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To cite this article: Saharnaz Nedjat, Miles Bore, Reza Majdzadeh, Arash Rashidian, Don Munro, David Powis, Mojgan Karbakhsh & Hossein Keshavarz (2013) Comparing the cognitive, personality and moral characteristics of high school and graduate medical entrants to the Tehran University of Medical Sciences in Iran, *Medical Teacher*, 35:12, e1632-e1637, DOI: [10.3109/0142159X.2013.826791](https://doi.org/10.3109/0142159X.2013.826791)

To link to this article: <https://doi.org/10.3109/0142159X.2013.826791>



Published online: 04 Sep 2013.



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WEB PAPER

Comparing the cognitive, personality and moral characteristics of high school and graduate medical entrants to the Tehran University of Medical Sciences in Iran

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Abstract

Background: Tehran University of Medical Sciences has two streams of medical student admission: an established high school entry (HSE) route and an experimental graduate entry (GE) route.

Aim: To compare the cognitive skills, personality traits and moral characteristics of HSE and GE students admitted to this university.

Methods: The personal qualities assessment tool (PQA; www.pqa.net.au) was translated from English to Persian and then back-translated. Afterwards 35 individuals from the GE and 109 individuals from the 2007 to 2008 HSE completed the test. The results were compared by *t*-test and Chi-square.

Results: The HSE students showed significantly higher ability in the cognitive skills tests ($p < 0.001$). They were also more libertarian ($p = 0.022$), but had lower ability to confront stress and unpleasant events ($p < 0.001$), and had lower self-awareness and self-control ($p < 0.001$).

Conclusion: On the basis of their personal qualities, the GE students had more self-control and strength when coping with stress than the HSE students, but the latter had superior cognitive abilities. Hence it may be useful to include cognitive tests in GE students' entry exam and include tests of personal qualities to exclude those with unsuitable characteristics.

Introduction

In some countries such as the USA and Canada, only applicants with a bachelor degree are admitted to medical school. Other countries such as the UK, Ireland and Australia admit university graduates alongside high school graduates (Carter & Peile 2007b; Charlton & Sihota 2011). In Iran since the 1980s, the only route of entry to a medical school has been after high school graduation but contingent upon success in the annual national university entrance exams (known as the "Konkoor"). Every year hundreds of thousands of Iranian high school graduates take part in the Konkoor. The Konkoor only evaluates an applicant's academic capabilities, via multiple-choice written tests that the applicants take over a four to five hour period in one day. Only the best performing science students are selected to study medicine in a tight competition that affects the lives of both the applicants and their families. Unfortunately, the weak to average correlation between applicants' academic grades before and after admission suggests that the predictive validity of the Konkoor is inadequate (Farrokhi-Khajeh-Pasha et al. 2012).

Tehran University of Medical Sciences (TUMS) has the highest education-research rank in the country, and studying

Practice points

- High school entrants had superior cognitive abilities relative to Graduate entrants
- High school entrants had less ability to confront stress and unpleasant incidents
- High school entrants had lower self-awareness and self-control
- High school entrants were more libertarian

medicine in this university is free-of-charge (except for those admitted to its international campus) as it receives generous government funding. The majority of students usually apply for admission after achieving a favourable rank in the Konkoor. In 2008, the TUMS started to experiment with a new admission route as part of a medical education reform process (Nedjat et al. 2008; Majdzadeh et al. 2009). The "new route" students were among Bachelor degree holders and were selected via a rigorous scientific test and a structured interview after considering their overall average grades. The admissions procedure had three objectives: (1) to strengthen

the connection between basic and clinical sciences; (2) In consideration of their older age, to give applicants the opportunity to make more informed decisions regarding their choice of medicine; and (3) to evaluate the non-academic personality characteristics of the applicants, so that if this method is proven successful by further evaluations, it might be implemented in other universities across the country as well (Majdzadeh et al. 2009).

