (CMQ)	1	0.82	119	97.55
Baseline Risk Identification of Ergonomics Factor (BRIEF)	1	0.82	120	98.37
Assessment of Repetitive Tasks (ART)	1	0.82	121	99.19
Severity Pain Scale (SPC)	1	0.81	122	100
Total			**122**	**100**
Africa	**Total**	**%**	**Cumulated Total**	**Cumulated %**
Nordic Musculoskeletal Questionnaire (NMQ)	4	36.36	4	36.36
Selfmade Questionnaires (SMQ)	4	36.36	8	72.72
Dutch Musculoskeletal Questionnaire (DMQ)	2	18.19	10	90,91
Orebro Musculoskeletal Pain Screening Questionnaire (OMPSQ)	1	9.09	11	100
Total			**11**	**100**
Ocenia	**Total**	**%**	**Cumulated Total**	**Cumulated %**
The Nordic Musculoskeletal Questionnaire	2	50	2	50
Self Made Questionnaires	2	50	4	100
Total			**4**	**100**

DISCUSSION

This review identified a total of 198 available instruments, along with self-made tools reported by studies, used to assess data regarding WMSD. To our knowledge, this is the first scoping review to evaluate the instruments available for WMSD assessment. Tools for assessing these injuries are crucial, as musculoskeletal disorders are considered the second most common work-related illness according to the National Institute for Occupational Safety and Health (NIOSH) (Bernard & Putz-Anderson, 1997). These disorders often incapacitate professionals from performing their duties due to pain, discomfort, or limited mobility. Previous studies have shown a high prevalence rate of WMSD among healthcare professionals (Jacquier-Bret & Gorce, 2023, Suganthirababu et al., 2023). Among various healthcare professionals, a recent systematic review reported an approximate WMSD rate of 78.4% (95% CI = 74.8–82) among dentists (Chenna et al., 2022), attributed to the prolonged postures maintained during their work (ZakerJafari & YektaKooshali, 2018).

Among the various types of questionnaires used, significant differences can be observed. The Nordic Musculoskeletal Questionnaire (NMQ) was the most frequently reported instrument among the included studies, even more so than the self-made questionnaires. This can be attributed to the NMQ's establishment in 1987 and its widespread use in the literature for assessing work-related musculoskeletal disorders (WRMSDs) (Kuorinka et al., 1987). Although it is the most common, there is no specific consensus regarding the use of the NMQ to assess the prevalence of WMSD; instead, it reports the prevalence of symptoms related to WMSD (Tajvar et al., 2019). However, the literature shows that this instrument has been translated, adapted, and validated in several languages (Pinheiro et al., 2002, Antonopoulou et al., 2004, Gobba et al., 2008), and it presents variations in its composition through expanded versions (Pugh et al., 2015, Ates & Yakut, 2023, Mohan et al., 2015, Mokhtarinia et al., 2024).

It is common for questionnaires to undergo translation and cross-cultural and linguistic adaptations, and validation by experts is considered one of the most crucial steps in the instrument construction process (Coluci et al., 2015, Alexandre & Coluci, 2011). A common misconception among researchers is that an instrument published in one language, such as English, can be translated into another language without undergoing a process of translation and cross-cultural adaptation. However, this is necessary because cultural differences exist among populations in different countries (Lai, 2013).

However, despite the importance and necessity of this process, it is often overlooked by researchers. This was evident in this scoping review, where the second highest rate of reported questionnaires consisted of self-made ones. While using self-made questionnaires is feasible, it is crucial that such instruments undergo validation to ensure their appropriateness for use. However, of the 69 self-made questionnaires identified, approximately 78.3% did not report any validation process. Moreover, among those that did report validation, the details of these processes were not provided, which can be considered methodologically incorrect. An appropriate validation process should include steps such as face and content validity, semantic analysis, exploratory and confirmatory factor analysis, and reliability and internal consistency (Lai, 2013).

Other important questionnaires were utilized with much lower frequency, often over 10 times less than the previously mentioned instruments. This mapping effort is crucial as it highlights the presence of alternative instruments that may sometimes be more suitable depending on the evaluation criteria. For instance, the CMDQ assesses similar areas to the NMQ but features a larger number of items and utilizes Likert scale responses ranging from 1-3 or 1-5. It evaluates the impact of routine activities over the past week, whereas the NMQ employs dichotomous questions (yes or no) to assess activity impact over the previous twelve months. In essence, these instruments share similarities but also possess crucial differences that researchers must consider based on their specific evaluation objectives. This is significant because some studies have demonstrated the utility of combining instruments for this type of assessment, such as NMQ + RULA or NMQ + REBA. Employing two instruments with distinct characteristics can enhance interpretation and differentiation of factors related to WMSD.

In terms of the prevalence of questionnaires used to assess WMSD, a notably higher number of publications originate from the Asian continent (48.74%). This results is corroborated by a previous umbrella review that included sixteen narrative reviews and indicated a high prevalence of studies conducted in Asian countries (55%) (De Sio et al., 2018). This trend may be linked to the elevated rates of healthcare professionals experiencing WMSD in Asian countries. A previous study noted that musculoskeletal disorder rates, not limited to work-related ones, tend to be lower in regions with higher levels of socioeconomic development compared to those with lower levels (Liu et al., 2022). This observation could explain the higher prevalence of studies in the Asian continent compared to the American and European continents. Interestingly, despite a large portion of African countries having low levels of socioeconomic development, the

continent also exhibited a low prevalence of studies examining WMSD incidence. Therefore, it cannot be stated that the incidence is directly related to the level of socioeconomic development.

This study presents several limitations that warrant consideration. Firstly, there is considerable variability among the included studies, which can complicate efforts to standardize and interpret the reported data. Secondly, methodological factors, such as the lack of duplicate data extraction and quality assessment of the included studies, may pose limitations. However, it is important to note that such steps are often considered optional for scoping reviews. Unlike systematic reviews, the primary aim of scoping reviews is not to provide specific practical recommendations but rather to comprehensively assess the breadth and nature of available research, clarify key concepts, identify gaps and areas for future research, and systematically disseminate findings from a diverse and heterogeneous body of evidence (Tricco et al., 2018, Munn et al., 2018).

CONCLUSION

Within the limitations of the present study, we conclude can be drawn:

1) There is a wide variety of questionnaires in the literature considered for the assessment of WMSDs in different regions.

2) The NMQ questionnaire is the most used for WMSD assessment.

3) There is a high prevalence of the use of self-made questionnaires, but all these lack consideration of validation parameters.

4) The Asian continent showed the highest prevalence of studies that used questionnaires for WMSD assessment.

5) The combination of two instruments with different characteristics can be considered a favorable alternative for better understanding of WMSDs.

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2.1 ARTIGO CIENTÍFICO 2

Prevalence of work-related musculoskeletal disorders among graduated dentists: A systematic review and meta-analysis.

