

## Evaluation of Pharmacology MCQ Papers of MBBS Professional Examinations

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### Abstract

This cross sectional descriptive study was conducted to observe the quality of Pharmacology professional MCQ papers of different Universities of Bangladesh. For this purpose, total 80 MCQ papers of five universities dated from January 2007 to July 2015 were reviewed against a checklist to find out the coverage of recall, understanding and problem solving type questions, content coverage and construction of each question. The mean of recall, understanding and problem based type questions of all the universities were 92.1, 7.8 and 0.1 respectively and all of them statistically significantly differed from curriculum standard. All of the MCQ papers contained more than 75% recall type questions and 27.5% MCQ papers had only recall questions, Only 1(1.2%) MCQ papers contained 100 % topics (all the 11 groups). Eighteen (22.5%) contained 10 groups and 26.3% contained 9 groups out of 11. Forty percent MCQ papers contained less than 80% topics. Most of the stems of the MCQ were in the form of incomplete sentence (53.5%), 28.4% were in the form of complete statement and 16.8% were in the form of single word. Only 0.4% stem were in the form of clinical scenario. Fifty (62.5%) MCQ papers had defective stems and 68.75% had defective options. Total 14 (17.5%) MCQ papers were without any flaw but the rest 88.5% MCQ papers were with flaws either defective stem or faulty options or both. Findings of this study may be used to redefine the distribution of different type of questions in SAQ papers and to improve the quality of question papers by ensuring their coverage.

**Keywords:** *Evaluation, MCQ, MBBS Professional Examinations*

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### Introduction

The educational objectives are broadly allocated to three domains- knowledge, skill and attitude, i.e. what we know, what we feel and what we do. Knowledge includes all cognitive process from the mere recall of facts through comprehension

and understanding to an ability to solve problem. Attitude includes the personal qualities of students and their attitude towards medicine, their patients and their peers. Skills include the various psychomotor skills those are required to be performed by a competent physician.<sup>1</sup>

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Different assessment instruments are used to judge the different learning outcomes. Curriculum for Undergraduate Medical Education in Bangladesh-2002 have introduced short answer questions (SAQ) and multiple choice questions (MCQ) for written examination, objective structured practical examination (OSPE) and objective structured clinical examination (OSCE) for practical examinations and structured oral examination (SOE) for viva examinations to assess the different domains of learning objectives of undergraduate medical students.<sup>2</sup> Single assessment instrument is perfect and single test tool can test all aspect of medical competence and performances. Each instrument has its strengths and weakness.<sup>3</sup> Some of the assessment tools are inherently subjective, while the rest of them may be applied with greater degree of objectivity. No method of assessment can however be intrinsically flawless.<sup>4</sup> Multiple Choice Question (MCQ) is a type of fixed response written test which is characterized by objective scoring. MCQs are used to test the cognitive domain and they have advantages of wide content coverage, easy scoring and, applicability to large group. MCQs are not devoid of disadvantages. They are often deemed unfit for testing higher order cognitive skill and there is scope for guessing by the students.<sup>5,6</sup>

Before the implementation of 2002 curriculum for undergraduate medical education in Bangladesh, written assessment of the students was carried out by essay questions. Essay questions have many disadvantages in covering content and judging students' actual learning. Furthermore essay type questions are very much subjective in nature. To overcome

these disadvantages Curriculum for undergraduate medical education-2002 implemented a dramatic change in the written assessment, introducing SAQ and MCQ.

Five public universities, Bangladesh University of Professionals (BUP), University of Chittagong (CU), University of Dhaka (DU), Rajshahi University (RU) and Shahjalal University of Science & Technology (SUST) are conducting MBBS examination of all medical students except two (Gonoshasthaya Samaj Vittik Medical College). There are some differences among the universities in the distribution of content in the different groups but all the universities suggested distribution of question type both in SAQ and MCQ would be: recall type-60%, understanding type-30% and problem based type-10%.<sup>7</sup> After implementation of the curriculum 2002 pharmacology professional written examination had been conducting following this rules since January 2007. During this period, no evaluation has been done whether the pharmacology professional MCQ papers of different universities are fulfilling the stated requirements about content coverage and coverage of different level of cognitive domain. This study tried to find out the actual content coverage and knowledge domain coverage in MCQ papers as per stated in the curriculum.