It is perhaps desirable to choose medical students based on qualities that can predict their better performance as a doctor in the future, qualities that a good doctor must possess and which are not eliminated or learned in medical universities (Bore et al. 2009; Poole et al. 2009). To be a good doctor requires certain personal qualities in addition to academic ability. That is why it has now been widely accepted that admission to medical schools should not be based on academic standards alone (Reede 1999; Barr 2010). In many prestigious universities, a student's scientific capabilities and meta-cognitive characteristics are evaluated side by side (Marley & Carman 1999; Lumsden et al. 2005; Roding 2005; Parry et al. 2006).

In 1997, researchers at the University of Newcastle in Australia designed the Personal Quality Assessment tool (www.pqa.net.au) after precise and systematic studies. This tool evaluates the cognitive, personality and moral characteristics of the applicants. It then identifies the individuals suitable for the medical field (Powis et al. 2006). At the moment, the predictive validity of this test is under review; the preliminary results of which have been encouraging (Dowell et al. 2011; Adam et al. 2012; Tsou et al. 2013). Currently, many prestigious universities around the world including Australia, United Kingdom and several other countries are using this tool to choose medical students (Allsopp & Shariff 2004) or are trialing the tests.

In Iran, the relevant organization is looking for alternative ways to select medical students as it plans to eliminate the Konkoor in the near future. One alternative is to select medical students among graduates with a bachelor's degree, which has been done as a pilot study in TUMS. Inconsistent evidence exists about some of the most discussed topics (Dodds & Van Liere 1951; Conroy 2011): which admission method is better? Will high school graduates make better doctors, or students with a bachelor's degree? This is the question to which medical literature has not yet provided an answer.

In this study, we used the PQA to compare the cognitive, personality and moral orientation characteristics of high school entrants (HSE) and graduate entrants (GE) to evaluate the TUMS graduate entry medicine programme.

Methods

The tests were translated into Farsi and the necessary cultural changes were made. Then the final translated questionnaires were back-translated into English and were sent to the PQA team to ensure the meaning of the questions had remained as designed. The construct validity of the test was confirmed by the PQA team. Furthermore, Cronbach's alpha was calculated in order to evaluate the internal consistency of the questionnaire domains.

The PQA battery (see www.pqa.net.au) consisted of three tests as follows:

- Test A1: the Mental Agility Test Version 2 (MAT2) which has 48 items. High scores indicate greater ability in verbal, numerical and spatial reasoning.
- Test A2: the Mojac Scale Version 2 which provides a measure of libertarian (low scores) to communitarian (high scores) moral orientations (LibCom score). This scale contains a total of 44 items.

Test A3 presents the 100 items of the NACE scale (Narcissism, Aloofness, Self-Confidence and Empathy) followed by 100 items from the Personal Characteristics Inventory (PCI). Three scores are generated from Test A3; Involved (high scores indicating high empathy and confidence and low narcissism and aloofness), Resilience (high scores indicating emotional stability and psychological resilience) and Control (high scores indicating high self-control and conscientiousness). The test also contains a Lie Scale, designed to measure the degree to which respondents are likely to be giving socially desirable responses; the score can be considered as a measure of social desirability bias.

Population under study

One hundred and forty-eight medical students completed the questionnaires in 120-min sessions. The graduate entrants were from the first two cohorts of graduates admitted in TUMS in 2007 and 2008. There were 41 graduate entry students, and all were invited to take part in the test. Only 35 agreed to take the test (response rate = 85.4%) and each completed at least 80% of the questionnaire that is necessary for valid scoring. One hundred and thirteen medical students from the HSE group who had passed the Konkoor in 2007 and 2008 were systematically selected. The test was taken at the same time by the two groups; i.e. at the time when the 2007 entrants were finishing their third semester, and at the time when the 2008 entrants they were finishing their second semester. Since all the students in the GE group were female only female students from the HSE group were selected. One hundred and nine students completed the questionnaire (response rate = 96.5%), but two of the participants completed less than 80% of the questions and were therefore excluded.

