A preliminary investigation on digital surveillance literacy among dental academicians

Investigación preliminar sobre la alfabetización en vigilancia digital de los académicos de odontología

Balraj Shukla[1], Anup Panda[2], Deepika Chari[3]

[1] BDS, MDS, Department of Pediatric and Preventive Dentistry, College of Dental Sciences and Research Centre. Gujarat University, Ahmedabad, India. 🔴 0000-0002-0923-5135

[2] BDS, MDS, Department of Pediatric and Preventive Dentistry, College of Dental Sciences and Research Centre. Gujarat University, Ahmedabad, India 🔴 0000-0002-9229-0097

[3] BDS, MDS, Department of Pediatric and Preventive Dentistry, College of Dental Sciences and Research Centre. Gujarat University, Ahmedabad, India. 🔴 0000-0003-2514-9031

ABSTRACT

Introduction: Since 2013 Digital Surveillance (DS) studies have been used in dentistry for infoveillance/infodemiology and understanding internet users' activity in this area. This preliminary investigation was done to understand dental academicians' awareness about DS as a research methodology tool. Methods: In the first phase, two Delphi rounds were conducted to identify the most frequently used terms related to DV. In the second phase, dental academics were interviewed and presented with the list of terms. An assessment tool based on word recognition, knowledge, and comprehension was applied. Responses of the 31 participants were tabulated for statistical analysis. Results: The paired t-test values revealed no statistically significant difference between recognition, knowledge, and comprehension of the presented terms (p > 0.05). 'Cross-sectional analysis', 'Google Scholar', and 'Datasets' were the most clearly comprehended, whereas 'real time', 'time trend analysis', and 'predictive/forecast models' were the least recognized. Conclusion: Preliminary results suggest a lack of awareness of DS among dental academicians.

Keywords: infodemiology, dental education, computer literacy

Resumen

Introducción: desde 2013, los estudios de Vigilancia Digital (VD) se utilizan en odontología para la infovigilancia, la infodemiología y el análisis del comportamiento en línea. Este estudio preliminar evaluó el conocimiento de los profesionales en odontología sobre la VD como herramienta metodológica. Métodos: en la primera fase, se realizaron dos rondas Delphi para identificar los términos más frecuentes relacionados con la VD. En la segunda fase, se entrevistaron a profesionales en odontología, presentándoles la lista de términos. Se aplicó una herramienta de evaluación basada en el reconocimiento, conocimiento y comprensión de palabras. Se analizaron estadísticamente las 31 respuestas de los participantes. Resultados: la prueba t pareada no mostró diferencias significativas entre reconocimiento, conocimiento y comprensión (p > 0,05). «Análisis transversal», «Google Scholar» y «conjuntos de datos» fueron los más comprendidos; «tiempo real», «análisis de tendencias temporales» y «modelos de predicción» los menos reconocidos. Conclusión: existe escaso conocimiento de la VD entre los profesionales en odontología.

Palabras clave: infodemiología, educación en salud dental, alfabetización digital

INTRODUCTION

Digital surveillance is an exploratory method to understand people's activities and behavior using digital tools to gather information. This online behavior has been used in healthcare research to understand people's perceptions towards infectious diseases, mental health, substance use, non-communicable diseases, and general population behavior.[1–3]

