ORIGINAL ARTICLE POJ 2025:17(2) 105-113

Is Biostatistics Relevant to Dentists? Understanding Pakistani Dental Professionals Knowledge, Attitude and Perceptions towards Biostatistics for Research and Professional Excellence

Sanaa Masood Aslam[a], Dil Ruba[b], Aymen Malik[c], Farah Farhan[d], Sadaf Rafi[e], Fizza Sahar Anwar[f], Batool Zara[g]

Abstract

Introduction: The objective of this study was to assess the knowledge, attitudes, and perceptions of dental faculty in a teaching dental hospital regarding bio-statistics as it relates to evidence-based dentistry.

Methodology: A cross-sectional survey was conducted on 231 licensed and registered dental practitioners from two teaching dental hospitals. A stratified sampling was applied by dividing the sample into three homogeneous groups. A closed-ended questionnaire containing questions pertaining to knowledge, attitude, and general perception was used, with responses recorded on a Likert scale. IBM SPSS Version 23 was used to perform descriptive and univariate data analyses (T- test). A p-value of <0.05 was considered statistically significant when comparing knowledge, attitudes, and perceptions.

Results: A response rate of 84.3% was achieved. 66.6% of the respondents found bio-statistics a difficult subject. 73.0% agreed that their training in bio-statistics is not adequate, while 62.7% respondents were unable to design and analyse their own research projects confidently. Although 70.1% claimed that knowledge of bio-statistics is an important part of evidence-based dentistry practice only 25.9% felt that learning bio-statistics would benefit their career.

Conclusion: Hospital-based dentists were found to have inadequate knowledge and training in the bio-statistics. Training programs must be re-evaluated and tailored for inclusion and integration of bio-statistics instruction as applied to dentistry to enable prospective dental professionals understand and solve dental problems/ challenges quantitatively.

Keywords: Attitude, bio-statistics, Dentists, Knowledge, Perception

Date of Submission: 19-Mar-2025 **Date of Final Revision:** 15-Dec-2025 **Date of Approval:** 21-Dec-2025

Introduction

Advances in dentistry and the emergence of evidence-based practices have emphasized the need to bridge the gap between theoretical knowledge and its clinical application. Evidence-based dentistry enables clinicians to make informed decisions grounded in scientific data rather than subjective judgment.[1]

bio-statistics plays a critical role in this process by providing a quantitative framework for evaluating treatment outcomes, comparing modalities, allocating resources, and accounting for demographic and socio-economic influences on patient care.[2-6] With the rapid expansion of scientific literature, statistics have become indispensable for validating research

[a] MDPH(UK), BDS(Ok), PhD (ABD), Assistant Professor, Community Dentistry, Foundation University College of Dentistry Islamabad

[b,c] BDS, RDS, FUCD, Islamabad.

[d] BDS, MPhil Oral Pathology, MHPE, Ex-Assistant Professor, FUCD Islamabad

[e] BDS, MCPS, MPhil Oral Medicine, Senior Registrar Oral Medicine, FUCD, Islamabad.

[f] BDS, MHPE, Assistant Professor, FUCD, Islamabad.

[g] Corresponding Author: BDS, MCPS, MPH, C-Ortho, AcMed, Professor/HOD Periodontology, FUCD
E-mail: batool_zara@hotmail.com

findings.[7,8] However, many dental professionals remain dependent on statisticians due to limited knowledge and confidence in interpreting analyses.[7,8]
In Pakistan, the British system of medical education continues to prevail, with bio-statistics taught within Community Medicine (MBBS) and Community Dentistry (BDS).[9-11] Students often perceive the subject as burdensome due to limited mathematical background, while instruction is frequently delivered by teachers with minimal expertise.[9]
This study aimed to assess the knowledge, attitudes, and perceptions of dental professionals in a teaching dental hospital regarding bio-statistics, focusing on basic sciences faculty and clinical postgraduate trainees. The findings are intended to inform future initiatives, such as workshops and conferences, to strengthen competencies in bio-statistics for research and evidence-based practice.

