

Evaluation of Community Medicine Postgraduate Theory Examination to Measure the Content and Cognitive Domain Coverage- A Retrospective Analysis

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ABSTRACT

Introduction: Assessment is a critical step in learning process. Postgraduate theory examination ideally should assess higher levels of cognition. In order to maintain high standard of public health the postgraduates of the specialty should be certified properly using the appropriate assessment methods. Since the assessment drives learning, ideally it should be aimed at judging a learner's attainment of curriculum outcomes.

Aim: To evaluate the postgraduate theory exam question papers from 2014 to 2018 in Community Medicine (CM) of various South Indian Universities and to measure the actual content coverage and cognitive domain coverage as per Bloom's taxonomy.

Materials and Methods: The present retrospective analytical study was conducted from April 2019 to July 2019 to assess the question papers from 2014-2018 in community medicine. Sixty theory exam question papers (20 per University) of last 5 years of three South Indian Universities namely Pondicherry (PU),

Tamil Nadu (TN), and Kerala (KR) of CM subject were analysed for content coverage and to categorise the level of knowledge assessed as per Bloom's taxonomy. The significance of difference between the data of various years was tested using Chi-square test.

Results: Questions testing higher cognitive domain was found only in 15%, 3.75% and 2.5% of PU, TN and KR Universities, respectively. Epidemiology of communicable and non communicable diseases was the content that received maximum coverage of total marks, 25%, 21.25% and 18.5% in PU, TN and KR Universities respectively. Certain topics were not covered in many papers. There was no statistical difference in distribution of marks among various Universities in South India.

Conclusion: Findings of this study may be used to redefine the distribution of contents and cognitive domain tested across universities ensuring the validity and reliability of the assessment.

Keywords: Assessment, Bloom's taxonomy, Blueprinting

INTRODUCTION

The Department of CM is a branch of healthcare that aims to develop a well-rounded and holistic medical professional, who will demonstrate knowledge and competence with compassion in dealing with primary healthcare, desire for lifelong learning, evidence-based practice, interdisciplinary teamwork, professional and ethical behaviour in practice in order to improve and sustain the health of the population [1,2]. In order to maintain high standard of public health the postgraduates of the specialty should be certified properly using the appropriate assessment methods. Since the assessment drives learning, ideally it should be aimed at judging a learner's attainment of curriculum outcomes [3].

The summative assessment for postgraduate in CM across various Indian Universities has written theory examination and clinical examination. Long Essay Question (LEQ) and Short Essay Question (SEQ) are the type of assessment tools of the written exam [4,5]. Ideally postgraduate theory exam needs to test higher level of cognitive domain namely critical thinking, evaluation and synthesis skills. Due weightage has to be given to all contents of the curriculum that ensures validity of the test paper. However, there are drawbacks in setting theory papers namely subjectivity in setting papers, loss of uniformity, lower cognitive domains predominantly assessed, no prevalidation by peer reviewers, and specific learning objectives not clearly defined [6]. The evaluation of examination question papers is hence crucial in educational institutes since examination helps to evaluate student's achievement and proficiency in specific course.

In this study, an attempt was made to evaluate the level of assessment of postgraduate CM question papers of selected South

Indian Universities namely Puducherry University (PU), Tamil Nadu-Dr. MGR University (TNMU) and Kerala University of Health Science (KUHS) for the levels of knowledge as well as weightage given to various topics which helps to give evidence-based suggestions to improve the validity of the theory exam.

MATERIALS AND METHODS

The present retrospective analytical study carried out in the department of CM, Sri Manakula Vinayagar Medical College and Hospital (SMVMCH), that trains and certifies undergraduate and postgraduate students, located at rural Puducherry. Postgraduate examination was conducted at the end of three years of Doctor of Medicine (MD) course. PU conducts two examinations annually that is one examination in the month of March-April and other examination in the month of October-November. The theory question papers of PU, TNMU, KUHS were publicly available in their respective websites after examination. Total time period of study from data collection to analysis and interpretation was for four months during the months of April and July 2019. Question papers from 2014 to 2018 in CM were reviewed by the first and second authors of the study who were guided by the third author. Total of sixty MD degree theory exam question papers (20 per University) of last five years from PU, TNMU, KUHS were included for content analysis.