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ABSTRACT

The dentist profession, are exposed to some occupational hazards such as staying prolonged periods in static positions, repetitive movements, and awkward postures like extreme forward-head and neck flexion, trunk inclination and rotation towards one side which causes emergence of musculoskeletal disorders. These disorders may cause a sort of problems like pain, compromising their health and ability to work and and in more severe cases this disordes can lead to burnout and cause the partial or total interruption of dental practice. Therefore, this systematic review aimed to asses the prevalence of Work Related Musculoskeletal Disorders (WRMD) among dentists worldwide considering the specific affected areas. This systematic review followed PRISMA 2020 items and was registered in the international database PROSPERO (registration number 474466). The searches found a total of 2015 articles, and 49 articles were selected for analysis. Of these, 38 cross-sectional were included. A random effect model revealed a cumulative proportion of 83% of WMSD (CI: 77% to 87%) Substantial heterogeneity was observed (I^2=96%; P < 0.01). When calculate the WMSD on specific sites the results showed that the neck region (58%), shoulders (44%), and lower back (50%) exhibited a higher incidence of WMSD compared to other areas. There were not significant difference in the prevalence of WMSD observed across different continents.

Keywords: Musculoskeletal Disorders, Dentists, Prevalence, Sistematic Review

INTRODUCTION

According to the World Health Organization (WHO), musculoskeletal conditions are commonly characterized by symptoms such as persistent pain, difficulty in mobility, and dexterity, significantly reducing the ability to work and participate in society. These disorders can affect multiple components of the body, including muscles, bones, and joints, and may manifest in various areas of the body ((WHO), 2022).

Musculoskeletal disorders represent a global issue, with a recent analysis from the Global Burden of Disease (GBD) 2019 estimating that approximately 1.7 billion people worldwide are living with some form of musculoskeletal condition (Cieza et al., 2021). A systematic review evaluated the healthcare professions with a higher prevalence of work-related musculoskeletal disorders (WMSD). The authors included six professions (physiotherapist, surgeon, dentist, nurse, midwife, osteopath), and indicated that surgeons

and dentists are more affected in specific areas such as shoulders, upper extremities, and lower back due to labor activity (Jacquier-Bret & Gorce, 2023).

Specifically, the impacts on the dental profession can be particularly severe due to the nature of the work and the conditions to which dentists are exposed, including prolonged periods in static positions, repetitive movements, and awkward postures (Bedi et al., 2015), such as extreme forward-head and neck flexion, trunk inclination and rotation towards one side, lifting one or both shoulders, increased curvature of the thoracic vertebral column, and incorrect positioning of the lower limbs with a high-leg angle of less than 90º (De Sio et al., 2018).

WMSD are the leading cause of illness among dental professionals, compromising their health and ability to work (Isper Garbin et al., 2017). In more severe cases, WMSD can potentially lead to burnout and partial or total interruption of dental practice (Bedi et al., 2015, Scepanovic et al., 2019, Mulimani et al., 2018). It is essential to evaluate the incidence of WMSD in dental professionals to identify impacted areas and other factors aiming at preventive therapies (De Sio et al., 2018).

Recent studies found that the prevalence of WMSD among dental professionals is around 78% (Chenna (Chenna et al., 2022); Lietz). However, these studies included dental students and dental hygienists, not focusing solely on dentists, which could affect the results because the years of profession should be considered an important factor that affects WMSDs. Therefore, a new systematic review to calculate the prevalence of WMSD among dentists considering the specific affected areas and countries is necessary.

MATERIAL AND METHODS

Registration and Protocol

This study adhered to the guidelines outlined in the Cochrane Handbook of Systematic Reviews of Interventions and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement 2020 for reporting. The protocol for this systematic review was registered in the International Prospective Register of Systematic Reviews under the registration number 474466.

Eligibility criteria

The primary question addressed in this review was the prevalence WMSD in dentists. Participants encompassed dental professionals with completed degrees, irrespective of training duration, while WMSD prevalence was the primary outcome of

interest. Inclusion criteria were as follows: studies reporting the prevalence of WMSD in graduated dentists, regardless of specialty, experience, location, or publication period. Exclusion criteria included literature reviews, studies involving dental students or hygienists, and other professions. Articles evaluating only WMSD symptoms were also not included. In cases where articles were unavailable, efforts were made to obtain them via email or ResearchGate.

Information sources and Search Strategy

Electronic searches were conducted by two independent researchers (L.P.G. and T.C.P.) across several databases, including MEDLINE/PubMed, Embase, Scopus, and Web of Science, for articles published up to September 2023. Additionally, a search of grey literature was performed using the ProQuest database to identify unpublished or non-peer-reviewed reports. Detailed search strategies for each database are provided in the Supplementary Table (Appendix A).

After initial selection, studies were imported into the Rayyan QCRI Reference Manager to remove duplicates and screen titles and abstracts according to pre-established inclusion criteria. Any discrepancies were resolved by a third reviewer (C.A.A.L.), aiming to achieve consensus. Furthermore, additional searches were conducted in the reference lists of included articles to identify potential eligible studies.

Data Extraction

Selected articles meeting the inclusion criteria were tabulated by one author (L.P.G.) using Microsoft Word and a standardized data extraction form. A second author (T.P.C.) cross-checked the tabulated data. Extracted data included author/year of publication, study design, patient demographics, continent/country, specialty, work experience, instrument/questionnaire used, and prevalence.

Risk of Bias

Risk of bias assessment was conducted using the Quality In Prognosis Studies (QUIPS) tool, addressing domains such as study participation, attrition, prognostic factor measurement, outcome measurement, confounding, and statistical analysis/reporting. Each domain was categorized as low, high, or of some concern, and an overall bias rating was assigned to each study. Certainty of evidence was not used for studies lacking comparative groups.

Meta-analysis

Single-arm meta-analysis was performed using an R statistical program (R version 4.0.2; The R Foundation for Statistical Computing http://www.r-projetct.org/). The "meta" and "metafor" packages were used to perform statistical calculations and generate forest graphs. A single-arm meta-analysis was performed to evaluate the cumulative proportion and 95% confidence interval (CI) of WMSD prevalence in dentists. A subgroup analysis was performed considering the affected region: neck, shoulders, upper back, elbows/forearms, mild back, lower back, wrists/hands/fingers, hips/thighs, knees, legs, ankles/feet. Furthermore, a sub analysis was performed considering the continent of the participants evaluated by the included studies.

RESULTS

Search Strategy

A total of 2015 articles were identified through the database search and imported into Rayaan. After removing duplicates, 1933 articles were evaluated. During the first phase, reviewers independently assessed the titles and abstracts against the eligibility criteria. Following the review of titles and abstracts, 49 articles were selected for full-text reading. Among these, 11 articles were excluded for the following reasons: unavailability through electronic means, inclusion of dental studies or dental auxiliaries/hygienists instead of dentists, duplication, and not evaluated prevalence. Therefore, 38 articles(Jaoude et al., 2017, Sakzewski & Naser-ud-Din, 2015, Younis et al., 2022, Kierklo et al., 2011, Faisal & Mathias, 2014, Souza et al., 2017, Rafeemanesh et al., 2013, Prudhvi & Murthy, 2016, Botha et al., 2014, Alnaser et al., 2021, Batham & Yasobant, 2016, Feng et al., 2014, Meisha et al., 2019, Dias et al., 2014, Newell & Kumar, 2004, Sustova et al., 2013, Hameed et al., 2016, Moodley & Naidoo, 2015, Chamani et al., 2012, Hedge et al., 1999, Gangaraju et al., 2021, Joshi et al., 2019, Rickert et al., 2021, Thacker et al., 2023, Phedy & Gatam, 2016, Gupta et al., 2015, Leggat & Smith, 2006, Isper Garbin et al., 2017, Saliba et al., 2016, Revankar et al., 2017, Freire et al., 2018, Zoidak et al., 2013, Muralidharan et al., 2013, Bedi et al., 2015, Hosseini et al., 2019, Akpinar & Mandđracđoğlu, 2022, Gandham et al., 2019, Pegah et al., 2023) were included for data qualitative and quantitative synthesis (Figure 1). Detailed information regarding the excluded studies, along with reasons for exclusion, can be found in Supplemental File 2.