The response sheets were then sent to the PQA team in Australia for scoring and analysis. The test scores of the GE and HSE groups were compared through independent sample *t*-tests and Chi-square.

Results

All of the participants in the study were female. The average age of the participants in the GE group was 25.4 (SD = 0.78), and in the HSE group it was 19.8 (SD = 0.72). The difference was statistically significant ($p < 0.001$).

As shown in Table 1, Cronbach's alpha ranged from 0.68 to 0.90 in different sub-domains. The MAT reliability was acceptable (alpha = 0.68), the Lie Scale reliability was good (alpha = 0.73). In all other sub-domains the reliability was considered excellent.

Table 1. Main trait means in the graduate and school entry groups.

| Scale | Groups | N | Mean | SD | T-value | P-value |
|--------------------------------|--------|-----|-------|------|---------|---------|
| MAT ($\alpha = 0.68$) | GE | 35 | 23.0 | 3.7 | -6.2 | <0.001 |
| | HSE | 109 | 27.9 | 5.1 | | |
| | Total | 144 | 26.6 | 5.1 | | |
| LibCom ($\alpha = 0.88$) | GE | 35 | 81.5 | 10.5 | 2.4 | 0.022 |
| | HSE | 109 | 76.7 | 10.8 | | |
| | Total | 144 | 77.6 | 10.9 | | |
| Involved ($\alpha = 0.87$) | GE | 35 | 271.7 | 20.2 | 1.9 | 0.062 |
| | HSE | 108 | 264.3 | 19.6 | | |
| | Total | 143 | 265.7 | 20.5 | | |
| Resilience ($\alpha = 0.90$) | GE | 35 | 110.2 | 9.8 | 3.7 | <0.001 |
| | HSE | 105 | 102.2 | 14.7 | | |
| | Total | 140 | 104.3 | 13.9 | | |
| Control ($\alpha = 0.85$) | MS | 35 | 113.7 | 10.6 | 4.9 | <0.001 |
| | HSE | 105 | 103.9 | 9.61 | | |
| | Total | 140 | 106.4 | 10.7 | | |
| Lie scale ($\alpha = 0.73$) | GE | 35 | 22.9 | 3.1 | 2.8 | 0.007 |
| | HSE | 105 | 21.1 | 3.7 | | |
| | Total | 140 | 21.6 | 3.6 | | |

As seen in Table 1, compared to the GE group, the HSE group had significantly higher cognitive ability (MAT scores), were more libertarian (Mojac LibCom scores), less resilient, less controlled and had slightly lower lie scale scores. There was no significant difference between the groups mean “involved” scores.

If the scores from a sample are to be used for selection purposes, it has been recommended that scores beyond ± 2 standard deviations from the cohort mean be considered for rejection for the Mojac Moral Orientation, Involved, Resilience and Control scales, and 2 standard deviations above the mean for the Lie scale (Bore et al. 2009).

The consideration of cut-points for MAT differs from the above in that MAT is a measure of ability rather than moral values or personality traits. High and low MAT scores indicate high and low cognitive ability, respectively. Thus, MAT scores could be used as a selection indicator (high scores) as well as an exclusion indicator (scores falling below 2 standard deviations below the mean, i.e. extremely low scores). However, in the present study the test results were not used in making selection decisions.

The extreme score rate is the number of people who are not considered suitable to study medicine in at least one of the sub-domains. Among the HSE this was 16 of 109, that is 14.6% of the participants. Whereas among the GE, 7 of the 35 participants, i.e. 20% were regarded as not suitable to study medicine. The difference between the two groups (HSE versus GE) was not statistically significant ($\chi^2 p = 0.45$).

In the cognitive test, MAT, the score difference between the groups was significant. While the extreme low score rate for the HSE participants was actually zero, for the GE participants the number was 5.7% ($p = 0.012$). This difference was not significant for any other sub-domain. In total, 23 people or 15.5% of the students under study in this test were considered unsuitable for the medical field.