## Method

The study was a Cross-sectional descriptive study and was conducted over one year period starting from July 2015 to June 2016 at Centre for Medical Education (CME).. All the available (BUP-14, CU-18, DU-18, RU-18 & SUST-12) total 80 2<sup>nd</sup>

professional MBBS Pharmacology MCQ papers from January 2007 (starting of 2<sup>nd</sup> professional examination under Curriculum 2002) to July 2015 of five public universities of Bangladesh were reviewed. Each MCQ paper was the sampling unit. Checklists were used to review the domain and content coverage in MCQ papers. Then question papers were highlighted by text marker of three colours to differentiate three types question-green for recall, yellow for understanding and pink for problem based questions according to the operational definition. Marks of different parts of the questions were recorded on a checklist according to type and content area. For each question paper there was separate checklist. Marks of each type and content area were summed up. Absent topic in the question paper was marked and number of topics area covered was recorded on the checklist. Construction of MCQs was reviewed by using another checklist.

After data collection a quality control check was made for completeness and internal consistency. The data were then entered in the computer, process and analysis were done by using computer SPSS 19programme. Interpretations were made subsequently. Data were presented in table and graph with necessary description where necessary for easy understanding and interpretation.

Necessary permission was taken from all the concerned authorities to conduct the study. All concerned were thoroughly briefed about the study and only the volunteer respondents were included in the study. Name of the teachers will not be disclosed. Findings of the study will be used only for research purpose.

## Results

Mean of the weightage (%) of recall questions in MCQ papers of BUP, CU, DU, RU & SUST were 96.1, 90.8, 91.9, 94.7 and 85.4 respectively. There were statistically significant differences of SUST value with BUP and RU value ( $p < 0.01$ ). For understanding type questions these mean were 3.9, 8.6, 8.1, 5.3 and 14.6 for BUP, CU, DU, RU, & SUST respectively. There were statistically significant differences of SUST mean with BUP, DU & RU means ( $p < 0.05$ ). Mean percentage of weightage of problem based type question for the above mentioned universities were 0.0, 0.6, 0.0, 0.0 and 0.0 respectively. There was no statistically significant differences between the mean of the different universities ( $p > 0.05$ ) (Table 1). The mean of recall, understanding and problem based type questions of all the universities were 92.1, 7.8 and 0.1 respectively and all of them statistically significantly differed from curriculum standard (Table 1). All of the MCQ papers contained 75% and more recall type questions 27.5% MCQ papers had only recall questions, 26.3 % MCQ papers contained 95% and 25% MCQ papers had 90% recall questions (Table 2). None of the MCQ papers contained 30% understanding type questions. Maximum percentage was 25 in only 2.5% MCQ papers. Twenty seven point five percent MCQ papers contained no understanding type questions (Table 3). Mean percentage of the weightage of Cardiovascular and Renal Pharmacology, Chemotherapeutics, General Pharmacology CNS Pharmacology, and Autonomic Pharmacology were 17.7, 16.4, 16.8, 13.8 and 10.3 respectively (Table 4)

Only 1(1.2%) MCQ papers contained 100 % topics (all the 11 groups). Eighteen (22.5%) contained 10 groups and 26.3% contained 9 groups out of 11. Forty percent MCQ papers contained less than 80% topics (Table 5).

Most of the stems of the MCQ were in the form of incomplete sentence (53.5%), 28.4% were in the form of complete statement and 16.8% were in the form of single word. Only 0.4% stem were in the form of clinical scenario (Table 6).

Out of total 1600 stems 161 (10.1%) were defective, 9.7% were grammatically incorrect and 0.4 % were with negative words but without bolding or capitalization (Table 7)

Out of 8000 options 170 (2.1%) were faulty because of lack of continuation with stem (Table 8).

Fifty (62.5%) MCQ papers had defective stems and 68.75% had defective options (Table 9).

Total 14 (17.5%) MCQ papers were without any flaw but the rest 88.5% MCQ papers were with flaws either defective stem or faulty options or both (Table 10).