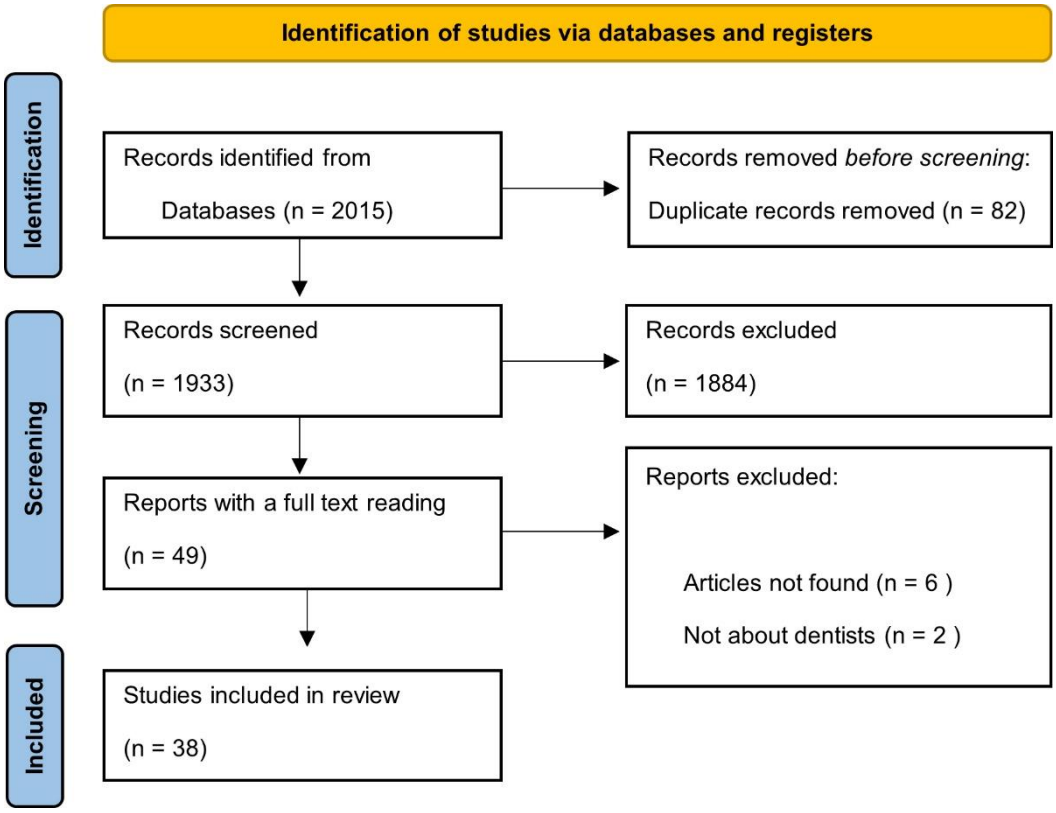


Figure 1. Flowchart of search strategy

Characteristics of included studies

The 38 included studies ranged from 2006 to 2023. Most of the included studies were cross-sectional design. The number of participants in the studies ranged from 32 to 877 with a mean age ranging from 27.73 to 50.4 years. A higher incidence of Asia countries was included when compared to other continents. A few numbers of studies reported data about work experience in years (Alnaser et al., 2021, Batham & Yasobant, 2016, Faisal & Mathias, 2014, Isper Garbin et al., 2017, Jaoude et al., 2017, Phedy & Gatam, 2016, Rafeemanesh et al., 2013, Pegah et al., 2023, Rickert et al., 2021, Souza et al., 2017, Zoidak et al., 2013). Different questionnaires were used in the included studies. Details about the included studies are presented in Table 1, while excluded studies are presented in Supplemental File 2.

Table 1. Characteristics of included studies

Authors	Year	Study type	Participantes Male/Female, n	Mean age, years	Continent/ Country	Work Experience, years	Instrument/ Questionnaire	Prevalence
Akpinar and Mandiracioglu	2022	Cross-sectional	190 128/62	43.81 ± 9.08	Turkey/Asia	-	NMQ QEC	175 (92.11%)
Alnaser, Almaqsied and Alshatti	2020	Cross-sectiona	186 106/78	34.3±9.9	Kuwait/ Asia	9.7±9.5	Selfmade questionnaire	89 (47.85%)
Batham and Yasobant	2016	Cross-sectional	93 34.5/58.5	27.73 ± 3.15	India/Asia	5.54 ± 2.97	QEC REBA NMQ	86 (92.47%)
Bedi et al.	2015	Cross-sectional	60 38/22	42.4	India/Asia	-	NMQ	41 (63.33%)
Botha et al.	2014	Cross-sectiona	338 232/116	45 ± 13	South Africa/ Africa		NMQ	
Chamani et al.	2012	Cross-sectional	110 80/30	38.2 ± 7.5	Iran/Asia	-	NMQ	-
DIAS, SILVA and GALVÃO	2014	Cross-sectional	100 40/60		Brazil/ America		DASH	48 (48%)
Faisal and Mathias.	2014	Cross-sectiona	306 177/129		Saudi Arabia/Asia	27.7 ± 5.2	postural discomfort chart	

							NMQ	
Feng et al.	2014	Cross-sectiona	272 151/121		China/Asia		NMQ	239 (87.87%)
Freire et al.	2017	Cross-sectional	96 35/61	30.68 ± 6:16	Brazil/ America		NMQ Pain Disability Questionnaire (PDQ)	87 (90.62%)
Gandham et al.	2019	Cross-sectional	150 94/56	29.06 ± 3.37	India/Asia	-	NMQ	88 (56.67%)
Gangaraju et al.	2021	Cross-sectional	106 59/47	-	India/Asia	-	NMQ	81 (76.42%)
GARBIN et al	2017	Cross-sectional	204 75/129	43 ± 9.5	Brazil/ America	21 ± 9.48	NMQ Questionnaire of risk factors at work PDQ	166 (81.37%)
Gupta et al.	2015	Cross-sectional	877 664/213		India/Asia		NMQ	623 (71.04%)
Hameed et al.	2016	Cross-sectional	182 80/102	-	Pakistan/ Asia	-	NMQ	138 (75.82%)
Hegde, Donly and Shankar	2018		200 118/82	-	India/Asia	-	Selfmade questionnaire	194 (97%)

