

Original Research Article

## Comparison of Knowledge and Attitude towards Biostatistics among Oral Health Professionals

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### ABSTRACT

**Objectives:** To find out the practice of Biostatistics as a tool by the Oral Health Professionals in their routine work like clinical decision making, comparing efficacy, drawing inferences and also comparison of knowledge and attitude towards Biostatistics.

**Methodology:** Cross-sectional study using self-administered, validated questionnaire, among the faculty, final year and postgraduate students of SDM College of Dental Sciences and Hospital, Dharwad, Karnataka, India.

**Results:** Out of a total of 269 questionnaires were distributed among teaching faculty, final year students and postgraduate students, in which only 212 questionnaires were received with dropout rate of 21.20%. The response rate was 78.80%. Most of the postgraduate students (mean=3.30) believed that, the Biostatistics is more difficult than other subjects of dental training as compared to teaching staff (mean=2.86) and interns (mean=2.78), the difference was significant ( $p=0.0180$ ). The total mean Perception of knowledge scores is  $42.73\pm 7.74$  and total mean Attitude scores is  $84.08\pm 15.51$ . The attitude towards the Biostatistics is similar among interns, postgraduates and teaching staff ( $p>0.05$ ).

**Conclusion:** The study showed a low level of perception of knowledge, and attitude towards Biostatistics in research and indicated an excessive motivation for further training is required. Therefore, there is a need of incorporating biostatistics as a subject in the undergraduate and postgraduate curriculum of dental / medical education.

**Key words:** Knowledge, Biostatistics, Useful Tool.

### INTRODUCTION

Knowledge of Biostatistics fulfills a substantial role in the scientific method taking into account the organization, description, analysis and interpretation of the data. Ongoing advances in knowledge and technology in healthcare has offered new and better ways to solve the key health problems. With the increasing volume and diversity of information, controversies, and complexities, particularly with the increasing cost of medical care, has necessitated a tool or application in order to

make a proper decisions about the care of individual patients or the delivery of health services. Perhaps Biostatistics fulfills this vacuum.

Knowledge of Biostatistics helps clinicians in determining test validity, designing research, and drawing inference. Without this a health professional may draw disastrous conclusions from clinical experience because, has no concept of appropriate scientific method. [1] Therefore, health professionals develop, at times, anxiety towards bio-statistics due to their

fear of mathematical formula. However, bio-statistics courses can, nowadays, be conducted without a high level of mathematics. [2]

Evidence-based Dentistry or Medicine (EBD/M) has appropriately focused attention on critical appraisal of clinical research. [3] Despite this motivation, statistical knowledge has remained poor among clinicians. [4,5] A result of this movement is that health specialists must develop their clutch of statistical principles. Altman and Bland, [6] Altman, [7] Morris [8] and Shah [9] have remarked on the importance of reversing this knowledge deficit. Despite these motivations to improve the knowledge and skill of epidemiological and statistical methods, the familiarity of statistical techniques of clinicians and medical faculty are still fragile as mentioned in the literature. Few of those citations are as follows: Reznick et al [10] indicated that residents of their survey showed suboptimal knowledge of statistics. Horton [11] pointed out that researchers may be able to understand the statistical results and interpret the outcome in research articles. Several studies have been conducted to address this issue and authors have indicated the importance to turn around this feeble situation. [12-15] The attitudes might influence their learning of statistical concepts as much as their cognitive abilities. The influence of attitudes towards bio-statistics on the development of statistical reasoning and thinking has been studied in different ways. [16,17] However, the attitudes towards Bio-statistics in health sciences' researchers are a new kind of research particularly pertinent due to an increasing number of researchers in this field.

Health professionals should understand the results of research and to make decisions after critically reviewing the evidence, they need to be equipped with good knowledge and understanding of concept and applications of Biostatistics. This can improve the clinical decision-making, programme assessment and

biomedical research; essentially used to verify the clinicians and researchers findings and feelings, and gives scientific validity for their inferences. [18]

However, studies conducted towards the perception of knowledge and attitude of oral health professionals towards Bio-statistics in India are scarce. Understanding the current level of perception of knowledge and attitude of oral health faculty towards Bio-statistics may help to revise the dental curriculum, teaching methods and continuing education programs, by incorporating this important field of research and data management. Therefore, this study was conducted to assess knowledge and attitude of oral health professionals towards bio-statistics in a private dental postgraduate institution in India.