Digital surveillance studies first started appearing in the early 2010s in healthcare.[1] Most of these studies rely on Google Trends' search data analytics. As of 2025, over 65 articles have been indexed in the PubMed database reporting on using Google Trends as a research tool in dentistry (Figure 1). Due to increased internet activity during the COVID-19 pandemic, a sharp spike in the publication frequency of these studies was observed during the lockdown. As a result, 50 articles on the topic were published between 2021 and 2024.
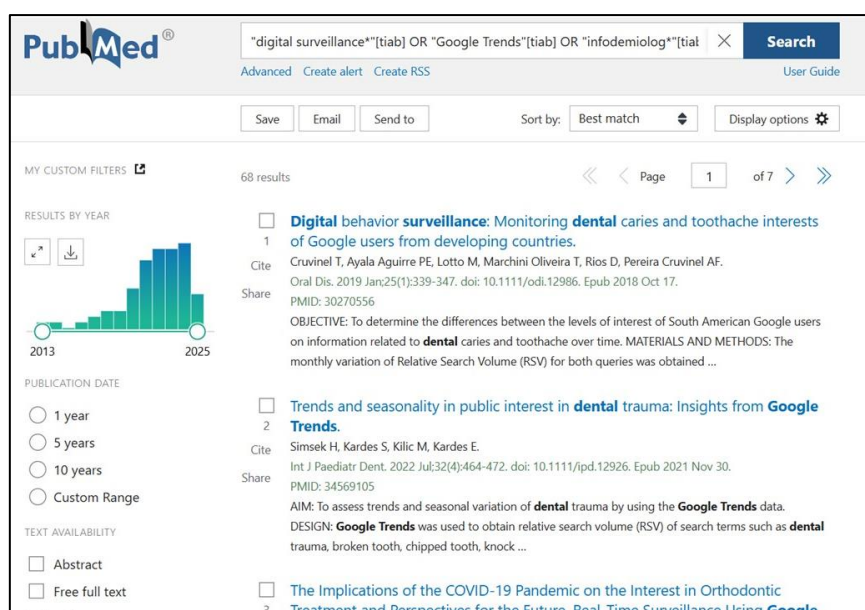

Figure 1. Digital Surveillance studies in the PubMed database
Source: by the authors

Digital surveillance studies represent a relatively novel facet of observational studies. Thus, this study aimed to evaluate dental academicians' awareness of digital surveillance through a literacy assessment based on word recognition, knowledge, and comprehension.

METHODS

This cross-sectional study obtained institutional ethics committee approval (CDSRC/IEC/2025/28). The COREQ criteria was used as a guide to ensure methodological rigor in the interview phase of this study.[4]

Phase 1. Listing the most important terms related to Digital Surveillance

The first step involved developing a list of the most recurring words that characterize a digital surveillance study. This was accomplished by an expert group of four members in two Delphi rounds. All four members were part of an editorial board in journals indexed in the Directory of Open Access Journals.

In the first round, 20 words were drawn, and in the second round, each word's content validation was done by the sum-score decision rule. Ten words met the agreement criteria and were chosen for further evaluation. The words excluded after the Delphi rounds were query category, combination (search strategy), small data, relative search volume, Google Flu, lead-time, time windows, infoveillance, and infodemiology (Table 1).

Table 1. Content Validation using Sum-Score Decision Rule*

	Term	Rater 1 (10)	Rater 2 (10)	Rater 3 (10)	Rater 4 (10)	Total (40)
1	Digital Surveillance	10	10	10	10	40
2	Google Trends	10	10	10	10	40
3	Query Category	7	7	8	7	29
4	Combination (Search strategy)	8	8	7	8	31
5	Quotation Marks	8	9	9	9	35
6	Small Data	8	8	7	7	30
7	Big Data	8	9	9	9	35
8	Time-trend Analysis	8	8	9	7	32
9	Cross-sectional analysis	9	9	9	9	36
10	Google Scholar	10	10	10	10	40
11	Relative Search Volume	7	7	7	7	28
12	Google Flu	7	7	8	7	29
13	Lead-time	7	7	7	7	28
14	Infodemiology	8	9	8	8	33
15	Predictive/Forecast Model	8	8	8	8	32
16	Datasets	9	9	9	9	36
17	Time Windows	7	8	7	8	30
18	Infoveillance	8	7	9	9	33
19	Real-time	9	9	9	9	36
20	Seasonality	7	7	8	7	29

Criteria:
35-40: Strong Agreement
32-34: Moderate Agreement; decision to be made through consensus
<32: Disagreement