Hosseini et al.	2019	Cross-sectional	136 60/76	35.6 ± 8.7	Iran/Asia	-	NMQ ART	125 (91.91%)
Jaoude el al.	2017		314 184/130	39.2 ± 11.66	Liban/Asia	15.50 ± 11.18	Selfmade questionnaire	-
Joshi et al.	2019	Cross-sectional	500 215/285	28.4	India/Asia	-	Selfmade questionnaire	339 (67.8%)
Kierklo et al.	2011		220		Poland/ Europe		Selfmade questionnaire	202 (91.82%)
Leggat and Smith.	2006		285 209/76		Australia/ Oceania		Selfmade questionnaire	249 (87.37%)
Meisha et al.	2019	Cross-sectiona	234 127/107		Saudi Arabia/ Asia		Diaz-Caballero et al's questionnaire	164 (70.09%)
Moodley and Naidoo	2015	Cross-sectional	109 79/30		South Africa/ Africa		Selfmade questionnaire	108 (99.08%)
Muralidharan, Fareed and Shanthi	2012	Cross-sectional	73 50/23	-	India/Asia	-	NMQ	57 (78.08%)
Newell and Kumar	2003	Cross-sectional	32 23/9		Canada/ America		NMQ	19 (59.38%)
Phedy and Gatam	2016	Cross-sectional	241 35/206		Indonésia/ Asia	2.9 ± 1.6	NMQ	153 (63.49%)

Prudhvi and Murthy	2016	Cross-sectional	100 70/30	34.1 ± 7	India/Asia		NMQ	
RAFEEMANESH et al.	2013	Cross-sectiona	58 49/9	43.2 ± 3.2	Iran/Asia	17.6 ± 4.8	NMQ REBA	51 (87.93%)
Pegah et al.	2023	Descriti-ve	132 64/88	30.41 ± 6.22	Iran/Asia	5.34 ± 5.28	NMQ RULA	152 (100%)
Revankar et al.	2017	Cross-sectional	150 81.5/68.5	-	India/Asia	-	Selfmade questionnaire	121 (81%)
Rickert et al.	2021		229	50.4 ± 12.5	Germany/ Europe	19.9 ± 11.6	NMQ Disability of the Arm, Shoulder and Hand (DASH)	212 (92.58%)
Sakzewski and Naser-ud-Din	2015	Cross-sectiona	216 149/67		Australia/Oceania		NMQ	192 (88.89%)
Sakzewski and Naser-ud-Din	2015	Cross-sectiona	250 210/40		Australia/Oceania		NMQ	209 (83.6%)
Saliba et al.	2016		64 38/26		Brazil/ America		NMQ World Health Organization Quality of Life questionnaire	

Souza et al.	2017		37 29/8	45.67 ± 10.89	Brazil/ America	25.51 ± 10.48	NMQ	36 (97.30%)
Sustová, Hodacová and Kapitán	2013		581 163/418	46.5	Czech Republic/ Europe		Selfmade questionnaire	-
Thacker et al.	2023	Cross-sectional	120 77/43	30.7 ± 7.6	India/Asia		NMQ REBA QEC	91 (75.83%)
Younis et al.	2022	Cross-sectiona	600 312/288	35.3 ± 10.2	Pakistan/ Asia	-	Selfmade questionnaire	522 (87%)
Zoidak et al.	2012	Cross-sectional	80 39/41	49.1 (9.74) male 49.3 (9.1) female	Greece/ Europe	22.24	JCQ Need for Recovey scale NMQ	-

NR: Not reported; NMQ: Nordic Muscuskeletal Questionnaire;

Meta-analysis

A total of 30 studies were pooled in single-arm meta-analysis of overall full body WMSD. A random effect model revealed a cumulative proportion of 83% of WMSD (CI: 77% to 87%). Substantial heterogeneity was observed (I^2=96%; P < 0.01) (Fig. 2).

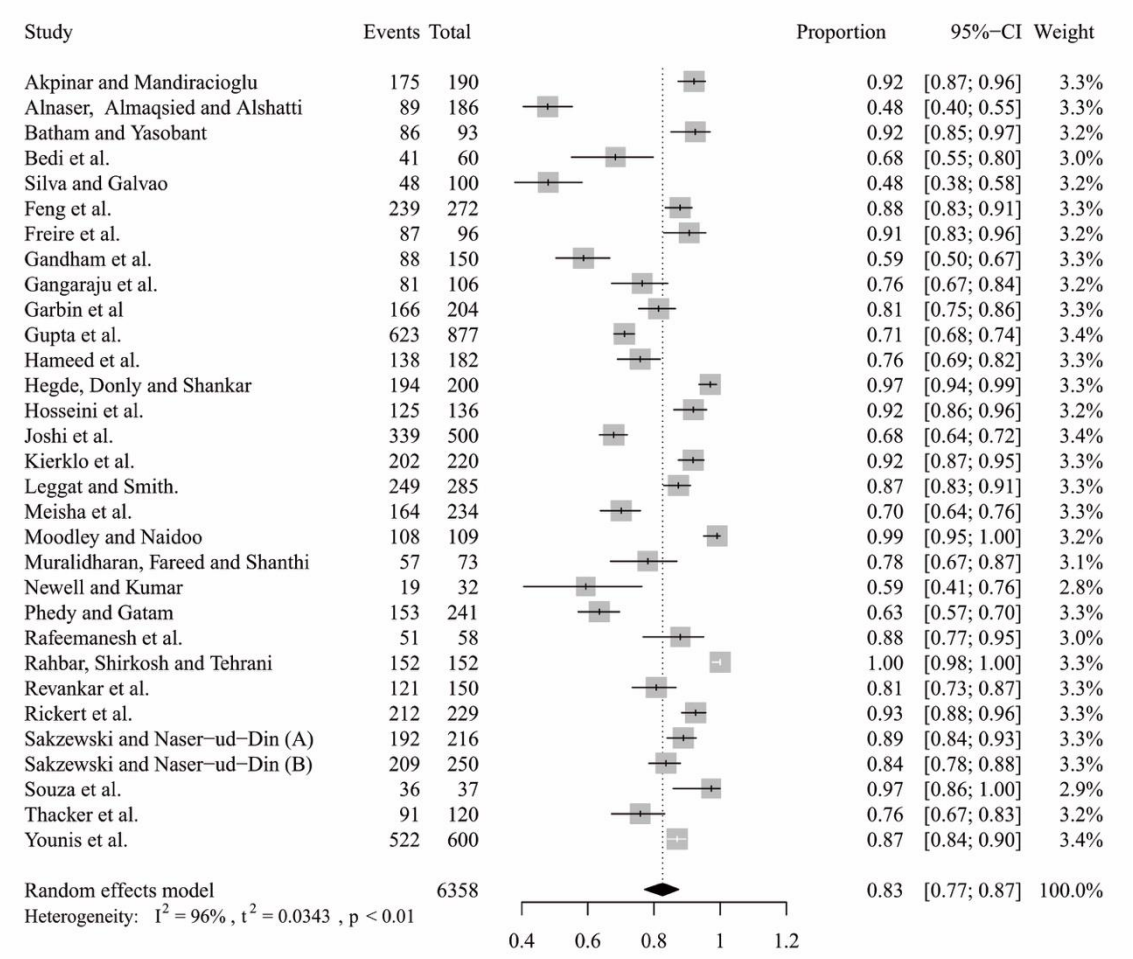


Figure 2. Forest plot of cumulative proportion of WMSD in dentists.