Theory question papers of CM postgraduation theory examination from three selected South Indian Universities (PU, TNMU, KUHS) were the samples. The study variables included name of university, year of examination, type of assessment tool, number and marks of the tools, contents of the curriculum assessed, domain of the cognition assessed.

Study Procedure

The question papers were reviewed, and data extraction sheet was prepared. Question papers were retrieved from respective university websites and from college libraries. The time spent for reviewing each question paper was 10-15 minutes. The parameters which were extracted from the question paper were categorisation of essay questions as per Bloom's taxonomical domains and weightage given to topics in various universities [7]. Classification of levels of Bloom's taxonomical domain was based on commonly used action verbs. The verbs used in Level-1 Bloom's taxonomical domain include "define, identify, explain, describe, summarise, interpret, classify, compare and contrast". Level 2 includes "solve, relate, apply, construct, develop, plan, utilise". Level 3 includes "analyse, categorise, classify, compare, contrast, distinguish, divide, determine, interpret, criticise, compile, imagine, predict, and propose". Any controversy in classifying the verb or topics was intervened and facilitated by the second author.

Details of each question paper: Four theory papers (I, II, III, IV), each with maximum mark of 100 were conducted in all the selected Universities. Duration of theory examination of all Universities was three hours. However, type of question varied within universities. In Pondicherry University, there were two LEQs, each carried 25 marks and five SEQs, each carried 10 marks. In Tamil Nadu Dr MGR University, there were two LEQs, each carried 15 marks and seven SEQs, each carried 10 marks. In Kerala University there was one LEQ for 20 marks and eight SEQs, each carried 10 marks.

Contents of theory examination question paper remain same in all Universities. Topics covered in theory paper-I include epidemiology, behavioural sciences, population sciences, demography, environmental health and research methodology and biostatistics. Paper-II includes epidemiology, prevention and control of communicable and non communicable diseases, health education, and behaviour change communication. Healthcare of special groups and nutrition were covered in paper-III. Paper-IV covers health services, health administration, primary healthcare, national health programmes, international health and health legislation [8].

Content representation in each university: Total number of theory examination papers reviewed from 2014-2018 in PU, TNMU, KUHS were four (Paper I, Paper II, Paper III, Paper IV) in each year. All four papers were selected from each year and each University. Marks allotted for each LEQ (25, 15, 20) and each SEQ (10, 7, 10) in Pondicherry, Tamil Nadu and Kerala respectively. Total marks in each paper were 100 in all universities.

STATISTICAL ANALYSIS

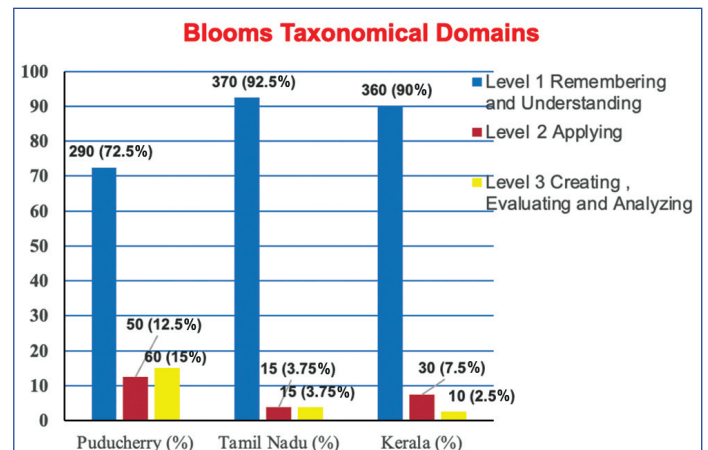
The software used for data analysis was Statistical Package for Social Sciences (SPSS) version 24.0. Description of categorical variables was expressed as frequencies and percentages. The significance of difference between the data of various years was tested using Chi-square test.

