Multiple mini interviews as a measure of non-cognitive skills for admissions into undergraduate medical education programme in Pakistan: A validity study
Rukhsana Ayub, Naveed Yousuf, Munazza Asad, Umer Ali Khan

Abstract
Student selection for Undergraduate Medical Education Programmes (UGME) is a highly selective process globally. Health care practice requires many attributes like communication skills, professionalism, critical thinking and problem solving in addition to cognitive abilities. This study reports the development and administration of Multiple Mini Interviews (MMI), the descriptive and psychometric properties of the MMI station scores and assesses the validity of MMI stations to ascertain if the stations measured the intended attributes.

Nine attributes considered most essential for a successful health care professional were selected. A 5 point rating scale was used to rate each item on the station. The scores were then converted into percentage scores. The mean scores on each MMI station ranged from 27.4% to 80.0%. The reliability of stations using Cronbach’s alpha ranged from 0.64 to 0.98. MMI can be used to make reliable and valid decisions to select students with desired non-cognitive attributes.

Keywords: Multiple mini interviews, Non-cognitive skills, Medical admission.

Introduction
Student selection for Undergraduate Medical Education Programmes (UGME) are high stake decisions with considerable economic implications for faculty, institution, society and students and usually, institutions have a large pool of applicants with good academic records to select from.1,2 Health care practices, however, requires many other attributes like communication skills, compassion, ability to maintain dignity and respect of patient, professionalism, critical thinking and problem solving in addition to cognitive abilities.3,4 The recent move to outcomes or competency-based curricula is motivated by the recognition that the presence of these attributes is required for a holistic and better quality of patient care.5

In most countries assessment of students’ cognitive abilities include evidence of prior academic achievement, such as undergraduate grade point averages (UGPA) and Medical College Admission Test (MCAT) scores in USA, Canada and Australia and A’ levels, General Certificate of Secondary Education (GCSE) in UK.1,6,7 These selection tools do not, however, assess students’ non-cognitive attributes which are so essential for their future practice as health care professionals.8,9 The traditional interviews used worldwide for this purpose are beset with reliability and validity issues in addition to incurring huge costs.1,3,9,10 With evidence emerging about the association between the non-cognitive admission criteria and better performance in medical school, post graduate training and clinical practice, it is essential to use admission methods which assess these non-cognitive attributes in a valid and reliable manner.11

Eva et al developed the multiple mini-interviews in 2004 for assessment of multiple non-cognitive constructs. Utilizing the structured multiple sampling approach used in Objective structured Clinical Examination (OSCE), scores on MMI have shown to be reliable and valid for assessing personal traits and exhibit generalizability to clinical and licensing examination performance.12

Since the regulatory body, Pakistan Medical and Dental Council (PMDC), has not included interviews in admission guidelines, only two Pakistani medical colleges including the Aga Khan University are using interviews for assessment of non-cognitive domain.13 To date no study has been reported on MMI for admissions into medical colleges in Pakistan. This study reports the development and administration of MMI in a private medical college in Pakistan. It assesses the descriptive and psychometric properties of the MMI station scores used and the construct validity of MMI stations.

Methodology
MMI Station Development: After getting permission

1,4 Al Nafees Medical College, Isra University, Islamabad, 2Agha Khan University, Karachi, Pakistan.
Correspondence: Munazza Asad. Email: munazza_wah@yahoo.com
from the Institutional Review Board, a core team developed a blueprint comprising of nine important attributes aligned to the institutional vision as well as the identified curricular outcomes after extensive literature search.3,7,11,12 Nine attributes identified by the core team were critical thinking, problem solving, and communication skills, working in a health care system, cultural sensitivity/social awareness, ethics, honesty/integrity and punctuality. Each attribute was operationally defined and one scenario for each of them was constructed. These 5-8 line scenarios served as a trigger and were followed by a question: "What will you do in this situation?" Each station had 3-5 items testing the underlying attribute. A 5 point rating scale was used to rate each item on the station and then converted into percentage scores for analysis and reporting purposes.

**MMI Administration:** The MMIs were administered to a total of 365 students over 6 days with 6-7 sessions held each day. Each applicant was assessed by 9 different assessors on nine different MMI stations.

**Descriptive and Psychometric Analysis of MMI Stations:** In addition to the mean scores, standard deviation and number of items for each station, the reliability coefficient using Cronbach’s alpha, standard error of measurement and item-total correlation of the scores on each station under study were determined.

**Factor Analysis for Construct Validity:** To determine the number of factors being assessed on MMI examination as a whole and to assess the construct validity of each station we used item-wise data for all stations for Exploratory Factor Analysis. We analyzed this data using principal component analysis, with varimax rotation following Kaiser Rule (i.e. eigenvalues > 1.0).

**Results**

The number of items, descriptive and psychometric properties of the nine MMI stations is shown in Table-1. The mean scores on each MMI station ranged from 27.4% to 80.0%. The reliability of these MMI stations using Cronbach’s alpha ranged from 0.64 to 0.98, and the standard error of measurement from 3.41% to 8.97%. The item-total correlations ranged from 0.53 to 0.96 except for