Regarding the sub analysis considering the specifics regions, the prevalence of WMSD should differences according to evaluated area. The neck, shoulders and lower back were the most prevalent area with WMSD, while legs, hip/thighs, and knees were the less prevalent areas, respectively. Substantial heterogeneity was observed for all sub analyses (I^2>92%; P < 0.01) Details about all specifics area presented in Figure 3.

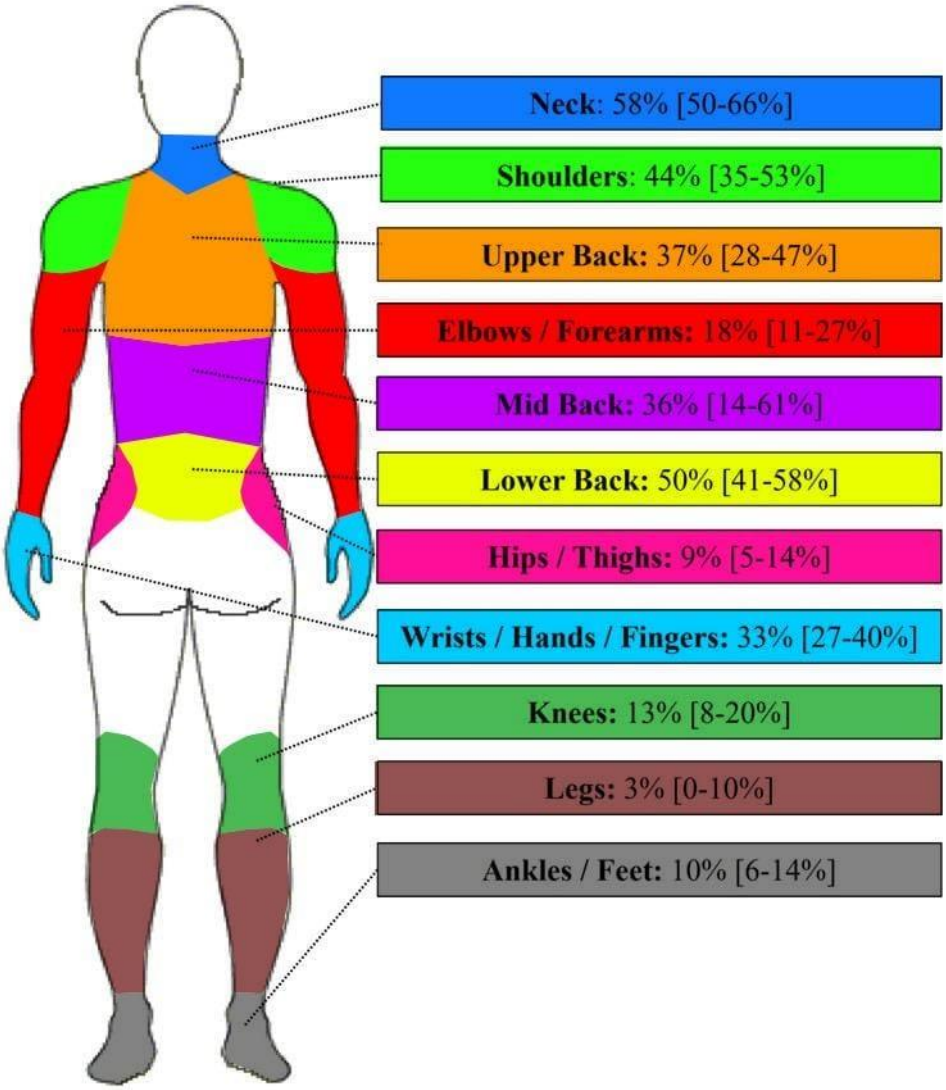


Figure 3. Human body diagram about the prevalence of WRMD on each assessed area.

In specific analysis considering the continent of the participants evaluated in the included studies, it was observed a highest prevalence of the included studies from Asia, followed by America, Oceania, Europe, and Africa. Regarding the cumulative proportion for each continent the Africa showed highest prevalence of WMSD (99%; CI: 96 to 100%), followed by Europe (92%; CI: 90 to 95%), Oceania (87%; CI: 84 to 89%), Asia (81%; CI: 74 to 87%), and America (78%; CI: 57 to 93%). A high heterogeneity was observed for Asia and America continent (I^2=>93%; $P < 0.01$), while Europe and Oceania showed low heterogeneity (Europe: $I^2 = 0\%$; $P = 0.77$; Oceania: $I^2 = 32\%$; $P = 0.23$), but a lower number of studies. The heterogeneity of Africa continent was not calculated due to only one study was included in sub analysis (Figure 4).