__Time-trend Analysis:__ To be included as it represents a key interpretation tool to understand time-based behavior of a particular topic. __Predictive/Forecast Model:__ To be included as it takes into consideration historical data to predict future outcomes. __Infodemiology:__ To be excluded due to the presence of the broader term digital surveillance; This term showed very less recognition in the pilot rounds. __Infoveillance:__ To be excluded due to a possible conflict between the terms infodemiology and digital surveillance as observed in the pilot rounds; This term was often used synonymously by participants when asked about digital surveillance or infodemiology, leading to a possible overlap and redundancy in listing the terms.

Source: by the authors

Phase 2. Calibration of the interviewers

The second step involved one-on-one interviews with dental academicians to evaluate their literacy in digital surveillance through stepwise evaluation of word recognition, knowledge, and comprehension. The interviews were taken by two researchers (BS & DC) who are currently PhD scholars and academicians in the field of pediatric dentistry. Both interviewers were first calibrated by calculating the inter-rater agreement based on pilot interview rounds conducted on a sample of six.

The interview process required the chosen participants to recognize a word. This was noted as a binary answer (Yes/No) by both interviewers independently. If the participant's answer was Yes, they would be later asked to explain the meaning of it (knowledge). If the knowledge of the

participant regarding the term was satisfactory, then they would be later asked to describe their understanding of the term through examples (comprehension). In the knowledge and comprehension rounds, the interviewers had to rate the answers independently through an objective scoring rubric wherein a score of 0 indicates a false answer, 1 for a partially correct answer, and 2 for an accurate answer.

After recording their observations, the assessment made by the interviewers was analyzed to determine the agreement between them. It was considered no variability in the recognition bracket when both interviewers had a 100% agreement in this stage. Since the method of assessment was on a three-point ordinal scale for the knowledge and comprehension rounds, a weighted Cohen's Kappa value was calculated. The inter-rater agreement in the knowledge and comprehension rounds was 0.97 and 0.99, respectively.

Phase 3. Interviews

Since the methodology involved in-person interviews, a feasibility concern for sample size estimation was addressed for the pilot testing. Fifty dental academicians were approached to carry out this preliminary investigation. This sample was considered based on the recommendations of Teresi et al, for sample size in pilot feasibility studies.[5]

Participants were included if they had three years of academic experience and consented to participate in the study. Participants were not approached if they had a personal relationship with the interviewer, as it could lead to an interpretation bias. A signed written consent was obtained from eligible candidates, which stated the credentials of the researchers and the reason behind conducting the research. The interviewer briefed each participant on the total confidentiality of answers and identity. At the time of the interview, no other individual was present except the interviewers and the participant.

Participants were asked if they knew about digital surveillance or studies that used Google Trends. The ones who answered in the affirmative were given a list of the ten included terms (derived from the Delphi rounds) and were asked to choose all the terms they recognized. They were then asked to describe each term they recognized to assess their knowledge. If the answer was correct, they were further asked to give an example or use of the term to evaluate their comprehension. The interviewers recorded their observations at the time of the interview itself. The two calibrated interviewers evaluated the judgment on the answers of each participant for each term. The recorded scores of each interviewer were tabulated and later sent for statistical analysis.

Phase 4. Data analysis

Statistical analysis included calculating the rate of recognition, knowledge, and comprehension for each term, which was done on Orange Data Mining Software (version 3.39.0). To calculate the magnitude of the difference between recognition, knowledge, and comprehension, a t-statistic was calculated based on the mean difference between recognition and knowledge, recognition and comprehension, and knowledge and comprehension. The p-value was calculated based on the t-statistic to evaluate if the difference was statistically significant.

RESULTS

Of the 42 participants contacted, 31 confirmed they were aware of digital surveillance studies or studies that use Google Trends. The mean age of participants (21 male and 10 female) was 33 years. 24 participants had a post-graduation degree, five had a graduation degree, and two stated that they were currently enrolled in the PhD program. The least time recorded for an interview was 12 minutes, and the maximum time was 16 minutes.

