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Review article

The impact of demographic, health-related and social factors on dental services utilization: Systematic review and meta-analysis

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ABSTRACT

Objectives: Regular and/or preventive dental services utilization is an indicator of healthcare access and associated with improved health outcomes. We assessed the proportion of individuals regularly/preventively utilizing dental services, and how this was affected by demographic, health-related and social factors.
Sources: Three electronic databases (Medline, Embase, Central) were searched (2005–2017).
Study selection: We included observational studies investigating the association between preventive/regular dental service utilization and age, oral and general health, edentulism, family structure and health literacy.
Data: The proportion of individuals with regular/preventive utilization overall and in different sub-groups were extracted. Random-effects meta-analyses, with subgroup analyses by region, were performed. Meta-regression was used to assess whether and how associations changed with time and countries' human developmental status (HDI). 103 studies on 7,395,697 participants from 28 countries were included. The global mean (95% CI) proportion of individuals regularly/preventively utilizing dental services was 54% (50–59%). In countries with higher HDI, more individuals regularly/preventively utilized services ($p < 0.001$). Age did not have a significant impact on utilization in adults (OR = 1.00; 0.89–1.12). Utilization was significantly lower in younger than older children (OR = 0.52; 0.46–0.59), individuals with poorer general health (OR = 0.73; 0.65–0.80) and poorer oral health (OR = 0.64; 0.52–0.75), edentulous individuals (OR = 0.32; 0.23–0.41), and individuals with less supportive family structures (OR = 0.81; 0.73–0.89) or poor health literacy (OR = 0.41; 0.01–0.81). The observed differences within populations did not significantly change with time and were universally present.
Conclusions: Regular/preventive utilization varied widely between and within countries. Understanding and tackling the reasons underlying this may help to consistently improve utilization.
Clinical significance: Higher developmental status of countries is reflected in greater regular/preventive utilization of dental services. However, large demographic, health-related and social differences in utilization remain. These may contribute to dental health inequalities.

1. Introduction

Dental diseases burden billions of people with pain or discomfort, loss of masticatory function and impaired speech or aesthetics [1]. One way of tackling dental diseases is to provide universal and accessible primary care [2], with regular and/or preventive utilization of dental services having the potential to improve dental health outcomes [28–30]. While in many healthcare systems, dental services are available (and costing billions of dollars) to provide both prevention and (more so) management of dental diseases [2–5], access to these services is not always fully universal, but limited in what or who is covered [6–9]. Regular and/or preventive utilization of services is one measure for characterizing the quality of care [10,11], while it is clear that the need for and benefits emerging from such regular or preventive utilization will differ depending on a large number of factors.

We have systematically collected data on regular/preventive dental services utilization in different countries and groups [12]. In a recent study, we have used these data to describe inequalities in regular/preventive utilization by educational, economical or occupational status, as well as by sex, ethnicity or place of living. Such systematic quantification of differences in regular/preventive services utilization across groups, countries, regions or welfare regimens is useful for policy-makers and researchers alike, because it offers insights into both the extent of differential service-use and ways in which it may be

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ameliorated.

In this study, we aimed to assess the global and regional proportion of individuals regularly/preventively utilizing dental services, and to evaluate demographic, health-related and social differences on regular/preventive utilization. Such analyses help to understand whether certain country-level measures like the human developmental index (HDI) predict regular/preventive dental services utilization on an ecological level, and how different individuals differ in their utilization. They can also help to detect changes in utilization with time.

2. Materials and methods

This review and meta-analysis was conducted according to established guidelines [13,14] and is part of a larger project [12]. The study protocol of this project was registered after the initial screening stage (PROSPERO CRD42017064755). Any deviations from the protocol are described below.

2.1. Search strategy

Three electronic databases (Medline, Embase, Cochrane Central Database) were systematically screened for studies published between January 2005 and April 2017. The search strategy was as unspecific as possible, since we expected poor indexing. The search combined the outcome of interest (utilizsation OR utilization OR demand OR utilisze OR utilise OR visit) and the medical field of dentistry (dental OR dentist). Searches for studies published before 2005 were not performed, because we aimed to appraise evidence which was likely to apply to today's healthcare systems (although, admittedly, publication year does not necessarily serve as a proxy for year of study conduct). Unpublished studies or grey literature were excluded, because we expected insufficient reporting for our analysis. Reviews or editorials were used to identify the associated original work. Only studies published in English were included. Since this could lead to some bias by selective inclusion, we performed assessment of such bias both graphically and statistically, as described below. Hand searches or cross-referencing was not performed. Screening of titles or abstracts was independently performed by two reviewers (SMR, FS). All potentially eligible papers were assessed in full-text against the inclusion criteria.