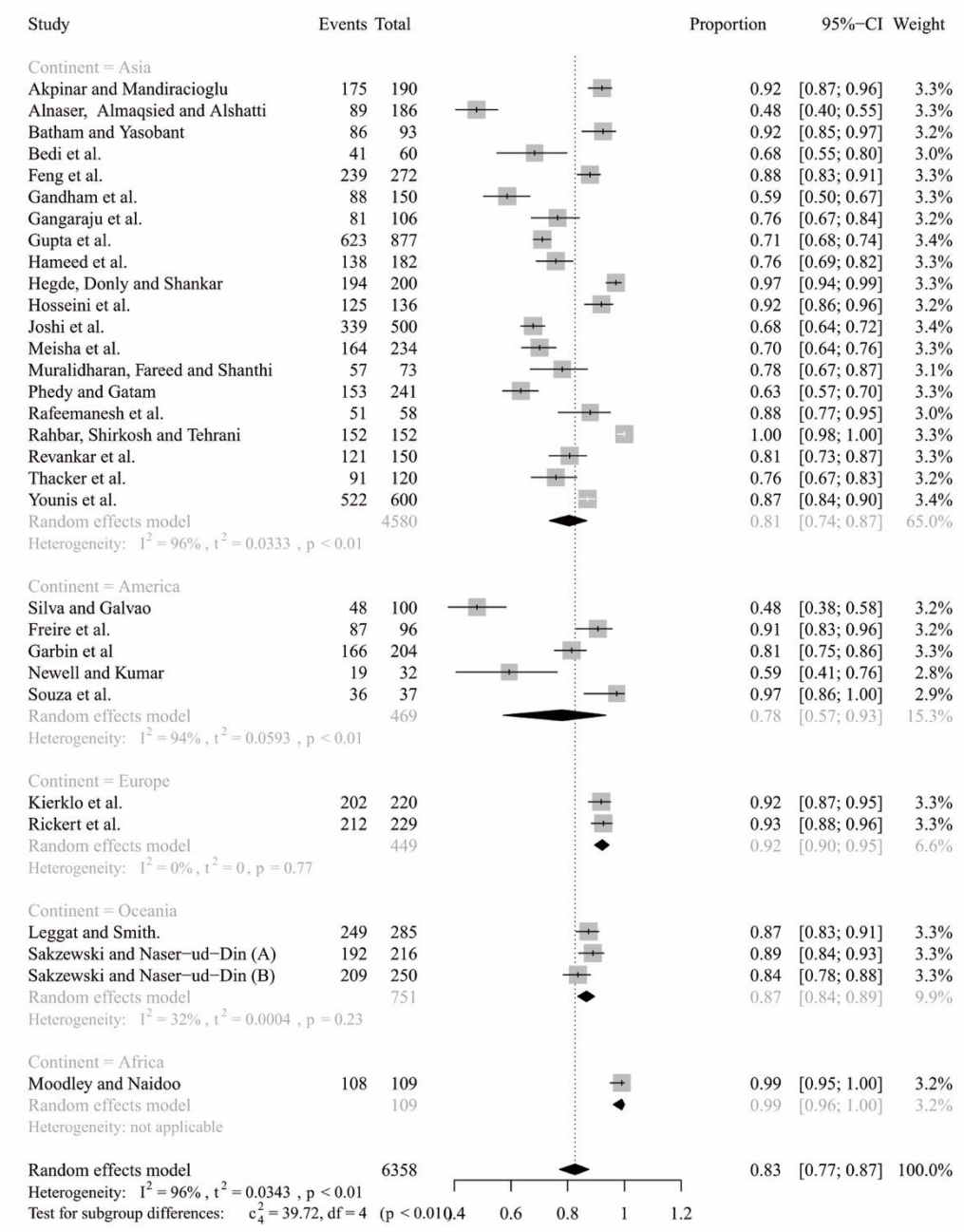


Figure 4. Forest plot of subgroup analysis considering the continent.

Risk of bias

Sixteen studies showed a high risk of bias, most related to the study participation, attrition, and confounding. Thirteen studies showed some concerns regarding the study participation, outcome measurement, study confounding and statistical analysis and reporting. Only nine studies were classified as low risk of bias (Figure 5).

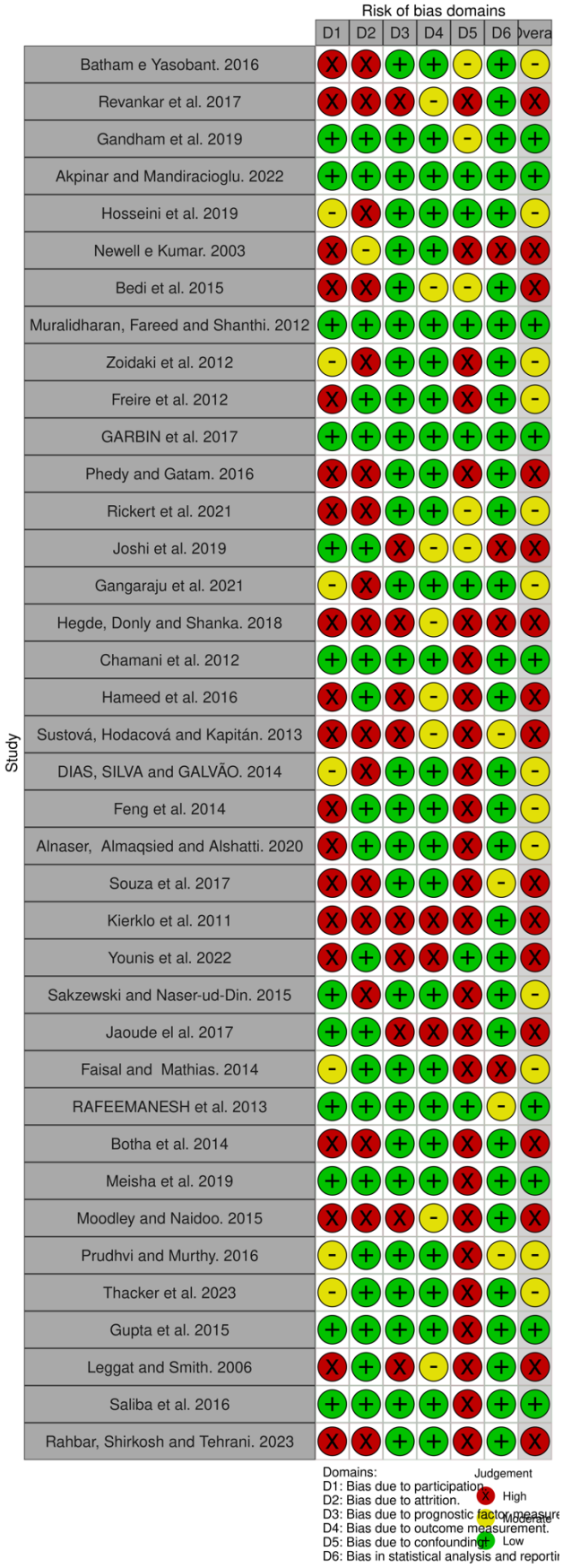


Figure 5. Risk of bias of individual studies through QUIPS tool.

DISCUSSION

The present systematic review revealed a high prevalence of work-related musculoskeletal disorders (WMSD) among dentists, estimated at 83%. These findings closely align with previous studies reporting prevalence rates ranging from 78% to 83% (Lietz et al., 2018, Chenna et al., 2022), underscoring the consistent burden of WMSD in this professional group. Such high prevalence rates are concerning, given the substantial impact of WMSD on health and its potential to disable or impede professionals' long-term ability to work effectively (Gupta, 2011). Furthermore, this situation has direct economic implications, as there exists a robust association between WMSD, pain, and the number of missed workdays (Alnaser et al., 2021).

Indeed, prevention remains is one of the main tools to avoid this type of disorder (Comper & Padula, 2014). Central to this preventive approach is the integration of comprehensive education on ergonomics principles into dental curriculum, particularly during the pre-clinical or early years of clinical training (Alyahya et al., 2018). Research underscores the role of such education in effectively preventing WMSD among dental practitioners (Talpos-Niculescu et al., 2022).

These findings are significant as they shed light on a prevalent issue within dental education. A substantial proportion of dental students tends to prioritize specific practical knowledge over ergonomics principles, often overlooking the latter's critical importance in clinical practice. This observation was underscored in a study examining the ergonomics knowledge among dental students at an Egyptian university. Among nearly 500 dental students surveyed, only a quarter demonstrated adequate knowledge of ergonomics, while half exhibited only moderate knowledge levels (El-Sallamy et al., 2018).

Despite the necessary precautions taken to mitigate WMSD among dental professionals, the nature of the profession often necessitates additional therapeutic interventions. (Koneru & Tanikonda, 2015) conducted a study involving 220 dentists, utilizing a self-reported questionnaire to assess the prevalence of WMSD. Their findings revealed that dentists who regularly practiced yoga exhibited lower prevalence rates of WMSD compared to those engaged in other physical activities or no physical activity at all. Specifically, the prevalence rates were 10.5%, 21.7%, and 45.6% among dentists with regular yoga practice, other physical activities, and no physical activity, respectively.

This trend was further corroborated by a recent systematic review, which highlighted physical activity as a potential preventive measure for WMSD among dental professionals (Soo et al., 2023). However, it is noteworthy that the focus of this review was primarily on assessing

the prevalence rate of WMSD in dentists. Therefore, future studies that aim to synthesize evidence on various preventive therapies should be considered to provide a more comprehensive understanding and effective assessment of these findings.