Discussion

The TUMS started the admission of graduates in 2008 as a pilot exercise. If evaluated as acceptable, this kind of admission

procedure would be used in the other universities of the country (Majdzadeh et al. 2009). Therefore, it was necessary to determine whether this method of admission had achieved its objectives or not. The results show that high school entrants had higher cognitive abilities, scoring approximately 4.5 points more in this domain ($p < 0.001$) than graduate entrants. This was not far from expectation as the high school entrants had achieved better ranks in the Konkoor exam as compared to graduate entrants. As the only graduate applicants eligible to study medicine in TUMS are those who have graduated from high school with a science diploma (Majdzadeh et al. 2009), most of these students' first choice had been medicine when taking the Konkoor exam, but because of their lower rating they chose to pursue their graduate study in another field, hence graduating with a bachelor's degree.

On the other hand, until this mode of admission (i.e. graduate entry) is restricted to one university alone (i.e. Tehran university of medical sciences), the top students will prefer to enter medicine directly from high school. This is because they enter medicine directly and without taking an additional exam. Moreover, this mode of admission (GE) may not be stable, and may change with the policy makers' change of attitude; meaning there will be no guarantee for it to continue and expand. The medical students admitted from the GE group have gone through a rigorous scientific test and a structured interview, and have presented their overall average grades. However, as long as there are two methods of admission into medical school, it seems that the students with superior scientific abilities take the shorter route of admission from high school, and will not consider a bachelor's degree prior to medical school. Also it should be noted that the GE group students are selected from a smaller pool of applicants, as compared with the Konkoor exam, and hence it might be inevitable to expect higher cognitive achievements among HSE group students.

On the other hand, previous studies conducted in other countries suggest that during the medical courses, the academic achievements of the GE group are no different from the HSE group (Shehmar et al. 2010). A study conducted in the UK in 2008 has shown both these groups complete the

medical courses at the same time (Manning & Garrud 2009). Some evidence supports the claim that the GE group has better knowledge based performance when compared with the HSE group, though this advantage has nothing to do with their bachelor's discipline (Price et al. 2010). However, another study denies this and claims the GE group's knowledge based performance to be weaker than that of the HSE group (Manning & Garrud 2009).

In Iran, GE students go through the basic science subjects in two semesters, while HSE students study these courses in five semesters. It must be noted that when applying, GE students take a test that is almost at the same level as the comprehensive basic sciences exam of medical course. Thereafter, both groups take similar basic sciences exams. The remaining curriculum is exactly the same for both groups. Hence, considering their similar curriculum in TUMS, the academic success of these two groups must be studied in future research. However, certain considerations must be taken into account when reviewing the GE group's academic curriculum (Price et al. 2010).

Graduate entry students spend less time completing the medical course. One of the main rationales for admitting graduate applicants around the world is to spend less time and resources for their education as medical students. Furthermore, the variety of admitted medical students will increase; individuals from poor communities can study medicine too and the medical students will be more like the general population (Carter & Peile 2007a, 2007b).

The graduate applicants who apply to study medicine at TUMS are mostly female, and 100% of the admitted students have been female. Their age range is significantly higher than the female high school entrants in TUMS, although 25 years is the age limit for taking the entrance exam. After graduation, male students in Iran either start working or are forced to join the military service. This could be the reason why all the admissions were women. However, even in England about 60% of graduate entrants were women, who were significantly older as compared to high school entrants (Powis et al. 2004; Searle 2004).

Like elsewhere in the world, the ratio of females to males is increasing in Iran's universities admissions; over 60% of Iran's academic students are female (Tabatabaee-Yazdi 2007). In addition to constituting the majority of the population in each discipline, females score higher in tests too. One study showed that the number of female medical students who got 'A's was 6 times the number of males who got 'A's (Rashidi Nejad & Mortazavi 2005). Therefore, caution must be taken in generalizing the findings of this study to all HSEs, because our study only consisted of female HSEs and the males were consequently excluded for matching purposes.