**Table 1: Distribution of mean weightage (%) of recall, understanding and problem based type questions of different universities in MCQ papers (n=80)**

Type of questions	BUP Mean±SD	CU Mean±SD	DU Mean±SD	RU Mean±SD	SUST Mean±SD	Total Mean±SD
Recall	96.1±4.00	90.8±7.71	91.9±7.88	94.7±4.36	85.4±7.21	92.1±7.19
Understanding	3.9±4.00	8.6±6.72	8.1±7.88	5.3±4.36	14.6±7.21	7.8±6.95
Problem based	00	0.6±2.35	00	00	00	0.1±1.12

Note. Statistical analysis between universities (ANOVA). Recall  $p < 0.05$ ; Understanding  $p < 0.001$  and Problem based  $p > 0.05$ .

**Table 2: Distribution of MCQ papers of different universities according to percentage of recall questions (n=80)**

Percentage of recall questions	BUP f(%)	CU f(%)	DU f(%)	RU f(%)	SUST f(%)	Total f(%)
75	0(00)	1(5.6)	1(5.6)	0(00)	1(8.3)	3(3.8)
80	0(00)	2(11.1)	2(11.1)	0(00)	5(41.7)	9(11.3)
85	0(00)	3(16.7)	1(5.6)	1(5.6)	0(00)	5(6.3)
90	3(2.1)	3(16.7)	5(27.8)	4(22.2)	5(41.7)	20(25)
95	5(35.7)	5(27.8)	3(16.7)	8(44.4)	0(00)	21(26.3)
100	6(42.9)	4(22.2)	6(33.3)	5(27.8)	1(8.3)	22(27.5)
Total	14(100)	18(100)	18(100)	18(100)	12(100)	80(100)

**Table 3: Distribution of MCQ papers of different universities according to percentage of understanding type questions (n=80)**

Percentage of understanding type questions	BUP f( %)	CU f( %)	DU f(%)	RU f( %)	SUST f(%)	Total f( %)
0	6(42.9)	4(22.2)	6(33.3)	5(27.8)	1(8.3)	22(27.5)
5	5(35.7)	5(27.8)	3(16.7)	8(44.4)	0(00)	21(26.3)
10	3(21.4)	3(16.7)	5(27.8)	4(22.2)	5(41.7)	20(25.0)
15	0(00)	5(27.8)	1(5.6)	1(5.6)	0(00)	7(8.8)
20	0(00)	1(5.6)	2(11.1)	0(00)	5(41.7)	8(10.0)
25	0(00)	0(00)	1(5.6)	0(00)	1(8.3)	2(2.50)
Total	14(100)	18(100)	18(100)	18(100)	12(100)	80(100)

**Table 4: Distribution of the mean marks (%) of different topics of Pharmacology in MCQ papers of different universities (n=80)**

Topics	BUP Mean±SD	CU Mean±SD	DU Mean±SD	RU Mean±SD	SUST Mean±SD	Total Mean±SD
General Pharmacology	17.5±6.12	21.7±8.91	18.1±5.18	13.1±3.88	12.1±4.50	16.8±6.89
Autonomic Pharmacology	8.9±4.46	11.7±4.85	10.6±3.79	9.2±4.92	10.8±3.58	10.3±4.42
Cardiovascular &Renal Pharmacology	21.8±8.90	17.8±6.23	15.0±5.94	18.6±4.79	15.4±7.82	17.7±6.93
Chemo Therapeutics	13.6±5.69	16.7±6.64	16.7±4.85	16.7±2.97	18.8±3.76	16.4±5.10
Endocrine Pharmacology	5.7±5.13	5.8±3.92	1.0±5.14	9.7±4.68	8.8±4.33	8.1±4.93
CNS Pharmacology	16.8±8.45	11.9±5.46	14.2±4.61	11.4±3.75	16.3±3.76	13.8±5.69
Respiratory Pharmacology	1.8±3.16	1.1±2.74	1.4±2.30	3.6±2.87	2.9±2.57	2.1±2.84
Autacoids Pharmacology	3.6±3.05	5.5±4.50	7.5±3.09	8.6±3.75	5.0±2.13	6.3±3.85
GIT Pharmacology	3.9±2.89	3.9±3.23	3.3±2.97	4.7±2.08	6.7±5.36	4.4±3.41
Haemopoietic Pharmacology	1.8±2.48	0.8±1.91	00±00	1.7±2.42	1.3±2.26	1.1±2.06
Special Topics	4.3±4.32	3.1±3.03	3.3±2.97	2.8±3.07	2.1±2.57	3.1±3.21

