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A questionnaire-based study to develop an instrument measuring poor interest in biostatistics among postgraduate medical students and faculties

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Abstract:

BACKGROUND: It has been realized by senior researchers that interest in biostatistics is very poor among medical professionals. Knowledge of biostatistics plays an important role in medical research. Studies conducted about knowledge, attitude toward biostatistics by many researchers, but there were no works about factors in relation to it. Considering this gap, we tried to develop a new instrument.

MATERIALS AND METHODS: Item generation and questionnaire formation were done using focus group discussion involving seven experts from different departments of medical colleges. Face validity and content validity and pilot testing were carried out step by step. In estimating reliability, internal consistency measured after collecting data from 66 study participants. Data were collected through self-administered paper-based questionnaire where response in each item was in five-point Likert scale. Cronbach's alpha for reliability analysis was used.

RESULTS: In first stage, item generation through FGD, then face validity was assessed by senior faculties. Content validity was checked by Aiken's V index. In initial stages, with six items, Cronbach's alpha was 0.805. Scale mean and variance were 24.24 and 27.26. After final reliability testing, it became 0.866 with four items where scale mean and variance came to 15.85 and 16.38.

CONCLUSION: All the six items were important factors. Reliability improved when knowledge in statistics in higher secondary level and biostatistics classes in PG course were eliminated as factors. More qualitative research is needed for better understanding of this concept.

Keywords:

Attitude, biostatistics, interest, knowledge, practice, reliability, validity

Introduction

Biostatistics is well recognized as an essential tool in clinical decision-making as well as in health management and research.^[1] It provides an outstanding contribution by gathering information in times of uncertainty. Despite all levels of motivation, clinicians have not shown much interest in it.^[2] Studies conducted decades ago found major lacunae in physicians'

knowledge of statistics.^[3,4] More recent studies have found this problem somewhat reduced in magnitude.^[4-6] India ranks 12th among the countries engaged in medical research,^[7] which is also not encouraging at all. There are fewer undergraduate students in India doing a research project at a given time.^[8]

Studies showing attitudes toward biostatistics are available on literature search, but no studies have been done

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about the factors in relation to poor interest in this subject among postgraduate medical students and faculties. Outcome of poor interest may adversely affect medical research process.^[9] Considering the importance and magnitude of the problem, a focus group discussion (FGD) involving seven experts in different field of medical research were done to discuss concept poor interest and related factors. We prepared a questionnaire after generating six items (factors). We will try to evaluate this questionnaire among our study participants for validity and reliability. If found valid and reliable, factors related to poor interest can be assessed among researcher using this newly formed scale.

Materials and Methods

Study design and setting

It was a mixed study design, FGD for item generation in initial stage was qualitative in nature, and validity testing in subsequent stages and reliability analysis in final stage was quantitative research design. A study was carried out in different stages in a Tertiary Care Government Medical College and Hospital from September 2020 to October 2020.

Study participants and sampling

Study subjects included in our study were senior teaching faculties and second and final year postgraduate trainees. Purposive sampling method was used.

Data collection tool and technique

Using purposive sampling method, seven experts of different medical colleges were invited to discuss the factors in relation to poor interest in biostatistics. In this FGD, item generation and questionnaire were formed in three phases. The decision was utilized to conceptualize the phenomenon of interest with the items for the development of a new instrument. To avoid bias, experts were kept anonymous, but their judgments were open. In the first stage, principal investigator distributed items information elements in the form of texts. Next phase passed through revision and then sent back for final verification, resulting in formation of a questionnaire consisting of six items representing factors. Total procedure took 3 days. This is a qualitative research design utilizing FGD to develop a new tool [Table 1 and Figure 1].

In second and third stage, face validity and content validity were done with the help of five senior faculties selected by purposive sampling technique. Validity is defined as the extent to which a concept is accurately measured in a quantitative study. A subset of content validity is face validity, where experts were asked their opinion about whether an instrument measures the concept intended. Basically face validity refers to

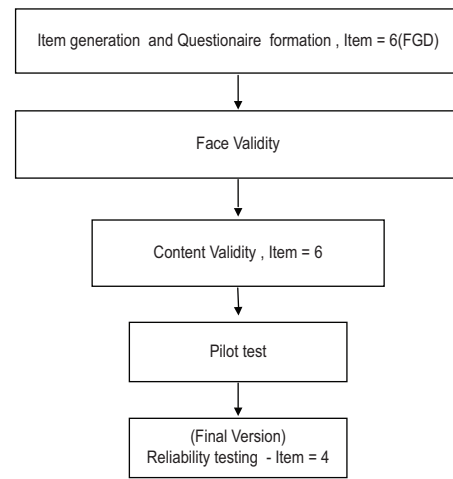


Figure 1: Study flow chart

the degree to which a test appears to measure what it purports to measure. In doing face validity, experts gave their opinion in a five-point Likert scale from poor to very good, and thus face validity score was quantified.

