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Review article

Prevalence of reported percutaneous injuries on dentists: A meta-analysis

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ABSTRACT

Objectives: To answer the focused question, "What are the prevalence of percutaneous injuries (PIs) on dentists, the location with the highest prevalence, and the dental instrument most responsible for these injuries?" As secondary outcomes, the prevalence by geographic location, type of PI, sex distribution, and dentist's specialty were also considered.
Eligibility criteria: Observational descriptive studies investigating the prevalence of percutaneous injuries on dentists were included.
Sources: Five electronic databases and three partial grey literature searches were performed.
Risk of bias: The MAStARI tool assessed the potential risk of bias (RoB) among the studies, while the GRADE approach determined the level of evidence.
Included studies: Among 2284 identified studies, 55 were included. Three studies were classified as low RoB, 17 as moderate RoB, and 35 as high RoB. The sample size ranged from 9 to 4107 dentists.
Synthesis of Results: The PI prevalence in dentists ranged from 7.72% (95% confidence interval [CI]: 0.93–37.59) to 66.74% (95%CI: 29.83–94.51). North America was the most affected region, while South America was the least affected. Differences between sexes were not significant. The dental bur was the most commonly reported dental instrument causing PIs.
Limitations: Owing to the very low GRADE level of evidence, caution should be applied when considering these findings and further research is required.
Conclusions: A high PI prevalence among dentists was noticed, and most were caused by dental burs. These findings imply that PIs should be considered by every dentist and proper measures instituted to reduce their prevalence.

1. Introduction

Percutaneous injuries (PIs) represent one of the major occupational risks for healthcare workers [1–3]. These injuries may expose the professional to infection by pathogens associated with significant morbidity and mortality, such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) [4]. The World Health Organization (WHO) estimated that 39% of HCV infections, 37% of HBV infections, and 4.4% of HIV infections in the year 2000 were caused by occupational exposure to PIs [5]. Furthermore, PIs have been severely underreported [6]. Reasons for underreporting include lack of information regarding safety and conflicts among workers in the work environment [7].

PIs represent a considerable cost for hospitals and other health facilities [8]. These costs derive from staff absence and compensation, counselling for those exposed to PIs, and post-exposure management

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[9]. In the USA, the mean cost in 2007 for exposures to HIV-infected patients was 2456 dollars [10]. In Sweden, the mean cost was found to be 272 euros per reported injury. It was also found that the introduction of safety devices would correspond to a reduction of 850,000 euros in associated costs [11]. In Korea, as well, PIs represent a significant economic burden, corresponding to a mean of 237 dollars per injury [12]. In Belgium, the introduction of safety devices in a hospital led to a 5-year overall savings of 51,710 euros owing to reduction in PIs [13].

Dentists are frequently exposed to PIs, which are caused by the multiple sharp instruments used in dental practice [14]. PIs in dental practice are caused mainly by needles (hollow-bore and suture); however, burs, scalpels, scalers, surgical elevators, explorers, and orthodontic wires are also responsible for a significant portion of these injuries [15].

Professional fatigue, long work hours, and sleep deprivation have also been associated with the occurrence of PIs [16]. Despite their relatively common incidence, the worldwide prevalence of PIs among dentists is unknown. No meta-analysis addressing this subject could be found.

Based on these premises, the goal of this systematic review was to answer the following focused question: "What are the prevalence of PIs in dentists, the location with the highest prevalence, and the dental instrument most responsible for these injuries?". As secondary outcomes, the prevalence by geographic location, type of PI, sex distribution, and dentist's specialty were also considered.

2. Materials and methods

2.1. Protocol and registration

A systematic review protocol based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) [17] was elaborated and registered at the International Prospective Register of Systematic Reviews (PROSPERO) under the number CRD42018083480 [18]. In addition, reporting of this study was based on the PRISMA checklist [19].