Methodology

A cross-sectional study was conducted to evaluate the knowledge, attitudes, and perceptions of dental professionals regarding bio-statistics. The study population consisted of academicians and clinicians working in teaching tertiary care dental hospitals of Islamabad and Rawalpindi which provides house job. Six such hospitals were identified, of which two were randomly selected using a lottery method to ensure fairness in sampling. Data collection took place over an eight-month period, from August 2020 to January 2021, following the necessary permissions and strict adherence to COVID-19 protocols.

Ethical approval was obtained from the Ethical Review Board at Foundation University Medical College/Hospital, ERC number FF/FUMC/215-3 Phy/19. Written informed consent was obtained from all participants, and confidentiality was assured.

Dentists working at targeted tertiary care teaching dental hospitals of Islamabad and Rawalpindi, were used for calculating sample size. Using OpenEpi version 3, the sample size was calculated based on a 25% expected frequency, a 95% confidence interval, and referencing similar studies conducted in India due to comparable socio-economic and educational contexts.[8] The required sample size was estimated at 278 participants.

On the days of data collection, 274 eligible dental professionals were present across the selected hospitals. Of these, 231 dentists provided informed consent and completed the questionnaire, resulting in a response rate of 84.17%.

A stratified sampling technique was employed, stratifying the study population into three groups: (i) faculty of basic dental sciences, (ii) faculty of clinical dental sciences, and (iii) postgraduate clinical trainees. Within each stratum, all available dentists were included regardless of designation, gender, or years of teaching/clinical experience.
Dentists currently listed on the official faculty or clinical roster of the selected hospitals, and who consented to participate, were included in the study. Exclusion criteria were:
Dentists on long-term leave or administrative postings during the study period.
Dentists with prior formal training in bio-statistics (e.g., certification courses or advanced degrees).

Incomplete or inconsistent questionnaire responses.
Data were collected using a structured, close-ended questionnaire adapted from Batra et al. (2014).[8] The tool comprised four major domains:

1. General Knowledge of bio-statistics
2. Perceptions regarding Training and Knowledge
3. Attitudes towards bio-statistics

4. Application in Research and Clinical Practice

Each item was scored on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Respondents were also categorized according to demographic variables such as gender, years of academic/clinical service, departmental affiliation, and career focus.

The questionnaire was first piloted among a small group of private practitioners and postgraduate faculty to ensure clarity and comprehensibility. Face validity was confirmed by experts at the Foundation University Islamabad (FUI). Following revisions, the finalized questionnaire was self-administered with the assistance of focal persons/co-researchers at the hospitals.

Statistical Analysis:

Data were entered and analyzed using IBM SPSS Statistics version 23.0. Descriptive statistics were applied: categorical variables were presented as frequencies and percentages, while continuous variables were expressed as means and standard deviations.

For inferential analysis, univariate methods were employed. Specifically, independent sample t-tests and one-way Analysis of Variance (ANOVA) were conducted to assess differences in mean scores across demographic subgroups (e.g., gender differences in knowledge scores or attitude variations across levels of teaching experience).

Only univariate analysis was undertaken because the primary objective was exploratory, to identify direct associations between demographic variables and outcome measures. Multivariate analysis was not performed to minimize overfitting and avoid drawing potentially unstable conclusions from the modest sample size. The results of univariate testing serve as a basis for identifying variables of interest for more complex analyses in future, larger-scale studies.

Result

Out of a sample of 278, 231 completed the questionnaires contributed to a response rate of 84.17%. Out of these 231 responses, 62 (26.8%) were male and 169 (73.2%) were female dental professionals.

Majority of the respondents, 149 (64.5%), were from clinical dental sciences faculty, while 33 (14.3%) and 49 (21.2%) were from basic dental faculty and postgraduate clinical training respectively. There were 64 (27.7%) professionals with clinical non-academic career focus, 158 (68.4%) had a mix of clinical-academic background while only 9 (3.9%) had research-oriented career focus.

