

Methodological Trends in Preventive Dentistry Research: A Bibliometric Analysis of Sample Size Determinations

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Abstract:

Introduction: Preventive dentistry research is one of the fields of dentistry where evidence-based strategies can be developed to prevent diseases, promote health and maintain community oral health. Adequate sample size determination is very important to ensure sufficient statistical power, accuracy, validity and reliability of the findings of a study. But sometimes lack of information on sample size determination and sampling methods prevents evaluation of methodological quality and replicability of the studies. Little evidence exists about the quality of reporting of sample size determination in preventive dentistry research.

Aim: To assess the methodological trends and reporting practices related to sampling methodology and sample-size determination in preventive dentistry research.

Result: A total of 52 studies on preventive dentistry obtained from PubMed, Scopus, and Web of Science were considered in this study. The sampling method was reasonably documented, with 90.4% of studies stating eligibility criteria, 84.6% of studies providing information on sampling frame, 76.9% of studies stating the type of sampling, and 69.2% of studies clearly describing the sampling method. However, sample size estimation reporting was poor. Only 19.2% of studies stated the formula or software used in sample size estimation, 21.2% mentioned source data, and 25.0% of studies stated justification for sample size based on the primary objective. Alpha, beta, and statistical power were seldom provided in these studies. Mean sampling reporting score was 3.21 ± 0.95 , while mean sample size reporting score was 0.60 ± 1.08 , with overall reporting quality score being 3.81 ± 1.69 . No significant relationship was noted between statistician involvement and formula reporting ($\chi^2 = 0.20$, $p = 0.654$) and overall reporting quality (Mann-Whitney $U = 75.0$, $p = 0.472$).

Conclusion: This study highlights a number of inadequacies in the way sample size determination has been reported in studies of preventive dentistry, even though sampling basics have been described fairly well. Critical aspects like the formula or software applied for sample size determination, the source of data, power statistics, and assumptions have been left out all too often.

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INTRODUCTION

Preventive dentistry is one of the most critical components of the reduction of oral diseases due to prevention of disease, detection, health promotion, and the application of population and community approaches [1]. In view of the persistent significance of oral diseases as an important public health problem, there is a need for high-quality research in preventive dentistry that would allow creating efficient preventive measures and providing credible

scientific evidence. With the rising amount of research in this area, the issue of the methodological quality of these publications has become as crucial as ever [2].

In a well-conducted research project, determining the sample size plays an important role in ensuring that the results are valid, precise, and reliable. In this case, a properly estimated sample size allows for proper statistical power to identify any effects while minimizing the chances of making either type I or II

errors[3]. However, poor sample sizes may lead to inaccurate estimates and insufficient statistical power, while large samples will cause inefficiencies. Consequently, it is very important to provide clear information on how the sample size has been determined by mentioning the methodology, assumptions, statistics, and data used.

Although sample size determination is highly important, reporting of sample size in dental literature has not always been well-structured or clear enough. According to guidelines such as CONSORT, there should be a proper calculation of the sample size and the methods utilized.[4] Unfortunately, little attention has been paid to how well the methodological aspects in the field of preventive dentistry have been addressed. In addition, conventional bibliometrics have been mainly focused on productivity, citations, authorship, and journal analysis, with comparatively little attention being paid to the methodology of the studies.[5]

The issue is especially important in preventive dentistry where scientific studies often form the basis for public health interventions, preventive programs, and evidence-based guidelines for dental practice[6]. Inadequate documentation of sampling methods and sample size estimation may hinder evaluation of the validity, statistical sufficiency, and generalizability of results that have been published. There is a need for more than mere measurement of publication volume and visibility, but systematic evaluation of the methodology behind preventive dentistry research.[7]

Considering this requirement, the current study involving bibliometric and descriptive analysis was conducted to assess the trends of methodology in preventive dentistry research focusing on sampling methodology and sample size.[8] The aim of the study is to assess the methodological trends and reporting practices in preventive dentistry research focusing on sampling methodology and sample size determination.