## **MATERIALS AND METHODS**

It is a cross-sectional study among the faculty, final year and postgraduate students of SDM College of Dental Sciences and Hospital, Dharwad, Karnataka, India. A questionnaire was developed to acquire the information related to the aim of the study. The perception of knowledge questionnaire contained 18 questions on 5-point Likert scales of 'strongly agree' to 'strongly disagree' a phrased in the negative direction with 'strongly agree' was coded as '1' and 'strongly disagree' as '5' adapted from validated existing questionnaire. [19] However, the attitude questionnaire contained 27 questions on 5-point Likert scales of 'strongly agree' to 'strongly disagree' a phrased in the positive direction with 'strongly agree' was coded as '5' and 'strongly disagree' as '1' adapted from validated existing surveys that address attitudes toward statistics, [20] Demographic variables considered were gender, level of education, specialty, and department. The questionnaires were distributed among the teaching faculty and students of SDM College of Dental Sciences (SDMCDS) and Hospital, Dharwad, Karnataka, India in June 2012, after getting proper permission from

the competent authority. Before start of the actual study, the reliability of the questionnaire was performed with a convenient sample of 45 students and the split half reliability coefficient was 0.9141 and internal consistency (i.e. Cronbach alpha) ranges from 0.2451 to 0.5354. Then the questionnaire was distributed.

Later, the non-respondents were approached one more extra time after reminding then through phone call and met personally. SDM Dental college has 98 teaching faculty in its different departments, 81 final year students and 90 postgraduate students at the study time. After many follow-ups, the author was able to get back a response of 79.0% filled questionnaires. Initially, the data were analyzed descriptively using SPSS ver. 20.0. Chi-square test was used to determine the association between demographic variables (gender and academic ranks) and other responses.

Academic ranks were categorized into senior faculty, included assistant professors and higher ranks; and junior faculty included the lecturers and other teaching faculty. A one way ANOVA was performed to test significance differences between different demographic variables with knowledge and attitude scores followed by Tukey's multiple post hoc procedures. Karl Pearson's correlation coefficient technique is used to assess the relationships between knowledge and its components with total attitude scores towards the biostatistics. A stepwise multiple regression analysis was performed to assess the impact of components of total perception of knowledge on attitude towards the biostatistics. Consequently, a relative contribution of each independent factor was calculated by taking the beta coefficient and Pearson's correlation coefficient on total attitude towards the biostatistics. A statistical significance was set at 5% level of significance ( $p < 0.05$ ). In table 1 represented the description of study samples by socio-demographic characteristics.

## RESULTS

Out of a total of 269 questionnaires were distributed among teaching faculty, final year students and postgraduate students, in which only 212 questionnaires were received with dropout rate of 21.20%. The response rate was 78.80%. The response rate of female is significantly higher (58.49%) as compared to males (41.51%) ( $p = 0.0130$ ). Further, 57.08% of the respondents have MDS degree as compared to 42.92% with BDS degree ( $p < 0.05$ ). Response rates differed by year of training, with a significantly lower response rate among teaching faculty (23.58% vs 46.70% among postgraduate students and 29.72% among interns; ( $p < 0.05$ ). Similarly, the response rates differed by extensive teaching experience and career focus ( $p < 0.05$ ) (Table 1).

**Table 1: Description of study sample**

Characteristic	No of samples	Percentage of samples
<b>Gender</b>		
Male	88	41.51
Female	124	58.49
<b>Qualifications</b>		
BDS	91	42.92
MDS	121	57.08
<b>Year of training</b>		
Interns	63	29.72
Postgraduate	99	46.70
Teaching staff	50	23.58
<b>Extensive teaching experience</b>		
Yes	55	25.94
No	157	74.06
<b>Career focus</b>		
Clinical and non academic	66	31.13
Clinical and academic	103	48.58
Research and academic	33	15.57
Non-health	10	4.72
<b>Total</b>	<b>212</b>	<b>100.00</b>

Responses to each of the individual survey questions are presented in Table 2. Most of the postgraduate students (mean=3.30) believed that, the Biostatistics is more difficult than other subjects of dental training as compared to teaching staff (mean=2.86) and interns (mean=2.78), the difference was significant ( $p = 0.0180$ ). But, the postgraduate and teaching staff felt that the biostatisticians have high status in the Dental field as compared to interns ( $p = 0.0310$ ).

Questions on perceptions of knowledge and training revealed that the respondents are neutral about the ability to design of research projects with confidence, in which interns are disagree with ability to design of research projects with confidence as compared to postgraduate and teaching staff are neutral ( $p=0.040$ ). A significant on opinion of interns on Biostatisticians should be an integral part of most research is neutral ( $p=0.0250$ ) and Biostatistics is a necessary skill for a clinician involved in

research ( $p=0.0370$ ) as compared to postgraduate and teaching staff. Nevertheless, comparable perceptions of knowledge and training was seen among interns, postgraduate and teaching staff with items like training in biostatistics is adequate for my needs, current level of training in biostatistics in dentistry is adequate, able to tell when the correct statistical methods have been applied and able to conduct my own statistical analyses with confidence ( $p>0.05$ ).