2.2. Selection

We included prospective and retrospective cohort, case-control and cross-sectional studies investigating the association between particular characteristics (see below) and the regular/preventive utilization of dental services. The independent variables needed to have been measured on individual or household, not neighborhood level. The following independent variables were used: (1) age in adults (older versus younger); (2) age in children (younger versus older); (3) self-rated general health status (poor versus good); (4) self-rated dental health status (poor versus good); (5) dentate state (edentate or severe tooth loss versus not); (6) family structure (unsupportive, i.e. single or having no supportive relatives versus married or coupled etc.); and (7) health literacy (low versus high). Those aged 18 years or older were defined as adults. Independent variables were not uniformly defined in different studies. For example, the age group definition varied widely across studies; general health had been measured as being disabled or not, having a long-term illness or not, taking medications regularly, or nutritional status; self-rated dental health was measured using established scales, but also via asking for "unmet dental treatment needs" or regularly having pain. In the case of utilization by children, some variables were measured on parental/maternal level (being a lone parent etc., parental-rated general and dental health). Note that not all independent variables had been originally planned to be collected, but were added after the initial searches had been undertaken, because collecting and reporting them increased the comprehensiveness of our analysis.

As described elsewhere [12], regular/preventive utilization was defined as regular or recent examination or preventive dental visits. Emergency visits or visits for specific dental procedures were not considered. As we expected a large range of different definitions of regular or preventive utilization, we did not specify further how exactly utilization was to be measured. This was also done, as the interval of such utilization clearly depends on disease patterns in different groups or settings. However, it should be noted that this may significantly distort our results, as in some studies the observed time frame for such utilization may have been a year, while in others this may have been shorter or longer. Consequently, the overall proportion of individuals showing some kind of regular/preventive utilization may have been affected by this observational period. Studies reporting on interventions which may affect utilization were excluded.

Studies needed to have used a multivariable statistic to assess the association between independent variables and utilization of dental services, and needed to have included an uncertainty estimate (confidence interval, p-value, standard error etc.) allowing to enter the study data into meta-analysis (see below). If studies presented both bivariable and multivariable analyses, only data from the multivariable model were extracted.

Studies needed to have included adults or children with permanent or primary teeth, or no teeth (edentulous individuals). Studies investigating non-representative groups (e.g. dental students, refugees, pregnant women, disabled patients) were excluded. Studies reporting on participants from non-representative settings (such as areas of violent conflict, or those affected by natural disasters) were also excluded.

Studies needed to fulfill all of the above described criteria to be included. Inclusion and exclusion were decided by two reviewers in consensus (SMR, FS).

2.3. Data extraction

Two authors (SMR, SFR) undertook the data extraction. A spreadsheet used in a previous study [12] was also applied in the present evaluation. We recorded data on: (1) study characteristics, including study type, year of conduct and publication; (2) country and place of conduct, including the Human Development Index (HDI, see below) in the year of conduct; (3) the sampling frame (national or subnational) and sample size; and (4) study findings, including the proportion of individuals showing regular/preventive utilization in the observed time frame (which differed between studies), and adjusted association estimates (e.g. odds or chance of utilization in older versus younger adults, or edentulous versus dentate individuals). Study authors were contacted if data were missing or where clarification was needed. We always extracted the association estimate capturing the largest difference [15]. In the event that a study assessed the same outcome using different instruments (such as different aspects of general health, etc.), we extracted the estimate capturing the largest difference. If several models (including different sets of covariates) were reported on, estimates were extracted from the model that included the largest number of covariates [16]. If the same survey/study was reported on in multiple articles, the article with the largest sample size was included, in order to avoid unit-of-analysis issues. In the event that several waves of the same study were reported, they were all extracted and estimates pooled using fixed-effects meta-analysis prior to entering them into our main meta-analysis. Data on different groups of participants from the same survey were similarly pooled for meta-analysis [16]. If one study reported on multiple surveys in different countries, these were separated wherever possible.

Most studies reported on the observed associations using Odds Ratios; only a small minority used the Risk or Prevalence Ratio (RR, PR). Since these could not be transformed into OR (as we included only adjusted estimates), we entered them into one meta-analysis nevertheless. To check the impact of this, we performed a sensitivity analysis, excluding studies using RR or PR; the resulting differences in the pooled

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