Material and Methods

This study employed a bibliometric and descriptive analytical study design to investigate the trend and methodological quality of sample size determination in the literature on preventive dentistry research. The eligible studies for this research were selected from the databases PubMed, Scopus, and Web of Science using systematic search strategies.

This study used three online database sources, namely, PubMed, Scopus, and Web of Science to conduct a thorough investigation. Preventive dentistry articles that were published during the specified study period were identified by conducting a literature search. Articles meeting the inclusion

criteria were screened for titles, abstracts, and full texts, and important methodological aspects were collected using a structured data collection form. The study was carried out for 4 months (April 2026 - July 2026). This was a bibliometric study of the published literature and therefore did not involve participant recruitment and follow-ups.

The inclusion criteria consisted of original observation and experimental research articles on preventive dentistry, published in peer-reviewed journals and in English. The review articles, editorials, case reports, letters, articles that were not about preventive dentistry, and articles without any methodological information were excluded from the literature search. The articles were found using predefined search terms on PubMed, Scopus, and Web of Science. After duplicates had been removed, title and abstract screening followed by the full-text evaluation were performed. All articles that fulfilled the inclusion criteria during the study period were used in the final analysis.

Sample size calculation quality was the main dependent variable to be measured for studies on preventive dentistry. The extracted variables included the following:

- Article characteristics (journal title, volume, issue and title of the article);
- Authorship characteristics (number of authors, statistician's involvement, and the country of the lead author);
- Study characteristics (study location and study design);
- Indexing in PubMed, Scopus, Web of Science, etc.;
- Sampling variables (sampling method, sampling procedure, sampling frame, inclusion criteria, and size of control group); and
- Sample size calculation variables (type of power analysis, sources of data and their relevance, consistency with the main purpose, formula/software, α and β levels, statistical power, expected difference, prevalence, and variance).

Study outcome variables included significance and generalization of findings.

Some categorical variables selected for this study were binary-coded with 0 = No and 1 = Yes. This is because the study was bibliometric in nature where the data had already been published in articles; therefore, exposures, confounders, effect modifiers, and diagnostic criteria were not relevant.

Statistical methods

IBM SPSS Statistics 26 was used to perform analysis. Data was collected and entered into MS

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Excel 2021 and then carefully verified. Statistics were employed to reported in terms of frequencies and percentages. For the continuous variables we presented the means and standard deviations or medians and interquartile ranges depending on the data distribution. To determine relationships between categorical variables we performed Chi-square test or Fishers exact test. For the continuous variables, Mann-Whitney U test was employed to assess the difference between the groups.

Results:

A total of 52 preventive dentistry research articles were included in the final analysis. The numbers of articles that were found checked, looked at for full-text eligibility.

Table 1. Characteristics of Included Preventive Dentistry Studies (N = 52)	
Characteristic	n (%)
Total studies included	52 (100.0)
Statistician among authors	4 (7.7)
No statistician among authors	48 (92.3)
PubMed indexed journals	28 (53.8)
Non-PubMed indexed journals	24 (46.2)
Scopus indexed journals	29 (55.8)
Non-Scopus indexed journals	23 (44.2)
Web of Science indexed journals	26 (50.0)
Non-Web of Science indexed journals	26 (50.0)

In total, 52 papers related to preventive dentistry have been used for the study, out of which just 4 (7.7%) mentioned the statistician involvement in their authorship. Most of the papers (48 (92.3%)) lacked such an involvement. As regards journal indexing, 28 (53.8%) of the papers appeared in PubMed-indexed journals, and 24 (46.2%) in non-PubMed-indexed journals.