Participants recognized, knew, and comprehended the terms' cross-sectional analysis', 'Google Scholar', and 'Datasets'. Based on the response rates, 'real time', 'time trend analysis', and 'predictive/forecast models' were the least recognized terms.

The paired t-test values revealed no statistically significant difference between recognition, knowledge, and comprehension of the presented terms ($p > 0.05$) (Table 2).

Table 2. Response rate of participants (Top); Paired significance Testing (Bottom)

Term	RR (%)	KR (%)	CR (%)
Digital Surveillance	100	90.32	90.32
Google Trends	100	93.54	83.87
Quotation Marks	83.8	67.7	64.51
Time Trend Analysis	45.16	32.25	25.8
Big Data	100	35.48	19.35
Cross-sectional Analysis	100	100	100
Google Scholar	100	100	100
Real-time	32.25	22.58	6.45
Predictive/Forecast Model	48.38	35.48	35.48
Datasets	100	100	100

	Mean Diff	SD	t-statistic	t-test	p-value
R vs K	4.1	5.87	0.22	0.054	0.83
R vs C	5.7	7.34	0.24	0.037	0.811
C vs K	1.6	2.06	0.25	0.037	0.817

R: Recognition, **K:** Knowledge, **C:** Comprehension
Source: by the authors

DISCUSSION

This pilot investigation uses a sequential mixed-methods approach to unearth digital surveillance understanding and related concepts among dental academicians. The first phase involved a deductive approach backed by a decision-rule with a predefined cutoff to finalize a list of terms fit for evaluating digital surveillance literacy. The qualitative responses from the interview rounds were then translated by calibrated raters for statistical analysis.

The authors searched the PubMed database using the keywords "Google Trends", "Digital Surveillance", and "Dentistry" using the necessary (truncations and Boolean operators) to search for studies in English till 2025. Title screening of these 27 results revealed that digital surveillance has been used in the field of dentistry to evaluate data based on people's search patterns on common oral problems, mouth cancer, toothache, dental caries, molar incisor hypomineralization, dental economics, facial esthetics, dental contact lenses, oral and maxillofacial surgery, orthodontic aligners, bruxism, dental trauma, and pediatric dentistry.

Despite its prominent use in recent times, the authors postulated its lack of awareness among dental academicians. Thus, we opted for a word recognition, knowledge, and comprehension tool, previously used as an intervention in evaluating literacy-based studies.[6-10] Based on our results, we can infer that recognizing a term might not necessarily mean that the participant had a thorough knowledge of the term. However, complete knowledge does not necessarily translate into comprehensive understanding.

Time trend analysis, real-time, and predictive/forecast models are key components of digital surveillance studies. Dental academicians' lack of comprehension of these phrases implies their ineptness in understanding the research methodology of digital surveillance studies.

This study had two notable shortcomings. Firstly, the preliminary question of whether the academician had or had not heard about digital surveillance might have been answered by overestimating or underestimating their knowledge, leading to a reporting/response bias. Secondly, while the threshold was set to three years of academic experience, no records were maintained to understand the educational levels or achievements of the participants.

This study can be improved by increasing the sample size and exploring different study designs for literacy assessment. It also highlights the need for a valid and reliable tool to standardize the aptitude testing of academicians concerning digital surveillance in research.

CONCLUSION

While digital surveillance has been used prominently in dentistry recently, academicians lack an in-depth awareness of its concepts. Based on the response rates, word recognition, knowledge, and comprehension of terms related to digital surveillance might not necessarily be streamlined.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

CORRESPONDING AUTHOR

Balraj Shukla
balrajshukla@hotmail.com
Department of Pediatric and Preventive Dentistry
College of Dental Sciences and Research Centre
Ahmedabad, India

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