In testing content validity, items after being tested for face validity, placed to experts and for quantification of each item, Aiken's V-index was used.^[10] Value >0.8 indicates good content validity. This category looks at whether the instrument adequately covers all the content that it should with respect to the variable. In other words, degree to which the instrument covers the entire domain related to the concept it was designed to measure. It was a web-based Delphi technique which uses consensus among a group of experts and is based on the assumption that group opinion has a greater validity than an individual opinion.^[11] In third stage, pilot testing (web based) done in seven study participants, based on 10% of total sample size of 66 (10 per item)^[12] to check readability, clarity, average time taken by each participant, and also minor corrections if needed. No modifications were needed; structure of the questionnaire remained same, capturing the same six items.

All postgraduate trainees, senior residents, and medical faculties were included in the study. Those who were unwilling to participate were excluded from the study. Owing to less interaction of first-year postgraduate trainee with biostatistics, they were kept outside the study.

Ethical issues in the study

After having approval from the Institutional ethics committee (RGMC/IEC/2020/03), Informed consent was taken before participation into the study. Each participant received self-administered paper-based questionnaire after explaining the purpose of the study, their freedom to participate and a confirmation of confidentiality. Their identity was kept anonymous in

Table 1: Measurement tool

Q. NO Question		Responses				
		Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
1	My knowledge in statistic at 10+2 level was poor					
2	I am weak in mathematics					
3	My knowledge in Biostatistics will not affect my result in post graduate course					
4	Being a doctor I don't require biostatistics					
5	I don't need to learn Biostatistics for publication of research works as other co-author may serve the purpose					
6	No schedule classes for Biostatistics in PG course					

(Tick your option. Choose only one option)

questionnaire considering sensitive nature of some of the items. After checking information elements in our new data collection tool in this cross sectional study, principal investigator collected data from a total of 66 study participants.

Finally, collected data were analyzed to estimate Cronbach's alpha for internal consistency (reliability) using Statistical Package for the Social Sciences (SPSS) version 16. This is the second measure of quality in a quantitative study is reliability or the accuracy or homogeneity of an instrument. In other words, the extent to which a research instrument consistently has the same results if it is used in the same situation on repeated occasions. Cronbach's alpha estimation procedure is based on correlation among items, item-total correlation along with improvement of alpha value if any item in the scale is deleted. Cronbach's alpha value increases as the intercorrelations among tool items increase. Because intercorrelations among test items are maximized when all items bear same construct, it indicates the degree to which a set of items measures a single unidimensional latent construct. During data entry, with the help of second author, coding and recoding the variables (items) as they were in Likert scale (ordinal) were done for the purpose of reliability analysis.

Results

In the first stage, there were six items [Table 1]. In stage of face validity, "very good" rated by the experts for questionnaire items. Aiken's-V index for each item were >0.8 signifying good content validity.^[13] Number of items remained same. Results of reliability testing have been presented in Tables 2-7. With six items, Cronbach's alpha value obtained 0.805 [Table 6]. Items deleted section shows, if item 1 and item 6 were deleted, alpha came to 0.866 [Table 7]. An acceptable reliability score is one that is 0.7 and higher.^[14-16] Finally, our new instrument consists of four items and having an alpha value of 0.866 and makes it a good questionnaire which is valid and reliable.

Table 2: Item statistics

Items	Mean	SD
Knowledge in statistics in 10+2 level	4.26	1.181
Weak in mathematics	3.91	1.173
Relation with results of PG degree	4.00	1.190
Not useful for doctors	4.00	1.190
Publication not affected	3.94	1.239
Biostatistics classes in PG course	4.14	1.357

SD=Standard deviation

Discussion

Realizing importance of biostatistics and inclinations of medical professionals toward it, in the initial stage FGD helped us to construct an instrument with six items. Principal investigator played main role in conducting this decision-making stage. After item generation, face validity was done by senior researchers. Aiken's V index was used for content validity. All the factors were important contributors in our study, but knowledge in biostatistics and biostatistics classes in PG courses when removed from the instrument, reliability improved. Four items in the final scale seems relevant in this study. It is a matter of understanding and judgments whether to keep or remove the items considering infrastructure in research and development, geographical region, and nature of temporal relationship (changing scenario in medical curriculum).