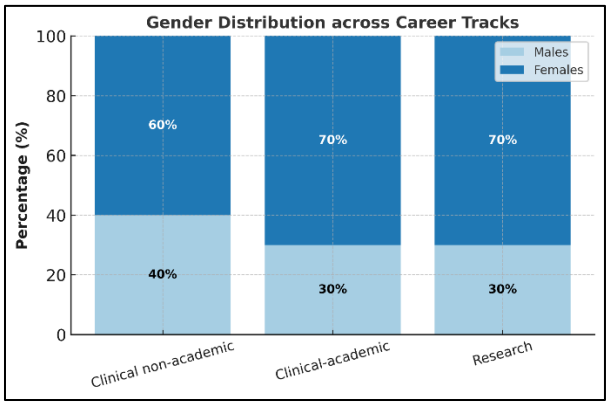

Fig. I: Distribution of career-focus in dentistry profession on basis of gender

As shown in Figure I, the male gender is significantly more oriented towards clinically focused career as compared to females who are more focused towards research and academic career (p=0.03). In terms of teaching experience, most of the respondents, 151 (65.4%), had 0-2 years of teaching experience while 11 (4.8%) had a teaching experience of more than 10 years.

With respect to the clinical dental experience, 86 (37.2%) had 0-2 years of clinical experience while 40 (17.3%) had more than 10 years of clinical practice. The demographic characteristics of study respondents are summarized in Table I.

Characteristics		n(%)
Gender	Males	62 (26.8%)
	Females	169 (73.2%)
Department	Basic dental faculty	33 (14.3%)
	Clinical dental faculty	149 (64.5%
	Postgraduate clinical training	49 (21.2%)
Career Focus	Clinical non-academic	64 (27.7%)
	Clinical academic	158 (68.4%)
	Research	9 (3.9%)
Years of teaching	0-2 years	151 (65.4%)
	3-5 years	45 (19.5%)
	5-10 years	24 (10.4%)
	>10 years	11 (4.8%)
Years of clinical practice	0-2 years	86 (37.2%)
	3-5 years	66 (28.6%)
	5-10 years	39 (16.9%)
	>10 years	40 (17.3%)

Table-I: Summary of demographic characteristics of study respondents (n=231)

Regarding use of statistician services, 16 (6.9%) respondents reported that they had taken help from statistician for deciding study design, 12 (5.2%) for sample size calculation, 19 (8.2%) for preparation or tables/graphs, 122 (52.8%) for data analysis and 62 (26.8%) for all aforementioned tasks as given in Figure II.

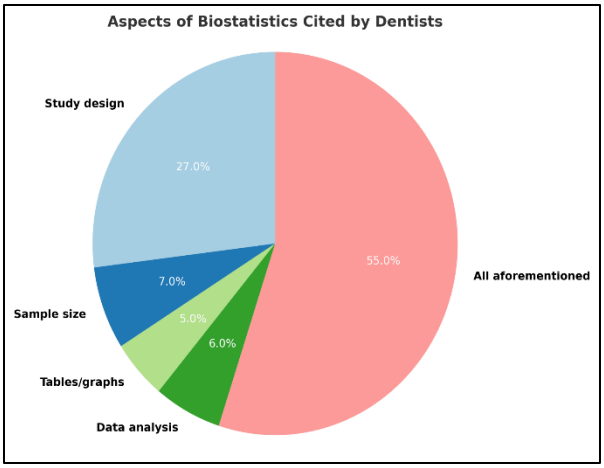

Fig. II: Percentage of respondents who had hired statistician to perform research/bio-statistics tasks for their study

The responses to perception, knowledge, and attitude of respondents regarding importance of bio-statistics in dentistry is given in Table – II.