<table>
<thead>
<tr>
<th>S.No</th>
<th>Task</th>
<th>No. of Items</th>
<th>Mean ± Standard Deviation</th>
<th>Reliability (Cronbach’s alpha)</th>
<th>Standard Error of Measurement (%)</th>
<th>Item-Total Correlations (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knowledge of health care system</td>
<td>3</td>
<td>80.00± 18.41</td>
<td>0.93</td>
<td>4.97</td>
<td>0.81-0.90</td>
</tr>
<tr>
<td>2</td>
<td>Empathy</td>
<td>5</td>
<td>52.37± 14.92</td>
<td>0.64</td>
<td>8.97</td>
<td>0.24-0.56</td>
</tr>
<tr>
<td>3</td>
<td>Critical Reasoning</td>
<td>5</td>
<td>59.09± 12.58</td>
<td>0.93</td>
<td>3.41</td>
<td>0.78-0.83</td>
</tr>
<tr>
<td>4</td>
<td>Punctuality</td>
<td>3</td>
<td>65.96± 11.79</td>
<td>0.77</td>
<td>5.62</td>
<td>0.59-0.62</td>
</tr>
<tr>
<td>5</td>
<td>Ethical dilemma.</td>
<td>4</td>
<td>64.39± 18.65</td>
<td>0.88</td>
<td>6.56</td>
<td>0.66-0.82</td>
</tr>
<tr>
<td>6</td>
<td>Moral entity</td>
<td>3</td>
<td>57.62± 25.66</td>
<td>0.98</td>
<td>3.95</td>
<td>0.93-0.96</td>
</tr>
<tr>
<td>7</td>
<td>Socio cultural issue</td>
<td>6</td>
<td>27.41± 11.78</td>
<td>0.85</td>
<td>4.59</td>
<td>0.53-0.77</td>
</tr>
<tr>
<td>8</td>
<td>Communication Skills</td>
<td>5</td>
<td>54.46± 17.72</td>
<td>0.95</td>
<td>3.78</td>
<td>0.85-0.90</td>
</tr>
<tr>
<td>9</td>
<td>Problem Solving</td>
<td>3</td>
<td>68.03± 17.01</td>
<td>0.88</td>
<td>5.81</td>
<td>0.75-0.81</td>
</tr>
</tbody>
</table>
one item on the station on empathy which had an item
total correlation of 0.24.

The results of the factor analysis for the 37 items on the
nine MMI stations are shown in Figure and Tables-2. As
shown in Figure and Table-2, the data loaded on a total of
ten factors converging after six iterations following the
criterion of eigenvalues >1.0. These ten factors accounted
for 78.3% of the total variance (Table-2).

**Discussion**

To be a successful medical student and ultimately an
effective and competent doctor, a prospective student
needs to possess a range of non-cognitive skills, qualities and positive attitudes along with the academic
ability.7,14 Our results show good reliability and
construct validity of the MMI stations developed for
selecting undergraduate students on basis of non-
cognitive attributes essential for their future
performance as professionals in a resource constrained
environment.

Eva et al12 in their seminal work had focused on assessing
communication skills, punctuality, critical thinking and problem solving and working in health care systems
which were consistent with our institutional philosophy
and outcomes as well. In our study we have assessed five additional attributes mainly cultural sensitivity, empathy, punctuality, responsibility and reliability which were also studied by Lemay et al.\textsuperscript{11}

The reliability of our MMI stations using Cronbach’s alpha ranged from 0.64 to 0.98, which is similar to the study by Lemay et al.\textsuperscript{11} The high Cronbach’s alpha scores in our study provide evidence of high item cohesiveness among the subscales of each station as well as the evidence of stable scores for each applicant.\textsuperscript{10,15} Our analysis shows that our students scored well on stations testing critical thinking, problem-solving, communication skills, working in health care systems, honesty, responsibility and reliability as shown by the mean score of the stations. The stations showed high internal consistency and item-total correlations validating that the content of each station was assessing the desired attribute.

The students’ performance on the station assessing cultural sensitivity/social awareness was, however, poor. Culture influences not only health practices but also how the healthcare provider and the patient perceive illness. Health care providers need to be culturally competent so that they are more compassionate and caring to the needs of the people they serve.\textsuperscript{16} The reasons for the poor performance of students on this station could be due to assessors’ bias or lack of training, and lack of exposure of our students to such issues during high school education. In our study we assessed our students on communication skills and empathetic approach to patients as these are considered to be the mainstay of medical care and good communication skills are highly correlated with better patient adherence.\textsuperscript{16,17}

So far the evidence of using MMI in undergraduate student admission process has come from resource rich countries like USA, Canada, Australia, Saudi Arabia and Israel.\textsuperscript{1,9,17} Though the costs of conducting MMI are more than written exams, they are considerably less than traditional interviews and MMI are more time efficient as well.\textsuperscript{18,19} However the significant additional information they provide about the non cognitive attributes as well as the evidence of their ability to predict future performance, calls for a wider usage. The only study from Pakistan using MMI for resident selection comes from AKU. The study also cites resource intensiveness of MMI as compared to interviews as the reason for its limited sample size of 16 residents and eight stations.\textsuperscript{20} In our study, we were able to develop and train faculty with minimum expenditure and within a very short span of time which augers well for private as well as public medical colleges of a developing country.

**Conclusion**

Our study shows that MMI can be developed and implemented within restricted resources and provides evidence for other institutions for adopting this method of student selection in place of the traditional interviews. The descriptive analysis was reported to provide psychometric evidence. The reliability and SEM of our MMI were found to be acceptable for most of the stations. Factor analysis revealed that the stations assessed the attributes that were intended to be assessed. The main purpose of using MMI is to make reliable and valid decisions to select students with desired non cognitive attributes.

**Acknowledgement**

Special thanks to Prof. Dr. Moeen Iqbal; who gave us a critical review on the project and provided us scientific advice.

**References**

8. Pau A, Chen YS, Lee VK, Sow CF, De Alwis R. What does the multiple mini interview have to offer over the panel interview? Med Educ Online 2016; 21: 10
11. Lemay JF, Lockyer JM, Collin VT, Brownell KW. Assessment of non-


17. Peskun C, Detsky A, Shandling M. Effectiveness of medical school admissions criteria in predicting residency ranking four years later. Med Educ 2007; 41: 57-64.