Studies have consistently indicated a higher incidence of work-related musculoskeletal disorders (WMSD) among older dental professionals with longer professional experience and those working longer hours during the day (Alnaser et al., 2021). Therefore, this review focused exclusively on established professionals to better understand the prevalence and distribution of WMSD within this demographic. While there was no possibility of conducting a sub-analysis considering the years of professional experience due to the absence of this information in the included studies, a sub-analysis was conducted considering specific affected regions.

Results revealed that the neck region (58%), shoulders (44%), and lower back (50%) exhibited a higher incidence of WMSD compared to other areas, consistent with previous findings (Chenna et al., 2022, Jacquier-Bret & Gorce, 2023, Lietz et al., 2018). These regions are particularly susceptible to WMSD due to the labor-intensive nature of dental work, which often involves prolonged sitting positions, repetitive movements, and prolonged forward head tilting. Such activities can lead to symmetrical muscle imbalances and nerve entrapment, exacerbating discomfort and pain (ZakerJafari & YektaKooshali, 2018).

Moreover, the precision required for interventions in small access areas, such as the mouth, further contributes to strain in these regions. To mitigate discomfort, the use of magnification tools, such as loupes, is recommended as they often promote proper posture and help in avoiding undesirable positions (Soo et al., 2023). This recommendation is supported by a semi-experimental study conducted on 75 dentists, which concluded that the use of magnification loupes significantly reduces the incidence of WMSD in various areas of the body (Aghilinejad et al., 2016).

The lower prevalence rates of WMSD observed for the lower limbs (legs) (3%), ankles/feet (10%), and knees (13%) can be justified by the configuration and standardized position of dental chairs (ZakerJafari & YektaKooshali, 2018). It is important to note that, except for the knees and ankles/feet, the lower limbs were the least evaluated by the included studies, considered by only three studies, with one of them not observing any incidence. This likely contributed to the low prevalence rate.

The lower prevalence rates of work-related musculoskeletal disorders (WMSD) observed for the lower limbs, specifically the legs (3%), ankles/feet (10%), and knees (13%), may be attributed to the ergonomic design and standardized positioning of dental chairs (ZakerJafari & YektaKooshali, 2018). However, it's crucial to note that, except for the knees

and ankles/feet, the lower limbs were the least evaluated by the included studies, with only three studies considering them, and one of them not reporting any incidence. This limited assessment likely contributed to the lower prevalence rates observed in these areas.

In terms of the continents evaluated, the prevalence rates of work-related musculoskeletal disorders (WMSD) were consistent with the overall analysis, except for the African continent, which stood out with a prevalence rate of 99%. However, it's important to interpret this data cautiously, as only one study was considered for this analysis. Therefore, more research is needed to evaluate the prevalence of WMSD in continents with limited inclusion, such as America, Europe, Oceania, and Africa. This recommendation is particularly relevant considering that only the Asian continent presented a substantial number of studies for location-based interpretation.

This finding aligns with a previous umbrella review, which noted that over 50% of the included studies were conducted in Asian countries (De Sio et al., 2018). Furthermore, the authors of that review highlighted the major limitation of the findings, which was attributed to the low methodological quality and inadequate statistical analyses in a significant portion of studies, primarily conducted in Asia. This observation may also be relevant to the findings of our systematic review, as only nine of the included studies demonstrated a low risk of bias, while the majority presented a high risk. Therefore, future well-designed and standardized studies are recommended to facilitate a more accurate interpretation of these findings.

CONCLUSIONS

Within the limitations of the present study, several conclusions can be drawn:

1) A high cumulative prevalence of WMSD was observed among dentists, estimated at 83% (95% CI: 77% to 87%).

2) Neck, shoulders, and lower back were identified as the regions with the highest incidence of WMSD among dentists, while the lower limbs, including legs, knees, and ankles/feet, exhibited lower incidence rates.

3) There was no significant difference in the prevalence of WMSD observed across different continents.

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Supplemental File 1. Specific search strategy in each database

MEDLINE/PubMed

#1	**((((((((((((("Dentists"[Mesh]) OR ("Dentists")) OR ("Dentist")) OR ("Dentistry"[Mesh])) OR ("Dentistry")) NOT ("Students"[Mesh])) NOT ("Students")) NOT ("Student")) NOT ("Patients"[Mesh])) NOT ("Patients")) NOT ("Patient")) NOT ("Infant"[Mesh])) NOT ("Infant")) NOT ("Child"[Mesh])) NOT ("Child")) NOT ("Children")**	435,890
#2	**(((((((("Musculoskeletal Pain"[Mesh]) OR ("Musculoskeletal Pain")) OR ("Musculoskeletal Pains")) OR ("Musculoskeletal Diseases"[Mesh])) OR ("Musculoskeletal Diseases")) OR ("Musculoskeletal Disease")) OR ("Musculoskeletal Disorders")) OR ("Musculoskeletal Discomfort")) OR ("Work-related musculoskeletal disorders")**	1,226,846
#3	**((((((("Prevalence"[Mesh]) OR ("Prevalence")) OR ("Prevalences")) OR ("Proportion")) OR ("Proportions")) OR ("Currency")) OR ("Currencies")**	1,416,190
#4	#1 AND #2 AND #3	875

Web of Science

#1	**((((((((((ALL=("Dentists")) OR ALL=("Dentist")) OR ALL=("Dentistry")) NOT ALL=("Students")) NOT ALL=("Student")) NOT ALL=("Patients")) NOT ALL=("Patient")) NOT ALL=("Infant")) NOT ALL=("Infants")) NOT ALL=("Child")) NOT ALL=("Children")**	68,554
#2	**((((((ALL=("Musculoskeletal Pain")) OR ALL=("Musculoskeletal Pains")) OR ALL=("Musculoskeletal Diseases")) OR ALL=("Musculoskeletal Disease")) OR ALL=("Musculoskeletal Disorders")) OR ALL=("Musculoskeletal Discomfort")) OR ALL=("Work-related musculoskeletal disorders")**	48,632
#3	**(((((ALL=("Prevalence")) OR ALL=("Prevalences")) OR ALL=("Proportion")) OR ALL=("Proportions")) OR ALL=("Currency")) OR ALL=("Currencies")**	1,880,763
#4	#1 AND #2 AND #3	126

Scopus

#1	TITLE-ABS-KEY ("Dentists") OR TITLE-ABS-KEY ("Dentist") OR TITLE-ABS-KEY ("Dentistry") AND NOT ("Students") AND NOT ("Student") AND NOT ("Patients") AND NOT ("Patient") AND NOT ("Infant") AND NOT ("Infants") AND NOT ("Child") AND NOT ("Children")	94,908C
#2	TITLE-ABS-KEY ("musculoskeletal pain") OR TITLE-ABS-KEY ("musculoskeletal pains") OR TITLE-ABS-KEY ("musculoskeletal diseases") OR TITLE-ABS-KEY ("musculoskeletal disease") OR TITLE-ABS-KEY ("musculoskeletal disorders") OR TITLE-ABS-KEY ("musculoskeletal discomfort") OR TITLE-ABS-KEY ("work-related musculoskeletal disorders")	71,384
#3	TITLE-ABS-KEY ("prevalence") OR TITLE-ABS-KEY ("prevalences") OR TITLE-ABS-KEY ("proportion") OR TITLE-ABS-KEY ("proportions") OR TITLE-ABS-KEY ("currency") OR TITLE-ABS-KEY ("currencies")	2,259,516
#4	#1 AND #2 AND #3	44