RESULTS

Total of 60 MD degree theory exam question papers (20 per University) of last five years were analysed for understanding the comprehensiveness of topics and to categorise the level of knowledge as per Bloom's taxonomy. Among all the three Universities, a total of 100 LEQ and 460 SEQ were reviewed.

Categorisation as per Bloom's taxonomical domains: More than half [290 marks (72.5%), 370 marks (92.5%), 360 marks (90%)] of the essay questions tested the remembering and understanding skills (Level 1 of Bloom's taxonomical domain) of the students in PU, TNMU, KUHS respectively. Level 2 (applied type of question) accounts for [50 marks (12.5%), 15 marks (3.75%) and 30 marks (7.5%)] in various universities. Level 3 (creating, evaluating and analysing) type of questions accounts for [60 marks (15%), 15 marks

(3.75%) and 10 marks (2.5%)] in PU, TNMU, KUHS, respectively. There was a significant difference in distribution of level 1 and level 2 Bloom's taxonomical domain among the three universities using Chi-square test, which shows blueprinting was not followed properly (p -value=0.032) [Table/Fig-1].



[Table/Fig-1]: Categorisation of marks in various University as per Bloom's taxonomical domains from year 2014-2018.

Weightage to topics in PG Community Medicine (CM) examination:

In total, there were four papers in PG CM examination in all universities. Total marks allotted for each paper was 100 in all the Universities. Average marks allotted in each University (PU, TNMU, KUHS) from 2014-2018 were given in [Table/Fig-2]. Epidemiology of communicable and non communicable diseases had maximum average marks [100 (25%), 85 (21.25%) and 74 (18.5%)] allotted in PU, TNMU, KUHS respectively. Certain topics which were less covered or not covered in some question papers were international health and health legislation, mental health, disaster management, man and medicine, genetic health, communication for health education and behaviour change communication. There was no statistical difference in distribution of marks among various universities of South India.

Topics	Average marks allotted in each University from 2014-2018			
	Pondicherry Marks (%)	Tamil Nadu Marks (%)	Kerala Marks (%)	p-value*
Epidemiology, research methodology	38 (9.50)	49.6 (12.4)	42 (10.5)	0.798
Biostatistics	12 (3)	13.2 (3.3)	14 (3.5)	0.980
Behavioural sciences, population sciences	16 (4)	13.4 (3.35)	14 (3.5)	0.970
Demography and family planning	27 (6.75)	19.8 (4.95)	16 (4)	0.668
Environment and health	8 (2)	38 (9.5)	26 (6.5)	0.079
Epidemiology of communicable and non communicable diseases	100 (25)	85 (21.25)	74 (18.5)	0.533
Communication for Health education and Behaviour change communication	7 (1.75)	5.8 (1.45)	4 (1)	0.890
Healthcare of special groups	49 (12.25)	55.6 (13.9)	36 (9)	0.547
Nutrition	22 (5.50)	16 (4)	18 (4.5)	0.877
Healthcare service, Primary healthcare	41 (10.25)	20 (5)	34 (8.5)	0.369
Health planning and management	26 (6.50)	18.6 (4.65)	32 (8)	0.634
Recent advances and updates	20 (5)	33.6 (8.4)	44 (11)	0.297
Miscellaneous	34 (8.50)	31.4 (7.85)	46 (11.5)	0.643
Total	400 (100)	400 (100)	400 (100)	

[Table/Fig-2]: Weightage of topics given in MD Community Medicine theory summative examination in various universities.