	Responses- N (%)				
	1	**2**	**3**	**4**	**5**
General Perception					
bio-statistics is a difficult subject	8 (3.5%)	11 (4.8%)	58 (25.1%)	117 (50.6%)	37 (16.0%)
bio-statistics is more difficult than any other subject in dental training	5 (2.2%)	68 (29.4%)	44 (19.0%)	87 (37.7%)	27 (11.7%)
bio-statistics would be more helpful for teachers and consultants if they understood dentistry within the dental field	5 (2.2%)	5 (2.2%)	26 (11.3%)	151 (65.4%)	44 (19.0%)
It would benefit my career to better understand bio-statistics	18 (7.8%)	105 (45.5%)	48 (20.8%)	41 (17.7%)	19 (8.2%)
Knowledge & Training					
My training in bio-statistics is adequate for my needs	40 (17.3%)	129 (55.8%)	30 (13.0%)	21 (9.1%)	11 (4.8%)
The current level of training in bio-statistics in dentistry is adequate	36 (15.6%)	119 (51.5%)	34 (14.7%)	40 (17.3%)	2 (0.9%)
My previous bio-statistics coursework was taught effectively	21 (9.1%)	105 (45.5%)	70 (30.3%)	33 (14.3%)	2 (0.9%)
I am able to tell when the correct statistical method has been applied in my study	50 (21.6%)	92 (39.8%)	48 (20.8%)	31 (13.4%)	10 (4.3%)
I am able to tell when the correct statistical method has been applied in my	39 (16.9%)	106 (45.9%)	50 (21.6%)	31 (13.4%)	5 (2.5%)

study					
I am able to conduct my own statistical analyses with confidence	55 (23.8%)	106 (45.9%)	33 (14.3%)	12 (5.2%)	25 (10.8%)
Attitude					
bio-statistics should be an integral part of most research	14 (6.1%)	41 (17.7%)	60 (26.0%)	88 (38.1%)	28 (12.1%)
bio-statistics is a necessary skill for a clinician not involved in research	27 (11.7%)	134 (58.0%)	31 (13.4%)	34 (14.7%)	5 (2.2%)
bio-statistics is an important part of evidence-based dentistry	12 (5.2%)	31 (13.4%)	26 (11.3%)	121 (52.4%)	41 (17.7%)
Knowledge of bio-statistics is necessary when evaluating dental literature	4 (1.7%)	13 (5.6%)	26 (11.3%)	147 (63.6%)	41 (17.7%)
Evidence based dentistry is important for clinical practice	6 (2.6%)	5 (2.2%)	17 (7.4%)	117 (50.6%)	86 (37.2%)
Response details; 1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree					

Table-II: Frequency of responses to perception, knowledge and attitude questionnaire by study respondents (N=231)

More than half of the respondents, 154 (66.6%), reported that bio-statistics is a difficult subject, whereas almost half of the respondents, 114 (49.3%) exclaimed bio-statistics is the most difficult subject than any other subject in dental training. It was reported by 60 (25.9%) respondents that learning bio-statistics would benefit their career. Majority of the respondents, 169 (73.0%), felt that their training in bio-statistics is not adequate, while 145 (62.7%) respondents said that they are unable to design and analyse their own research projects with confidence. Similarly, the majority of respondents, 162 (70.1%), agreed that having knowledge of bio-statistics is essential for practicing evidence-based dentistry.

	Perception		Knowledge		Attitude	
	Score	P-value	Score	P-value	Score	P-value
Gender						
Male	13.2±1.9	0.031	15.8±3.0	<0.001	17.6±2.5	0.416
Female	13.8±2.0		13.7±3.1		17.3±2.2	
Department						
Basic dentistry	13.8±2.1	0.033	16.1±2.9	0.001	17.1±1.6	0.735
Clinical dentistry	13.4±1.9		13.8±3.2		17.4±2.3	
Postgraduate training	14.3±2.2		14.4±3.2		17.4±2.8	
Career Focus						
Academic non-clinical	13.2±2.2	0.139	14.5±3.5	0.585	17.6±2.4	0.215
Academic + clinical	13.8±1.8		14.1±3.2		17.3±2.2	
Research	14.1±2.6		15.0±2.7		16.2±3.8	
Teaching experience						
0-2 years	13.7±1.8	0.719	13.9±3.2	0.038	17.6±2.4	0.016
3-5 years	13.5±2.5		14.3±3.1		17.5±1.7	
5-10 years	13.4±2.2		15.6±3.3		16.7±2.4	
>10 years	13.3±1.5		15.8±3.6		15.5±1.9	
Clinical experience						
0-2 years	13.8±1.9	0.169	13.5±3.1	0.037	17.3±2.0	0.037
3-5 years	13.6±1.2		14.4±3.4		18.2±2.4	
5-10 years	13.0±1.9		14.6±2.6		16.2±2.7	
>10 years	13.9±1.8		15.3±3.7		17.4±2.1	