**Table 5: Distribution of MCQ papers according to content coverage (n=80)**

Coverage	BUP f( %)	CU f( %)	DU f(%)	RU f( %)	SUST f(%)	Total f( %)
100%	0 (00)	0 (00)	0 (00)	1(5.5)	0 (00)	1(1.2)
≥90 to <100	1(7.1)	3(16.7)	2(11.1)	10(55.6)	2(16.7)	18(22.5)
≥80 to <90	4(28.6)	2(11.1)	6(33.3)	2(11.1)	7(58.3)	21(26.3)
<80	9(64.3)	13(72.2)	10(55.6)	5(27.8)	3(25.0)	40(50.0)
Total	14(100)	18(100)	18(100)	18(100)	12(100)	80(100)

**Table 6: Nature of stems of MCQs in Pharmacology examination papers (n=1600)**

Nature of MCQ stem	BUP f( %)	CU f( %)	DU f( %)	RU f( %)	SUST f( %)	Total f( %)
Single word-	27(9.6)	12(3.3)	77(21.4)	126(35.0)	27(11.3)	269 (16.8)
Incomplete sentence-	225(80.4)	153(42.5)	220(61.11)	126(35.0)	132(55.0)	856(53.5)
Complete statement	27(9.6)	191(53.1)	63(17.5)	92(25.6)	81(33.8)	454(28.4)
In the form of question	1(0.4)	1(0.3)	0 (00)	15(4.2)	0 (00)	17(1.1)
In the form of clinical scenario	0(00)	3(.83)	0 (00)	1(0.3)	0 (00)	4(0.3)
Total	280	360	360	360	240	1600

**Table 7: Distribution of MCQ stem in Pharmacology examination papers (n=1600)**

Nature of MCQ stem	BUP f( %)	CU f( %)	DU f( %)	RU f( %)	SUST f( %)	Total f( %)
Grammatically incorrect stem	36(12.9)	25(6.9)	10 (2.8)	28(7.8)	55(22.9)	154(9.7)
Stem with negative word without bolding or capitalization	2(0.7)	2(.6)	1(0.3)	2. (0.6)	0	7(0.4)
Total defective stem	38(13.6)	27(7.5)	11 (3.1)	30(8.4)	55(22.9)	161(10.1)
Stem without any flaw	242(86.4)	333(92.5)	349(96.9)	330(91.6)	185(77.1)	1439(89.9)
Total	280	360	360	360	240	1600

**Table 8: Distribution of defective options of MCQ among different universities (n=8000)**

	BUP (n=1400) f (%)	CU (n=1800) f (%)	DU (n=1800) f (%)	RU (n=1800) f (%)	SUST (n=1200) f (%)	Total (n=8000) f (%)
Option not in continuation with stem	44(3.1)	28(1.6)	46(2.6)	26(1.4)	26(2.2)	170(2.1)

**Table 9: Distribution of MCQ papers according to constructional flaws (n=80)**

	BUP (n=14) f (%)	CU (18) f (%)	DU (18) f (%)	RU (18) f (%)	SUST (12) f (%)	Total (80) f (%)
MCQ paper with defective stem*	11(78.57)	8(44.44)	5(27.78)	15(83.33)	11(91.67)	50(62.5)
MCQ papers with defective options*	9(64.29)	7(38.89)	11(61.11)	8(44.44)	10(83.33)	55(68.75)

\* Some MCQs have both the flaws.

**Table 10: Distribution of MCQ papers of different universities having flawless and flawed items (n=80)**

	BUP (n=14) f (%)	CU (18) f (%)	DU (18) f (%)	RU (18) f (%)	SUST (12) f (%)	Total (80) f (%)
MCQ papers without constructional flaw	1(7.1)	4(22.2)	6(33.3)	2(11.1)	1(8.3)	14(17.5)
MCQ papers having constructional flaws	13(92.9)	14(77.8)	12(66.7)	16(88.9)	11(91.7)	66(82.5)

## Discussion

This cross sectional descriptive study was carried out by reviewing professional written question papers on Pharmacology in five public universities of Bangladesh.