*p-value was based on Chi-square test

Comparison of weightage given to topics in various universities

each year: It was observed in [Table/Fig-3] that there was significant difference (p-value 0.001, 0.005, 0.001, 0.001 and 0.008) in weightage given to topics such as demography and family planning, epidemiology of communicable and non communicable diseases, communication for health education and behaviour change communication, healthcare of special groups, healthcare services and primary healthcare in each year in Pondicherry University. In TN Dr. MGR University topics such as healthcare of special groups, nutrition, healthcare service, primary healthcare showed significant difference (p-value 0.001, 0.010 and 0.001) in weightage over the years. Environment and health, healthcare of special groups, nutrition,

health planning and management and recent advances and updates were found to be significant (p-value 0.001, 0.001, 0.041, 0.001 and 0.026) in KUHS. This shows that blueprinting was not followed in last five years of examination in all the three universities.

DISCUSSION

Content analysis of theory exam question papers revealed that questions testing higher cognitive domain were found only in 15%, 3.75% and 2.5% of PU, TN and KR Universities respectively. Epidemiology of communicable and non communicable diseases was the content that received maximum coverage of total marks, 25%, 21.25% and 18.5% in PU, TN and KR Universities respectively.

Pondicherry University Marks (%)						
Topics	2014 n (%)	2015 n (%)	2016 n (%)	2017 n (%)	2018 n (%)	p-value*
Epidemiology, research methodology	20 (5)	35 (8.75)	55 (13.75)	45 (11.25)	35 (8.75)	0.289
Biostatistics	20 (5)	20 (5)	10 (2.5)	10 (2.5)	0	0.198
Behavioural sciences, population sciences	0	20 (5)	10 (2.5)	25 (6.25)	25 (6.25)	0.102
Demography and family planning	35 (8.75)	25 (6.25)	0	65 (16.25)	10 (2.5)	0.001*
Environment and health	0	10 (2.5)	10 (2.5)	0	20 (5)	0.062
Epidemiology of communicable diseases and NCDs	135 (33.75)	90 (22.5)	65 (16.25)	95 (23.75)	115 (28.75)	0.005*
Communication for health education and BCC	0	10 (2.5)	25 (6.25)	0	0	0.001*
Healthcare of special groups	90 (22.5)	10 (2.5)	65 (16.25)	25 (6.25)	55 (13.75)	0.001*
Nutrition	35 (8.75)	20 (5)	35 (8.75)	10 (2.5)	10 (2.5)	0.104
Healthcare service, primary healthcare	30 (7.5)	70 (17.5)	60 (15)	25 (6.25)	20 (5)	0.008*
Health planning and management	25 (6.25)	30 (7.5)	10 (2.5)	45 (11.25)	20 (5)	0.138
Recent advances and updates	0	25 (6.25)	20 (5)	20 (5)	35 (8.75)	0.071
Miscellaneous	10 (2.5)	35 (8.75)	35 (8.75)	35 (8.75)	55 (13.75)	0.083
Tamil Nadu Dr. MGR University						
Topics	2014 n (%)	2015 n (%)	2016 n (%)	2017 n (%)	2018 n (%)	p-value*
Epidemiology, research methodology	43 (10.75)	64 (16)	43 (10.75)	58 (14.5)	40 (10)	0.627
Biostatistics	7 (1.75)	7 (1.75)	14 (3.5)	28 (7)	15 (3.75)	0.263
Behavioural sciences, population sciences	15 (3.75)	7 (1.75)	21 (5.25)	14 (3.5)	15 (3.75)	0.777
Demography and family planning	21 (5.25)	21 (5.25)	14 (3.5)	28 (7)	15 (3.75)	0.797
Environment and health	51 (12.75)	51 (12.75)	35 (8.75)	28 (7)	25 (6.25)	0.343
Epidemiology of communicable diseases and NCDs	63 (15.75)	78 (19.5)	96 (24)	103 (25.75)	85 (21.25)	0.456
Communication for health education and BCC	0	0	7 (1.75)	7 (1.75)	15 (3.75)	0.144
Healthcare of special groups	107 (26.75)	36 (9)	42 (10.5)	28 (7)	65 (16.25)	0.001*
Nutrition	0	0	29 (7.25)	21 (5.25)	15 (3.75)	0.010*
Healthcare service, primary healthcare	0	44 (11)	7 (1.75)	14 (3.5)	35 (8.75)	0.001*
Health planning and management	29 (7.25)	14 (3.5)	28 (7)	7 (1.75)	15 (3.75)	0.278
Recent advances and updates	29 (7.25)	56 (14)	35 (8.75)	28 (7)	25 (6.25)	0.299
Miscellaneous	35 (8.75)	22 (5.5)	29 (7.25)	36 (9)	35 (8.75)	0.872
Kerala University of Health Science						
Topics	2014 n (%)	2015 n (%)	2016 n (%)	2017 n (%)	2018 n (%)	p-value*
Epidemiology, research methodology	50 (12.5)	40 (10)	40 (10)	20 (5)	60 (15)	0.210
Biostatistics	10 (2.5)	30 (7.5)	10 (2.5)	10 (2.5)	10 (2.5)	0.205
Behavioural sciences, population sciences	20 (5)	10 (2.5)	20 (5)	20 (5)	0	0.205
Demography and family planning	10 (2.5)	20 (5)	20 (5)	10 (2.5)	20 (5)	0.744
Environment and health	60 (15)	30 (7.5)	20 (5)	10 (2.5)	10 (2.5)	0.001*
Epidemiology of communicable diseases and NCDs	80 (20)	100 (25)	60 (15)	60 (15)	70 (17.5)	0.326
Communication for health education and BCC	10 (2.5)	10 (2.5)	0	0	0	0.108
Healthcare of special groups	10 (2.5)	50 (12.5)	10 (2.5)	30 (7.5)	80 (20)	0.001*
Nutrition	10 (2.5)	10 (2.5)	20 (5)	40 (10)	10 (2.5)	0.041*
Healthcare service, primary healthcare	40 (10)	20 (5)	50 (12.5)	40 (10)	20 (5)	0.215
Health planning and management	10 (2.5)	20 (5)	60 (15)	50 (12.5)	20 (5)	0.001*
Recent advances and updates	40 (10)	10 (2.5)	60 (15)	60 (15)	50 (12.5)	0.026*
Miscellaneous	50 (12.5)	50 (12.5)	30 (7.5)	50 (12.5)	50 (12.5)	0.742