Table-III: Comparison of perception, knowledge and attitude scores with demographic characteristics

Table III presents a comparison of perception, knowledge, and attitude scores based on gender, department, career focus, and experience in teaching and clinical practice. Males had a better knowledge score than females ($p<0.001$), respondents from basic dentistry sciences had better perception and knowledge score than clinical dentistry ($p=0.001$), respondents with greater years of teaching had a better knowledge score ($p=0.038$) but respondents with lesser teaching experience had a better attitude score ($p=0.016$), and respondents with greater clinical experience had higher knowledge and attitude score.

Discussion

Adequate knowledge, refined attitude, and profound realistic perceptions towards the discipline of bio-statistics is of great importance to evidenced based practice of dentistry. Epistemological deficit in the discipline of bio-statistics as applied to dentistry has become a reason for great concern and consideration in recent times. Research particularly among dental fraternity remains unexplored and circumscribed to traditional empirical methods in developing countries. Numerous studies have highlighted the significance of competency and skills in planning, conducting and analyzing evidence-based research/ data analysis for sustained improvement and professional development of clinicians in their expanded role and responsibilities for enhancement of heuristic healthcare delivery system through scientific and technological advancements. Medical/ dental colleges in both developing and developed countries have identified this need and significance of bio-statistics.[12-14] However, in South Asia, research remains an under-explored area by the dental fraternity. Despite acknowledging its importance most dentists find it difficult to familiarize themselves with it as reported in scientific literature pertinent to the region.[8,15,16] This study also reflects similar findings, highlighting a low interest in pursuing research and bio-statistics as a career focus. A significant proportion of respondents perceived bio-statistics as more challenging than other subjects in undergraduate and postgraduate dental training programs.

Apart from this, majority of the respondents believe that it is a field of science limited to teachers and consultants only and bio-statistics is of little significance and purpose in their own career. This was further reflected in the trends observed in this research as a majority of respondents had very little knowledge and poor attitude towards pursuing bio-statistics professionally. These findings are consistent with the results reported by Batra et al.[8] and Shetty et al.[17]

This may be due to the fact that the majority of licensed dentists throughout the world are working in the clinical areas and only a comparatively smaller number of them continue teaching as a primary profession. Consequently, they turn to seeking help in this area especially the component of data analysis for which more than half of them refer to statisticians.[18] This finding however is not limited to clinical practice dentists but oddly enough those who had received some form of training in statistical analyses and/or had past research experience also reported a notable self-perceived lack of competence in bio-statistics. A similar observation was noted by Javaili and Sunkund in dentists who had received extensive training in bio-statistics and had a sound past research experience.[19]

The inadequate knowledge and training of dentists in bio-statistics might be a reason for their lack of awareness of the importance of the subject. From the results of this study, nearly half of respondents admitted to being deficient in curriculum-based education and training in this discipline of research and as a

result they found themselves under-confident enough to analyse and interpret their own scientific work, hence referring to the statisticians. This aligns with the findings of Batra et al.[8], Wulff et al.[9], Swetha et al.[16], and Altman and Bland[20], all of whom have emphasized the lack of dental professionals possessing fundamental knowledge, a positive attitude, and favorable perceptions toward the subject of bio-statistics

Gender wise comparisons between males and females show the fact that males are more confident in carrying out the statistical test than females. Another statistically significant difference was found among different career orientations with the non-clinical subjects being most confident, followed by the post graduate students and finally the clinicians. This means that pursuit of a career can be a motivating factor for learning bio-statistics and research also reported by previous authors.[17,19]

Despite the current lack of knowledge and training the attitude of dentists towards learning remains equivocal and majority agree that bio-statistics is an integral part of research that plays a pivotal role in evidence-based dentistry. Similarly, it is important to have a knowledge of bio-statistics in order for the clinicians to interpret the latest literature in support of their clinical practice.