Table 2: Item wise responses of respondents

Items	Mean scores of				H-value	P-value
	Interns	Post graduate	Teaching staff	Total		
<b>General perceptions</b>						
Biostatistics is more difficult than other subjects of dental training	2.78	3.30	2.86	3.04	8.0290	0.0180*
Bio-statisticians would be more helpful as teachers and consultants if they understood more dentistry	3.13	3.44	3.22	3.30	2.4740	0.2900
Within the Dental field biostatisticians have high status	2.81	3.22	2.96	3.04	6.9740	0.0310*
It would benefit my career to better understand biostatistics	3.02	3.44	3.34	3.29	5.2960	0.0710
<b>Perceptions of knowledge and training</b>						
My training in biostatistics is adequate for my needs	2.75	2.72	2.70	2.72	0.1220	0.9410
The current level of training in biostatistics in dentistry is adequate	2.76	2.75	2.62	2.72	1.2080	0.5470
I am able to tell when the correct statistical methods have been applied	2.46	2.52	2.84	2.58	4.0750	0.1300
I am able to design my own research projects with confidence	2.46	2.53	3.00	2.62	7.4190	0.0240*
I am able to conduct my own statistical analyses with confidence	2.40	2.36	2.74	2.46	3.5380	0.1700
<b>Perceptions of biostatistics and research</b>						
Biostatisticians should be an integral part of most research	3.35	3.80	3.64	3.63	7.4100	0.0250*
Biostatistics is a necessary skill for a clinician involved in research	3.37	3.82	3.66	3.65	6.5690	0.0370*
Biostatisticians are not necessary for most research	2.63	2.34	2.56	2.48	3.7530	0.1530
<b>Perceptions of biostatistics and evidence-based dentistry</b>						
Biostatistics is an important part of evidence-based dentistry	3.40	3.58	3.74	3.56	3.0970	0.2130
Knowledge of biostatistics is necessary when evaluating dental literature	3.44	3.74	3.70	3.64	3.8280	0.1480
<b>Attitude towards Biostatistics</b>						
A good research must have training in Biostatistics	3.59	3.83	3.84	3.76	2.5630	0.2780
I can easily understand how Biostatistics relates to my career	3.32	3.11	3.58	3.28	7.2060	0.0270*
Biostatistics is really useful	3.51	3.51	3.54	3.51	0.2390	0.8870
Biostatistics is a worthwhile part of my area of study	3.49	3.46	3.42	3.46	0.2360	0.8890
Biostatistics is too mathematical oriented	3.63	3.46	3.60	3.55	1.5030	0.4720
Biostatistics is best left to the 'experts'	3.51	3.27	3.24	3.33	2.2250	0.3290
Biostatistics helps me to understand research in my specialty	3.68	3.48	3.50	3.55	1.5770	0.4550
Training in Biostatistics will make me better professional	3.68	3.51	3.46	3.55	1.7040	0.4270
Enrolling in a Biostatistics training course make me anxious	3.33	3.14	3.22	3.22	1.2480	0.5360
Biostatistics is very mysterious to me	3.17	3.08	3.18	3.13	0.3690	0.8310
Biostatistics is too complicate for me	3.29	3.21	3.06	3.20	1.2210	0.5430
Dealing with numbers makes me feel uneasy	3.19	2.97	3.06	3.06	1.3400	0.5120
Biostatistics knowledge is relevant to my area of study	3.48	3.48	3.50	3.49	0.0120	0.9940
I am excited about actually using Biostatistics in my job	3.35	3.07	3.36	3.22	5.0530	0.0800
Bio-statistical thinking is an important characteristic of good research	3.67	3.53	3.52	3.57	1.2980	0.5230
I would like to take more statistical training	3.56	3.38	3.14	3.38	4.2820	0.1180
I wish I have taken more statistics classes	3.35	3.35	3.06	3.28	2.0250	0.3630
Biostatistics become more understandable and useful in my career	3.52	3.38	3.26	3.40	1.9990	0.3680
Biostatistics is the science of uncertainty	3.22	3.03	3.22	3.13	1.9520	0.3770
The logic behind Biostatistics is not clear to me	3.32	3.21	3.16	3.23	0.4570	0.7960
It took me a long time to understand statistical concepts	3.57	3.44	3.38	3.47	2.2250	0.3290
It is difficult to expect the average professional to master and apply	3.48	3.26	3.26	3.33	2.3890	0.3030
You should be good in mathematics before attempting Biostatistics	3.35	3.06	3.36	3.22	4.9490	0.0840
Biostatistics is too theoretical to an average health professional	3.38	3.16	3.22	3.24	1.5340	0.4640
I feel difficult to write the statistical section of my articles.	3.59	3.53	3.48	3.53	0.4840	0.7850