[Table/Fig-3]: Comparison of weightage of topics in covered various Universities over past five years.

NCD: Non communicable diseases; BCC: Behaviour change communication; p-value was based on Chi square for trend; *statistically significant (p<0.05)

It was observed that majority (72.5%, 92.5%, 90%) of essay questions tested the Level-1 of Bloom's taxonomical domain in postgraduate CM examination in all the Universities (PU, TNMU, KUHS) respectively. Similar to the current study's finding, previous studies done also expressed that the lower order questions were asked more than higher order questions [Table/Fig-4] [9-13]. A good and reasonable postgraduate examination paper must consist of various difficulty levels to accommodate the different capabilities of students. Therefore, there is a crucial need to construct a balanced and high-quality exam, which satisfies higher cognitive levels. There has to be a system that automatically handles the classification of questions in papers before finalising it in accordance with Bloom's taxonomy. It is high time to make use of preplanned software program to auto check the papers based on the examination type.

variation in percentage of questions asked on each topic among different colleges [22-24].

It was clear that the weightage given to higher cognitive domains was negligible in the summative written exam. However, the formative assessment might have tested higher cognitive domains but they could not be evaluated and that was one of the limitations. The content coverage was not uniform across universities and also many chapters were ignored and under-represented. One might argue that as it was postgraduate examination students should be prepared to answer any variations in contents asked in the test paper but there have to be an acceptable range of variation. As there was no standard recommendation about these variations our evaluation could not account for it.