Total 80 MCQ papers dated from January 2007 to July 2015 of five public universities (BUP-14, CU-18, DU-18, RU-18 and SUST-12) were evaluated to observe the standard of the question papers in respect coverage of recall questions, understanding

questions, and problem based questions, content coverage and construction.

In the coverage of cognitive domain, mean percentage of recall questions of BUP, CU, DU, RU &SUST were  $96.1 \pm 4.00$ ,  $90.8 \pm 7.71$ ,  $91.9 \pm 7.88$ ,  $94.7 \pm 4.36$  and  $85.4 \pm 7.21$  respectively. Mean percentage of recall questions of all the universities were statistically significantly different from curriculum standard 60%. Recall question coverage of SUST was statistically significantly differed from

BUP & RU (ANOVA  $p < 0.05$ ). Mean percentage of understanding type questions were  $3.9 \pm 4.00$ ,  $8.6 \pm 6.72$ ,  $8.1 \pm 7.88$ ,  $5.3 \pm 4.36$  &  $14.6 \pm 7.21$  for BU, CU, DU, RU and SUST respectively. All universities mean were statistically significantly differed from curriculum standard ( $p = 0.000$ ). Coverage of understanding question of SUST were statistically differed from BUP, DU & RU ( $p < 0.05$ ). Mean percentage of problem based questions in CU was  $0.6 \pm 2.35$ . In other universities problem based questions were absent in MCQ papers. In this study it was found that MCQs were mainly recall type, understanding type questions are negligible and most of the question papers (98%) were devoid of problem based questions. This study supports the criticism that MCQ could be used to assess recall only.<sup>8,9</sup>

In case of content coverage, 19 (24%) question papers covered more than 90% topic area of the curriculum. Most of the (61%) question papers of RU covered more than 90% of the content group. Though it was always claimed that MCQ covers more content area<sup>10-13</sup> but it was less in this study. Probably it was due to less MCQ questions.

In case of coverage of topic, most covered topics were cardiovascular and renal pharmacology 17.7%, general pharmacology 16.8%, chemotherapeutics 16.4%, CNS Pharmacology 13.8%, and autonomic pharmacology 10.3% respectively. There were statistically significant differences between the universities in the coverage of general pharmacology, endocrine, CNS, autacoids and respiratory pharmacology (ANOVA  $p < 0.05$ ), but there were no statistically significant differences in case of other six topics between the universities ( $p < 0.05$ ).

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Most of the stems of the MCQ were in the form of incomplete sentence (54%), and 28% were in the form of complete statement. Though single word is discouraged to be used as stem<sup>14</sup> (Begum 2012) but in this study 17% stems were in the form of single word. Only 0.4% stem were in the form of clinical scenario. In this study 154 (9.7%) stems were grammatically incorrect. It is required to capitalize or to bold the negative word in the stem<sup>14,15</sup> but in this study 7(0.4%) item stems were with negative words but none them was capitalized or bolded. One hundred and seventy (2%) options were found not in continuation with stem. In this study 10% test items were with defective stems. Palmer and Devitt<sup>16</sup> found twenty percent flawed MCQs in a study. The flawed items were 46% in another study by Downing<sup>17</sup> and 47% by Tarrant and Ware.<sup>18</sup> All these studies were conducted with SBA type MCQs and MCQs were reviewed for all the 31 principles for MCQs.<sup>15</sup> Total 66 (86%) MCQ papers contained these defective stems and options. Printing mistakes were not considered as defect in this study. If proper care was taken during moderation of question papers these types of flaws could be avoided easily.

### Conclusion

Overall content coverage in the MCQ papers of the universities professional examination was satisfactory. But in case of coverage of different type of questions was not as per curriculum standard. Coverage of problem based type question was negligible. Measures must be taken during moderation of university professional question papers to cover stated standard of different type questions of the curriculum.



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