To the best of our knowledge, this is first of its kind to develop such a new instrument (we call it "Roy's Scale Of Poor Interest In Biostatistics") as per literature review in India and also in the world. Literature survey gives us information about knowledge, attitude, and importance of biostatistics. As less interest in this area may adversely affect research process, evaluation of factors concerned were necessary.

From this study, we have developed a new instrument which is valid and reliable. This instrument addresses different factors of importance in it. Assuming its unidimensional nature, construct validity was not done. Furthermore, test for stability and equivalence were not

Table 3: Inter-item correlation matrix

Items	Knowledge in Statistics in 10 + 2 level	Weak in mathematics	Relation with results of PG degree	Not useful for doctors	Publication not affected	Biostatistics classes in PG course
Knowledge in statistics in 10 + 2 level	1.000	0.295	0.427	0.383	0.421	-0.157
Weak in mathematics	0.295	1.000	0.518	0.661	0.610	0.375
Relation with results of PG degree	0.427	0.518	1.000	0.587	0.626	0.181
Not useful for doctors	0.383	0.661	0.587	1.000	0.699	0.352
Publication not affected	0.421	0.610	0.626	0.699	1.000	0.270
Biostatistics classes in PG course	-0.157	0.375	0.181	0.352	0.270	1.000

Table 4: Inter-item covariance matrix

Items	Knowledge in statistics in 10 + 2 level	Weak in mathematics	Relation with results of PG degree	Not useful for doctors	Publication not affected	Biostatistics classes in PG course
Knowledge in statistics in 10 + 2 level	1.394	0.408	0.600	0.538	0.616	-0.251
Weak in mathematics	0.408	1.376	0.723	0.923	0.887	0.597
Relation with results of PG degree	0.600	0.723	1.415	0.831	0.923	0.292
Not useful for doctors	0.538	0.923	0.831	1.415	1.031	0.569
Publication not affected	0.616	0.887	0.923	1.031	1.535	0.455
Biostatistics classes in PG course	-0.251	0.597	0.292	0.569	0.455	1.843

Table 5: Summary item statistics

Items	Mean	Minimum	Maximum	Variance
Item means	4.040	3.909	4.258	0.017
Item variances	1.496	1.376	1.843	0.032
Inter-item covariances	0.609	-0.251	1.031	0.098
Inter-item correlations	0.417	-0.157	0.699	0.047

Table 6: Item-total statistics (initial reliability analysis)

Items	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
Knowledge in statistics in 10 + 2 level	19.98	22.046	0.345	0.324	0.820
Weak in mathematics	20.33	18.810	0.695	0.511	0.745
Relation with results of PG degree	20.24	19.110	0.648	0.468	0.755
Not useful for doctors	20.24	18.063	0.770	0.612	0.727
Publication not affected	20.30	17.907	0.746	0.592	0.730
Biostatistics classes in PG course	20.11	22.096	0.261	0.271	0.846

Table 7: Item-total statistics (Final Version Scale)

Items	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
Weak in mathematics	11.94	9.935	0.685	0.841
Relation with results of PG degree	11.85	10.007	0.658	0.852
Not useful for doctors	11.85	9.392	0.764	0.809
Publication not affected	11.91	9.161	0.758	0.811

done. There were a small number of study participants. Although purposive sampling method (type of nonprobability sampling) was used, heterogeneity of experiences among postgraduate trainees, and different level of faculties yielded a very good conceptual framework.

Recently, biomedical research course has been introduced and is compulsory for both postgraduate medical students and faculties.^[17] This scenario may change

their inclination and will improve interest in the field of research methodology and biostatistics. Hence, items in the tool may be changed inviting data needs for further qualitative research.

Limitation and recommendation

Poor interest in a subject is not well defined; it is totally based on experienced senior faculties. Recently, first-year PGTs are also involved in research work in the middle of the year, but they were excluded from the study. Study

proper was not done in all Medical Colleges in the state of West Bengal. To know the concept of factors, better more qualitative research is needed. Study should be extended to other colleges where such condition prevails. Validation and reliability are the two most important parts in this study.

Conclusion

Interest is a motivational process that helps us learning, guides academic, and is both a psychological state of attention and affect toward a particular object or topic. It is very important to consider that how the issues of reliability and validity of this new tool have been addressed which an essential component in this research is. Here, these were determined in a systematic way. A good quality research will provide evidences of how all these factors have been addressed effectively and help us decide whether or not to apply this tool in respective area. After synthesizing a conceptual framework, it passed through different stages of research cycle and yielded a valid and reliable scale. Items in relation to it will give new ideas to the researchers and administrators. More qualitative research is needed for better understanding of this concept. As it was based on experience of senior researchers for a particular region, contents may not be appropriate to others and is always to be kept in mind.

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Conflicts of interest

There are no conflicts of interest.

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