S. No.	Author's name and year	Place of study	Question paper considered	Universities considered	Parameters compared	Conclusion
1.	Mehta SJ and Kikani KM, 2019 [9]	Gujarat	March 2005-January 2015	Saurashtra University	Theory question papers with respect to question form, learning objectives, relevance to core syllabus, relevance to teaching hours and language and grammatical errors were analysed.	Results showed that majority of questions (97%) were framed from known areas of the syllabus and tested the basic knowledge level (95%) of cognitive domain. They concluded that a standard blueprint is essential to bring the uniform standard in theory examination.
2.	Swart AJ et al., 2010 [10]	Republic of South Africa (RSA)	2002-2006	Vaal University of Technology, South Africa	To distinguish between higher order and lower order type of questions considering Bloom's taxonomy.	The results indicated that academics in electronics are using more lower order (52%) than higher order questions (48%) in their final examination papers.
3.	Chauhan RP 2019 [11]	Maharashtra	2001-2018	Maharashtra University of Health Sciences (MUHS)	Analysed whether Community Medicine examination papers are representative of the syllabus.	Less than half (39%) of paper setting in community medicine at MUHS was not appropriate for syllabus representation.
4.	Kar SS et al., 2016 [12]	Puducherry	December 2008-May 2012	JIPMER, Puducherry	Community Medicine question papers were analysed for coverage and weightage to content areas and compared with number of hours of theory class.	Majority (68.9%) questions tested the knowledge skills of the students.
5.	Choudhary R et al., 2012 [13]	Rajasthan	2001-2006	Rajasthan University of Health Sciences	Analysed for content validity and compared with percentage frequency of teaching hours devoted to each topic	Concluded that there is some difficulty in setting of questions due to the absence of weight for different subdivisions. Some sub-divisions of physiology were covered low (1.26%) and some remains uncovered in some question papers. Hence, content validity is the first priority of any assessment.
6.	Present study	Puducherry	2014-2018	Pondicherry University	Evaluated Postgraduate theory exam question papers in Community Medicine of various South Indian Universities to measure the actual content coverage as stated in NMC curriculum and cognitive domain coverage as per Bloom's taxonomy.	Questions testing higher cognitive domain was found only in 15%, 3.8% and 2.5% of PU, TN and KR Universities respectively. It was evident that the theory test papers testing the higher cognitive domains were negligible across all three Universities evaluated. The content under representation and lack of uniformity of content coverage across universities was another issue identified.

[Table/Fig-4]: Comparison of results of similar studies from different regions [9-13].

In the present study, it was found that non communicable and communicable diseases chapter were given more weightage and many topics namely international health and health legislation, mental health, disaster management, man and medicine, genetic health, communication for health education and behaviour change communication were ignored in most of the universities. Validity is an important characteristic of good assessment and construct under-representation is one of the major validity threats in medical education. Under-representation is under-sampling or biased sampling of the curriculum or course content [11,12,14]. Blueprinting is a guiding map which specifies the assessment program and curriculum over a specified period of time [15]. Blue printing helps to reduce the two major threats to validity such as construct under-representation (CU) and construct irrelevance variance (CV) [16-21]. Few of the previous studies that evaluated question papers revealed that blue printing though existed was not followed in their specialties [11,16]. It is recommended that a system should be developed for centralised moderation of question papers at national level to avoid

Limitation(s)

The results cannot be generalised across nation as only three South Indian University question papers were evaluated.

CONCLUSION(S)

It was evident that the theory test papers testing the higher cognitive domains were negligible across all three universities evaluated. The content under representation and lack of uniformity of content coverage across universities was another issue identified. Findings of this study may be used to redefine the distribution of contents and cognitive domain tested across universities ensuring the validity and reliability of the assessment. Measures must be taken during system increasing moderation of university professional question papers to look into the identified issues in setting theory examination question paper for postgraduates.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Jul 28, 2021
- Manual Googling: Jan 08, 2022
- iThenticate Software: Jan 20, 2022 (6%)

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