Table 2: Distribution of Included Studies According to Study Type

Study Type	Count
Observational	36
Experimental	8
Interventional	3
Qualitative	2
Other (mixed/computational/program evaluation)	3

In total, among the 52 articles, there was a preponderance of observational studies (36 articles), representing the bulk of research. There were 8 experimental studies, 3 interventional studies, and 2 qualitative studies. The rest 3 articles were categorized as other kinds, including mixed, computational or program evaluation studies. On the whole, one can state the preponderance of observational study designs in preventive dentistry research.

Table 3. Reporting of Sampling Methodology		
Reporting Item	Reported n (%)	Not Reported n (%)
Sampling type mentioned	40 (76.9)	12 (23.1)
Explicit sampling technique reported	36 (69.2)	16 (30.8)
Sampling frame described	44 (84.6)	8 (15.4)
Eligibility criteria reported	47 (90.4)	5 (9.6)

The reporting of sampling methodology varied across the included studies. Eligibility criteria were most frequently reported (90.4%), followed by the sampling frame (84.6%). Sampling type was mentioned in 76.9% of studies, whereas an explicit sampling technique was reported in 69.2%. Overall, some important aspects of sampling methodology were inadequately reported in a substantial proportion of studies.

Table 4. Reporting of Sample-Size Estimation

Reporting Item	Reported n (%)	Not Reported n (%)
Formula/software reported	10 (19.2)	42 (80.8)
Source data reported	11 (21.2)	41 (78.8)
Based on primary objective	13 (25.0)	39 (75.0)
Alpha (α) reported	Rarely reported	Predominantly absent
Beta (β) reported	Rarely reported	Predominantly absent
Statistical power reported	Rarely reported	Predominantly absent

Sample-size estimation was poorly reported among the included preventive dentistry studies. Only 19.2% reported the formula or software used, while 21.2% provided the source data for sample-size calculation. In only 25.0% of studies was the sample size estimation based on the primary research objective. Reporting of α , β , and statistical power was rare, indicating substantial deficiencies in the transparency and reproducibility of sample-size determination.

Table 5. Reporting Quality Scores

Score	Mean $\pm$ SD
Sampling reporting score	3.21 $\pm$ 0.95
Sample-size reporting score	0.60 $\pm$ 1.08
Overall reporting quality score	3.81 $\pm$ 1.69

Mean scoring for the sampling reporting was 3.21 $\pm$ 0.95, showing good reporting on sampling techniques. On the other hand, the scoring for the sample size was significantly low (0.60 $\pm$ 1.08), demonstrating poor reporting on the way sample size is calculated. The overall reporting score was 3.81 $\pm$ 1.69.

Table 6: Association of Statistician Involvement with Formula Reporting and Overall Quality Score

Variable	Test	Statistic	p-value
Statistician involvement vs formula reporting	Chi-square	0.2	0.654
Statistician involvement vs overall quality score	Mann-Whitney U	75	0.472

No significant relationship was found between statistician involvement and formula reporting regarding sample size ($\chi^2 = 0.2$; $p = 0.654$). Also, there was no significant difference between the overall quality of reporting depending on statistician involvement (Mann Whitney U = 75; $p = 0.472$). Therefore, there was no significant relationship between statistician involvement and formula reporting or overall reporting quality in the current study.

Table 7: Comparison of Reporting Quality Scores

Group	Mean Overall Score
Statistician present	3.25
Statistician absent	3.85
Mann-Whitney U test:	$p = 0.472$

The average score for overall reporting quality of studies with the presence of statisticians was 3.25, while that of studies without the presence of statisticians was 3.85. However, this difference was not statistically significant (Mann Whitney U = 75.0, $p = 0.472$). Therefore, the presence of statisticians was not significantly related to overall reporting quality.

Discussion:

In the current study, sampling methodology and sample-size determination were assessed in 52 research articles published on preventive dentistry. It was shown that there was considerable

discrepancy in reporting sampling methodology and sample-size determination. In spite of the adequate reporting of eligibility criteria (90.4%) and sampling frames (84.6%), the reporting of sampling techniques was reported in only 69.2%. The most serious problem was revealed in the insufficient reporting of sample-size determination, when 19.2% of papers reported the formula or software, 21.2% provided the source data, and 25.0% noted that sample-size calculation was made according to the aim of primary research. Also, α , β , and statistical power were rarely reported.