\* $p<0.05$

Questions concerning perceptions of biostatistics and its relationship to research, the opinion was less strong regarding Biostatisticians should be an integral part of most research as compared to postgraduate followed by teaching staff ( $p < 0.05$ ) and Biostatistics is a necessary skill for a clinician involved in research ( $p < 0.05$ ). But, the perception of all most all respondents on Biostatisticians are not necessary for most research is disagree. Questions concerning EBM revealed that of respondents believed that biostatistics is an important part of EBM, and believed that knowledge of biostatistics is necessary when evaluating medical literature ( $p > 0.05$ ). The attitude towards the Biostatistics is similar among interns, postgraduates and teaching staff ( $p > 0.05$ ) except the teaching staff have good attitude towards the item they can easily understand how Biostatistics relates to their career as compared to interns and postgraduates ( $p < 0.05$ ).

The characteristics like gender, educational qualifications, year of training, extensive teaching experience and career focus were compared with respect to perception of knowledge and attitude towards biostatistics (Table 3). The total mean Perception of knowledge scores is  $42.73 \pm 7.74$  and total mean Attitude scores is  $84.08 \pm 15.51$ . Male and female respondents did not vary significantly in their overall knowledge and Attitude scores ( $p > 0.05$ ); however, the mean knowledge scores for the overall knowledge and Attitude scores are similar among respondents with graduate (BDS) and postgraduate (MDS) degree.

However, the intern, postgraduate students and teaching staff, respondents with and without extensive teaching experience have similar knowledge and Attitude scores ( $p > 0.05$ ). But, a significant and higher mean attitude scores towards the biostatistics is observed in research and academic as a career focus ( $89.33 \pm 16.73$ ) as compared to Clinical and non-academic ( $85.39 \pm 15.55$ ) and minimum is in clinical and academic as a career focus ( $81.04 \pm 14.35$ ) ( $p < 0.05$ ).

The relationships were established between perception of knowledge and attitude towards the Biostatistics scores of oral health professionals (Table 4). A significant and positive relationship is observed between attitude towards the Biostatistics scores with total perception of knowledge, general perception of knowledge, perceptions of knowledge and training, perceptions of knowledge of biostatistics and research and perceptions of knowledge biostatistics & evidence based dentistry in entire respondents, interns, postgraduate and teaching staff. It means that, the attitude towards the Biostatistics scores, total perception of knowledge and its components are dependent on each other ( $p < 0.05$ ).

Introduction to the four components of total perception of knowledge (general perception of knowledge, perceptions of knowledge and training, perceptions of knowledge of biostatistics and research and perceptions of knowledge biostatistics & evidence based dentistry) into the stepwise regression analysis showed that the contribution or influence of all of them was statistically significant and explained approximately 35.62% percent of the variance of attitude of Biostatistics ( $P < 0.05$ ).

Although two components (i.e. perceptions of knowledge biostatistics & evidence based dentistry and perceptions of knowledge and training) contributed significantly ( $P < 0.05$ ) in explaining 36.28% of the variance of attitude towards Biostatistics of interns. Also, two components (i.e. perceptions of knowledge of biostatistics and research and general perception of knowledge) was found to significantly contribute to attitude scores towards Biostatistics of respondents of postgraduate degree and explained approximately 48.32% percent of the variance of attitude of Biostatistics ( $P < 0.05$ ). Further, two components (i.e. perceptions of knowledge and training, perceptions of knowledge of biostatistics and research) was found to significantly

contribute to attitude scores towards Biostatistics of teaching staff and explained approximately 51.64% percent of the variance of attitude of Biostatistics (P < 0.05) (Table 4).