It can be interpreted from these findings that although bio-statistics can be introduced as an independent subject entity in undergraduate professional training curriculum of prospective dentists, in the absence of a robust assessment scheme, little change to improved levels of understanding and application of bio-statistics skills will be made. Although the same has been practiced in other South Asian countries such as India and Bangladesh in a variety of curricula diverging in scope, distributed time, topics covered and core- competencies focused.[21,22] For sustained improvements in bio-statistics and a skilled workforce, continued professional development courses including those on bio-statistics and research as part of post-graduate trainings, CME/CDE hours for retention of name in the national dentists' registry, integration of data science in undergraduate and post graduate dental training programs, workshops and small group interactive sessions using practice exercises can be considered as suggested by Okoro and Karibi[23] and Daher and Amin[24] in developing countries like Pakistan.

Limitations

The study design posed methodological challenges which include sampling limitation to teaching dental hospital faculty, and post-graduation trainees. For a more comprehensive generality of results, private general dentistry practitioners should also be surveyed in future research.

The data collection for this study was based on a closed ended questionnaire, which restricted the study to empirical knowledge and statistical analysis. Inclusion of qualitative methods such as open-ended questions or interviews could improve understanding of attitude and perspectives of dentists towards training in bio-statistics.

Conclusion

Dentists in Pakistan demonstrate limited knowledge of bio-statistics despite recognizing its importance for evidence-based practice, reflecting inadequacies in current dental education. Strengthening bio-statistics training within curricula and conducting further research to explore underlying gaps are essential to enhance research competency and evidence-based dental care.

Ethical Approval

The study was approved by the Foundation University Medical College/Hospital, ERC number FF/FUMC/215-3 Phy/19.

Disclaimer

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest

It is declared that the authors don't have any conflict of interest.

Authors' Contribution

SMA: conceptualization, study design, manuscript writing
DR: Data collection , initial draft
AM: Methodology , statistical analysis
FF: Literature review , data interpretation
SR: Final manuscript revision, data collection
FSA: Manuscript editing, proof reading
BZ: Final manuscript revision