Such a discrepancy is seen in a significantly lower mean sample-size reporting score (0.60 ± 1.08) compared to the sampling reporting score (3.21 ± 0.95). Also, it is worth mentioning that the statistician involvement was reported in 7.7%, and there was no statistically significant correlation between statistician involvement and the reporting of the formula ($p = 0.654$) or the reporting score ($p = 0.472$). The observational studies were the most frequently used research design (36/52), which means that the preventive dentistry literature under review was mostly observational. These results clearly imply that while the basics of sampling are fairly adequately communicated, the critical elements needed for an appropriate and accurate sample-size calculation are grossly insufficiently mentioned in the study.

Results from the current study are in line with the methodological issues that were found by Sánchez-Tito (2026) after assessing the sample size calculations performed in original research papers in the Journal of Conservative Dentistry and Endodontics [9]. According to Sánchez-Tito (2026), formal sample size calculations were infrequent, while methodological coherence in terms of full reporting was found in a small number of studies. More specifically, lack of reporting regarding effect size, alpha level, statistical power, and congruence between the calculation model and statistics used were noted as key issues.

Consequently, in this current investigation, similar results were observed that the formula/software used, source data and the statistical factors including α , β and power have not been stated frequently, suggesting the presence of shortcomings regarding sample size estimation reporting in dental studies. This present finding may also be compared to the bibliometric study by Ponraj et al. (2023) which reported significant increase and rising international research interest in dental age estimation literature [10], and Kaur et al. (2025) which reported the rise in research publications and inter-disciplinary involvement in the dental management of children with autism spectrum disorder. However, these bibliometric analyses were focused on the aspects of publication trend, citation analysis, authorship,

geographical distribution, institutions, journals and keywords.

Consequently, the current study contributes to the existing body of bibliometric literature through a departure from the previous attention paid to the amount and influence of dental articles towards the openness of one of the key elements of methodology - sample size calculation. Contrary to the hypothesis that statistics can positively affect the quality of the reporting, the current study did not find any statistically significant relationship between the involvement of a statistician and both formula reporting and overall quality of the reporting.

There are numerous strengths in the current study. First, the current study concentrated on preventive dentistry and provided a comprehensive evaluation of an essential but not extensively researched area related to methodological quality. The current study evaluated sampling methods, sample size estimation, statistical parameters, and overall reporting quality while traditional bibliometric studies like Ponraj et al. (2023) and Kaur et al. (2025) mainly concentrated on publications and citations [11]. Second, the current assessment included papers retrieved from major bibliographic databases like PubMed, Scopus, and Web of Science. Nonetheless, certain limitations need to be recognized.

A relatively low number of studies included in the sample (52), could reduce the statistical power of subgroup analyses, especially that related to statistician involvement in sample size determination since there were only four studies that involved a statistician. Another potential limitation is that the preponderance of observational studies in the review reduces the applicability of the results to experimental and interventional research of preventive dentistry. This review investigated the adequacy of reporting of sample size determination rather than the recalculation of each reported sample size to establish the statistical adequacy of it. Also, the nonsignificant association between sample size factors and statistician involvement needs to be treated with caution due to the low number of studies in the presence of statistician group.

Conclusion

However, in this study it has been shown that although the essential elements related to sampling methodology have been reported well enough in researches conducted in the field of preventive dentistry, the element of sample size calculation has been poorly reported in such researches. Such essential methodological elements as the formula used, source data, statistical power, and α and β values have often been not mentioned in the studies, which makes research results hard to be transparent and replicable. The involvement of statistician in the

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research has not been reported often as well and has not been correlated with formula reporting or reporting quality.

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