**Table 3: Comparison of gender, educational qualifications, year of training, extensive teaching experience and career focus with respect to perception of knowledge and attitude towards biostatistics scores**

Characteristic	Perception of knowledge scores	Attitude scores
	Mean±Std.Dev.	Mean±Std.Dev.
<b>Gender</b>		
Male	42.56±7.74	82.98±14.87
Female	42.85±7.77	84.85±15.96
t-value	-0.2681	-0.8681
P-value	0.7889	0.3863
<b>Qualifications</b>		
BDS	41.82±7.75	85.64±18.42
MDS	43.40±7.70	82.90±12.85
t-value	-1.4758	1.2736
P-value	0.1415	0.2042
<b>Year of training</b>		
Interns	40.75±8.55	86.22±20.18
Postgraduate	43.56±6.79	82.94±12.70
Teaching staff	43.58±8.13	83.62±13.74
F-value	2.9887	0.8899
P-value	0.0525	0.4122
<b>Extensive teaching experience</b>		
Yes	42.77±7.56	81.07±12.00
No	42.71±7.83	85.15±16.49
t-value	0.0466	-1.6974
P-value	0.9629	0.0911
<b>Career focus</b>		
Clinical and non academic	41.85±8.18	85.39±15.55
Clinical and academic	42.76±7.74	81.04±14.35
Research and academic	44.00±7.02	89.33±16.73
F-value	1.0073	4.8481
P-value	0.3670	0.0087*
<b>Total</b>	<b>42.73±7.74</b>	<b>84.08±15.51</b>

\*p<0.05

**Table 4: Step-wise regression analysis of attitude towards Biostatistics by perception of knowledge scores**

Year of training	Independent variables	Estimate	SE of estimate	t-value	P-value	R-value	F-value
Total	Intercept	48.86	5.08	9.6210	0.00001*	0.5968	28.6365*
	X1	3.02	0.56	5.3698	0.00001*		
	X2	-0.87	0.24	-3.6553	0.0003*		
	X3	1.41	0.61	2.3194	0.0213*		
	X4	0.55	0.28	1.9690	0.0500*		
Interns	Intercept	67.99	9.08	7.4838	0.00001*	0.6023	17.0791*
	X4	5.70	1.04	5.4686	0.00001*		
	X2	-1.62	0.53	-3.0645	0.0033*		
Postgraduate	Intercept	33.64	5.42	6.2028	0.00001*	0.6951	45.3101*
	X3	3.14	0.61	5.1411	0.00001*		
	X1	1.34	0.32	4.2480	0.00001*		
Teaching staff	Intercept	43.47	8.91	4.8816	0.00001*	0.7186	16.0184*
	X3	4.22	0.82	5.1425	0.00001*		
	X2	-0.96	0.35	-2.7640	0.0082*		

\*p<0.05 Note: X1=General perception of knowledge

X2=Perceptions of knowledge and training, X3=Perceptions of knowledge of biostatistics and research, X4=Perceptions of knowledge biostatistics & evidence based dentistry

## DISCUSSIONS

The results of present study suggest that 32.55% and 25.94% of oral health professionals have high perceived knowledge and attitude towards the bio-statistical concepts despite a clear appreciation of the importance. Even those with extensive research experience and

advanced statistical training thought they had a notable lack of competence. The existing literature on clinician statistical knowledge and research quality supports these observations, which should spur renewed efforts to improve bio-statistical education. Our study is limited in that we surveyed dental students, internal medicine

trainees, and dental faculty at a single institution looking into the study. It clearly shows the subjects have least perception about knowledge of Biostatistics with applications and its importance. The analysis shows; Biostatistics is more difficult than other subjects in Dental training, within the Dental field biostatisticians have high status, Biostatisticians should be an integral part of most research and Biostatistics is a necessary skill for a clinician involved in research. These statements are statistically significant in these items between interns, postgraduate and teaching staff in view of "p" value <0.05. The opinion of interns, postgraduate and teaching staff on understand Biostatistics and how it relates to their career is different. Expectedly, the interns have significant lowest perception about the designing their research projects with confidence compared to postgraduates and teaching staff. Fortunately, non-significant difference was observed between interns, postgraduates and teaching with their attitude towards the biostatistics.

## CONCLUSIONS

A fundamental knowledge of biostatistics is essential for every researcher especially health professionals for understanding the concepts, applications and importance of biostatistics. The study showed a low level of perception of knowledge, and attitude towards Biostatistics in research and indicated an excessive motivation for further training is required. Therefore, there is a need of incorporating biostatistics as a subject in the undergraduate and postgraduate curriculum of dental / medical education. The role that Statisticians play in the development of the academic curriculum is very important, especially if Problem based learning (PBL) is introduced as a teaching method in Medical Schools. It will remain however a challenge to successfully include it in this type of teaching, if not, it can be detrimental to Biostatistics and Research Methodology,

particularly in clinical Epidemiology and Evidence Based Medicine.

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## Contribution

The authors have their own individual contribution to this article. The study design, analysis, article writes up done by Dr. Javali, while data collection, data arrangement, article layout done by Dr. Mohan. The authors have no conflicts; no competition or contradictory interests and they read and approved the final manuscript.

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