References

1. Afrashtehfar KI, Assery MK. From dental science to clinical practice: knowledge translation and evidence-based dentistry principles. Saudi Dent J. 2017;29(3):83-92. doi:10.1016/j.sdentj.2017.02.002
2. Kalantharakath T. Knowledge and attitude of medical and dental postgraduate students toward practice of bio-statistics. J Postgrad Med Edu Res. 2015;49(1):1-4. doi:10.5005/jp-journals-10028-1134
3. Suryakantha AH. Community Medicine with Recent Advances. 3rd ed. New Delhi: Jaypee Brothers Medical Publishers; 2013.
4. Sujatha BK, Reddy MNT, Vijayan S. Assessment of knowledge, attitude, and perception about bio-statistics among faculty and postgraduate students in a dental institution, Bengaluru city – A cross-sectional survey. J Dent Res Rev. 2018;5:54-58. doi:10.4103/jdrr.jdrr_22_18
5. Gore A, Kadam Y, Chavan P, Dhumale G. Application of bio-statistics in research by teaching faculty and final-year postgraduate students in colleges of modern medicine: A cross-sectional study. Int J Appl Basic Med Res. 2012;2:11-16. doi:10.4103/2229-516X.96792
6. Scheutz F, Andersen B, Wulff HR. What do dentists know about statistics? Scand J Dent Res. 1988;96(4):281-287. doi:10.1111/j.1600-0722.1988.tb01557.x
7. Moskowitz EM. Statistics in dentistry. Who needs them? N Y State Dent J. 2007;73:4. PMID:17969473
8. Batra M, Gupta M, Dany SS, Rajput P. Perception of dental professionals towards bio-statistics. Int Sch Res Notices. 2014;2014:291807. doi:10.1155/2014/291807
9. Wulff HR, Andersen B, Brandenhoff P, Guttler F. What do doctors know about statistics? Stat Med. 1987;6(1):3-10. doi:10.1002/sim.4780060103
10. Khan N, Almas K. Need of bio-statistics in dental education. J Pak Dent Assoc. 1997;8(1):45-48.
11. Mahmood Z. State of bio-statistics in medical education and research in Pakistan. J Pak Med Assoc. 1996;46:161-163. PMID:8993047
12. Bourzgui F, Abidine Z, Diouny S, Serhier Z, Bennani OM. Assessment of knowledge, perception regarding bio-statistics and interpretation of research among Moroccan dental professionals. Int J Dent Res. 2019;4(2):49-54. doi:10.31254/dentistry.2019.424
13. Sami W. Bio-statistics education for undergraduate medical students. Biomedica. 2010;26:80-85.
14. Hannigan A, Hegarty AC, McGrath D. Attitudes towards statistics of graduate entry medical students: the role of prior learning experiences. BMC Med Educ. 2014;14:70. doi:10.1186/1472-6920-14-70
15. Zhang Y, Shang L, Wang R, Zhao Q, Li C, Xu Y, et al. Attitudes toward statistics in medical postgraduates: measuring, evaluating and monitoring. BMC Med Educ. 2012;12:117. doi:10.1186/1472-6920-12-117
16. Swetha JL, Arpita R, Srikanth C, Nutalapati R. Cognition, comprehension and application of bio-statistics in research by Indian postgraduate students in periodontics. J Indian Soc Periodontol. 2014;18:65-68. doi:10.4103/0972-124X.128219
17. Shetty AC, Al Rasheed NM, Albwardi SA. Dental professionals' attitude towards bio-statistics. J Dent Oral Hyg. 2015;7:113-118. doi:10.5897/JDOH2015.0161
18. Best AM, Laskin DM. Oral and maxillofacial surgery residents have poor understanding of bio-statistics. J Oral Maxillofac Surg. 2013;71:227-234. doi:10.1016/j.joms.2012.03.010
19. Javali SB, Sunkad M. Comparison of knowledge and attitude towards bio-statistics among oral health professionals. Int J Health Sci Res. 2016;6(9):32-39.
20. Altman DG, Bland JM. Improving doctors' understanding of statistics. J R Stat Soc Ser A Stat Soc. 1991;154:223-267. doi:10.2307/2983040
21. Mohd Ibrahim MS, Mohamad Zin AN, Haslim HZ, Che Musa MF, Sayed Kamar SH. Perceived knowledge and perceptions toward bio-statistics among dental and medical undergraduate students in International Islamic University Malaysia. Int J Oral Health Sci. 2022;3:111-123. doi:10.31436/ijohs.v3i1.97
22. Guzman LM, Pennell MW, Nikelski E, Srivastava DS. Successful integration of data science in undergraduate bio-statistics courses using cognitive load theory. CBE Life Sci Educ. 2019;18(4):ar49. doi:10.1187/cbe.19-02-0041

23. Okoro PE, Karibi EN. Knowledge and use of bio-statistics among resident and junior doctors at the University of Port Harcourt Teaching Hospital, Port Harcourt. Niger J Surg. 2019;25(1):60-63. doi:10.4103/njs.NJS_37_18

24. Daher AM, Amin F. Assessing the perceptions of a bio-statistics and epidemiology module: views of Year 2 medical students from a Malaysian university. A cross-sectional survey. BMC Med Educ. 2010;10:34. doi:10.1186/1472-6920-10-34