2.2. Eligibility criteria

2.2.1. Inclusion criteria

The acronym PECOS (Population, Exposition, Comparison, Outcomes, Studies) was used to formulate the focused question of this study, of which: P) Dentists; E) Presence of PIs; C) Not applicable; O) Prevalence of PIs in dentists; S) Observational studies. There were no limitations regarding the time of publication. Only studies written in the Latin (Roman) alphabet were included.

2.2.2. Exclusion criteria

(1) Studies that did not investigate the prevalence of PIs among dentists; (2) Studies in which the prevalence of PIs in dentists was not clearly reported or could not be calculated; (3) Reviews, case reports, protocols, short communications, personal opinions, letters, posters, conference abstracts, and laboratory research; (4) Studies not written in the Latin (Roman) alphabet.

2.3. Information sources and search strategy

Search strategies were independently developed for five databases: Latin American and Caribbean Health Sciences (LILACS), LIVIVO, PubMed (including MEDLINE), Scopus, and Web of Science. An additional partial search of the grey literature was performed on Google Scholar, OpenGrey, and ProQuest. Search strategies were developed with the assistance of an experienced librarian. All database searches were performed on October 17, 2017 (Appendix 1). Furthermore, references cited in included articles were screened manually for articles likely to be relevant. All references were managed with reference manager software (EndNote X7®, Thomson Reuters, Philadelphia, PA, USA), in which the references were stored, and duplicate articles were removed.

2.4. Study selection

Study selection was executed in two phases. In phase-1, two independent authors (M.C.P. and F.W.M.) individually screened titles and abstracts of all selected references and crosschecked the information. Phase-1 was performed using a web application for systematic reviews (Rayyan®, Qatar Computing Research Institute, Doha, Qatar) [20]. Search strategies were developed to include studies reporting the prevalence of PIs in dentists, medical doctors, and nurses. However, due to a large number of studies identified and to avoid clustering heterogeneous data, after phase-1 this systematic review was narrowed in dentists with the intent of reviewing specific features more carefully. In phase-2, the same authors applied the eligibility criteria to the full-text assessment of the selected articles. A third author (D.M.R.) was consulted to make a final decision, when required.

2.4.1. Data collection process

For data collection, two authors (M.C.P. and F.W.M.) collected information from included studies independently and cross-checked the information to warrant integrity of contents. Gathered data consisted of included study characteristics (author, year of publication, country, and study design), sample characteristics (sample size, specialty of dentists, study location, and period considered in the study), and main findings (number of injured dentists, related factors, and prevalence of injured dentists).

2.5. Risk of bias (RoB) in individual studies

The RoB of the included studies was assessed using the Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data [21] by two reviewers independently (M.C.P. and F.W.M.). A third reviewer (D.M.R.) was involved in case of ambiguity. Studies were categorized by the authors as "high" in cases of a score as high as 49% "yes"; "moderate" in cases of a score of 50%–69% "yes"; and "low" in cases when the study had a score of 70% or more "yes". Figures for the RoB assessment were developed with Review Manager 5.3 (RevMan 5.3, The Nordic Cochrane Centre, Copenhagen, Denmark).

2.6. Summary measures

The prevalence of PIs in dentists was the main outcome and was expressed as a percentage. As secondary outcomes, the prevalence by geographic location, type of PI, sex distribution, and dentist's specialty were considered.

2.7. Synthesis of results

A qualitative analysis of results based on the prevalence of PIs was performed. In order to decrease heterogeneity among studies, results were separated according to the different time periods reported by the studies (entire professional life, 5 years, 3 years, 1 year, 6 months, and 20 days) and by different geographic locations. Assessment of types of PI was performed a descriptive analysis regarding quantity of PIs caused by different dental instruments.

The individual PI results were combined by means of a proportion meta-analysis if sufficient data were available, following the appropriate Cochrane Collaboration guidelines and were performed using MedCalc version 14.8.1 (MedCalc Software, Ostend, Belgium). Heterogeneity within studies was determined by inconsistency (I^2). A value greater than 50% was considered a signal of substantial heterogeneity among studies and a random-effect model was prioritized [22]. The significance level was set at 5%.