Embase

#1	('dentists'/exp OR 'dentists' OR 'dentist'/exp OR 'dentist' OR 'dentistry'/exp OR 'dentistry') NOT ('students'/exp OR 'students') NOT ('student'/exp OR 'student') NOT ('patients'/exp OR 'patients') NOT ('patient'/exp OR 'patient') NOT ('infant'/exp OR 'infant') NOT ('infants'/exp OR 'infants') NOT ('child'/exp OR 'child') NOT ('children'/exp OR 'children')	351,190
#2	'musculoskeletal pain'/exp OR 'musculoskeletal pain' OR 'musculoskeletal pains' OR 'musculoskeletal diseases'/exp OR 'musculoskeletal diseases' OR 'musculoskeletal disease'/exp OR 'musculoskeletal disease' OR 'musculoskeletal disorders'/exp OR 'musculoskeletal disorders' OR 'musculoskeletal discomfort'/exp OR 'musculoskeletal discomfort' OR 'work-related musculoskeletal disorders'	2,912,052
#3	'prevalence'/exp OR 'prevalence' OR 'prevalences' OR 'proportion' OR 'proportions' OR 'currency' OR 'currencies'	2,132,813
#4	#1 AND #2 AND #3	2,340

SciELO

#1	("Dentist") OR ("Dentists") OR ("Dentistry") AND NOT ("Students") AND NOT ("Student") AND NOT ("Patients") AND NOT ("Patient") AND NOT ("Infants") AND NOT ("Infant") AND NOT ("Child") AND NOT ("Children")	2,266
#2	("Musculoskeletal Pains") OR ("Musculoskeletal Pain") OR ("Musculoskeletal Diseases") OR ("Musculoskeletal Disease") OR ("Musculoskeletal Disorders") OR ("Musculoskeletal Discomfort") OR ("Work-related musculoskeletal disorders")	815
#3	("Prevalences") OR ("Prevalence") OR ("Proportions") OR ("Proportion") OR ("Currency") OR ("Currencies")	58,635
#4	#1 AND #2 AND #3	11

ProQuest

noft("Dentists" OR "Dentist" OR "Dentistry" NOT "Student*" NOT "Patient*" NOT "Child" NOT "Children") AND noft("Musculoskeletal Pain" OR "Musculoskeletal Diseases" OR "Musculoskeletal Disorders" OR "Musculoskeletal Discomfort" OR "Work-related musculoskeletal disorders") AND noft("Prevalence" OR "Prevalences" OR "Proportion" OR "Proportions" OR "Currency" OR "Currencies")	88

Supplemental File 2. Excluded Articles

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3 CONCLUSÃO

Em virtude dos dados apresentados é importante ressaltar que dentre os instrumentos utilizados para medir o desconforto musculoesquelético em dentistas, o mais utilizado foi o Questionário Nórdico de Sintomas Musculoesqueléticos, mas vale lembrar que não é um consenso na literatura de que este questionário consiga calcular a prevalência de distúrbios osteomusculares, sendo indicado apenas para a avaliação de sintomas. Foi destacado também que o uso de questionários criados pelos próprios autores foi expressivo, o que gera problemas devido a falta de estudos que comprovem a validade e a confiabilidade destes questionários comprometendo o resultado final da pesquisa. É necessário frisar que nenhum questionário é perfeito, todos possuindo seus pontos fortes e suas falhas, e uma forma de contornar estas adversidades é justamente na combinação de questionários com uma melhor forma de complementar os resultados.

Em relação a prevalência de DORTs em dentistas o resultado encontrado (83%) está de acordo com a literatura. As áreas mais afetadas são o pescoço, os ombros e a lombar os mais afetados e regiões como pernas, calcanhares e pés as menos afetadas, o que pode ser explicado pelo alto numero de posições e movimentos que os dentistas realizam com seus membros superiores, não foram encontradas diferenças significativas na prevalência pelos continentes. Estes resultados mostram o quanto o dentista está exposto aos riscos ocupacionais sendo necessário a identificação prévia e correta destes distúrbios para um melhor tratamento e evitar futuras complicações

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ANEXO 1 – Normas da revista que foram submetidos os artigos



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Manuscripts should not exceed the following word counts:
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references are included in the word count).
Professional Practice - 2000 words (Structured Abstract (up to 250 words)and Keywords are not included in the word count. 'In-text' references are included in the word count).
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Letters to the Editor - 500 words (This word count includes the references contained within the article.)

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In keeping with the ethos and standards inherent in *Musculoskeletal Science and Practice*, Masterclasses must show depth, rigour, originality and high standards of presentation. The purpose of the Masterclass section is to describe in detail clinical aspects of conservative musculoskeletal interventions. This may relate to specific treatment techniques, a particular management approach or management of a specific clinical entity. Masterclasses are showcase articles and authors are normally invited to write a masterclass paper because of their significant expertise in a relevant area. However if an author feels that they have a topic that would be appropriate for a masterclass and have recognised expertise in the field, the author should contact Karen Beeton (contact details below) before submitting the paper to ascertain that the proposed topic and content will be suitable and meets requirements. Opinion papers should be submitted as a Professional Issue.

- The article should be a maximum of 4000 words in length excluding references.
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    3. **Implications**(for practice)
- The introduction should review the relevant literature and put the subject matter into context.
- The main body of the text will describe the technique or approach in detail.
- Clinical indications and contraindications should be outlined where relevant.
- Illustrations are considered an essential part of the Masterclass in order to fully inform the reader and a minimum of six photographs or line drawings are required.
- The topic should have clear application to clinical or professional practice. This sets a masterclass apart from a narrative review paper.

Case studies are often very valuable in order to illustrate the theoretical principles discussed within the masterclass. If the word limit precludes the inclusion of a case study within the body of the masterclass then a case study can be submitted as a separate paper alongside the masterclass and will be published on-line only.

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Qualitative researchers might wish to consult the guideline listed below: Qualitative studies - COREQ - Consolidated criteria for reporting qualitative research http://www.equator-network.org/reporting-guidelines/coreq/

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Use of the TIDieR checklist can guide authors to describe their interventions better and, consequently, help clinicians and journal readers to use the interventions, and researchers to synthesise and replicate the evidence. *Musculoskeletal Science and Practice* will request authors to incorporate the TIDieR statement into their manuscript processing workflow. Submitting authors are encouraged to use the TIDieR checklist to ensure that any interventions described in their manuscript are fully reported. However, submitting authors will not be required to submit the checklist. Authors are requested to refer further to the recent Editorial - "The TIDieR checklist will benefit the physiotherapy profession", http://www.manualtherapyjournal.com/article/S1356-689X(16)30022-4/fulltext.

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Reference to a chapter in an edited book:
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