The PQA score for cognitive abilities, as shown by a study in medical universities of Scotland, is not influenced by gender. However, females show more empathy and are more communitarian (Reede 1999).

Our study shows that HSE group had less self-control and strength when coping with stress. This finding concurs with other studies in this field. In 2009, a study at Nottingham University using the PQA tool concluded that, in comparison to high school entrants, graduate entrants were significantly

more conscientious, self-confident and had more self-control. That study also showed graduate entrants to be more communitarian when compared to the high school entrants (James et al. 2009). In our study also graduate entrants proved to be more communitarian. Communitarianism scores of graduate and high school entrants of TUMS, both combined and separate, were higher than that of medical students in other countries. For example, the population under study in our research scored a total of 77.6 in the LibCom test, whereas medical students in Australia and Japan scored 63.9 and 65.1, respectively (Bore et al. 2005); in Scotland, female applicants in one medical school scored 51.0, a much lower level of communitarianism (or higher libertarianism; Lumsden et al. 2005).

As mentioned above, being "involved" means having high levels of empathy and self-confidence, yet low levels of narcissism and aloofness. Nottingham University's study shows their graduate entrants to have higher empathy levels than school leavers (James et al. 2009), whereas in our study the difference in the levels of involvement did not reach significance, possibly due to the study's small sample size.

In our study, high school entrants had less resilience (the ability to confront stress and unpleasant incidents), and their control scores (level of conscientiousness and self-control) were also significantly lower than graduate entrants. This is yet another finding that is in line with the Nottingham study (James et al. 2009).

What was of some concern in our study was the small number of graduate entrants. Our non-significant differences could be explained by the small sample size and low power of the study. However, all the differences turned out to be significant except for the involved scores.

The respondents knew the objective and goal of this test. The GE students knew that they were to be compared with HSE students, and that their poor results might affect the continuation of this type of admission. Furthermore, they were the first two groups admitted to study medicine using this method of admission in Iran. All of these factors may have caused an extra level of stress and could be the reason why their scores on the Lie scale were higher.

The study was restricted to female students, eliminating the possibility of comparing the two genders. Our initial assumption was that gender would affect the results though PQA scores for cognitive ability in medical universities in Scotland were not influenced by gender (Reede 1999). To provide more accurate results, gender matching was done in this study, though the number of graduate entrants and hence sample size was limited. Our respondents scored higher on empathy were more communitarian relative to medical students in other countries, but the interpretation and generalization of the results must be treated with caution.

The Persian version of the PQA test was created in this study, and has shown good reliability (Cronbach's Alpha) and validity and in relation to results from other countries. Evaluating these groups' grades, academic and professional achievements in future studies will be necessary to prove the predictive validity of this test. The questionnaire can be used to select suitable candidates for the medical field in the event that the Konkoor is eliminated. Also, GE profiles should be

compared with those of HSE students in future studies, when they are more closely matchable in terms of age and experience. Although, it is generally assumed that personality is relatively stable after childhood, and though there may be some changes during late adolescence or due to experiences in medical school, there is very little evidence of this. Indeed, the impact of the medical school experience, and how that affects later development and behaviour as a professional, is a topic that needs to be researched in all cultures. In addition, older age does not necessarily imply more maturity. As people grow older, their lives become more complicated. Their family responsibilities grow and they may have to tackle financial problems (Powis et al. 2004).

Although the graduate entrants' cognitive abilities are lower than those of the high school entries, their personality characteristics are perhaps better for aspirants to the medical profession. Of course, we do not know how the students will actually perform in the medical programme, nor do we have any idea whether or not they will make good doctors so the caution is necessary in the interpretation of findings. It was assumed that the works on selection methods for medical school were appropriate only for predicting behaviour during medical school, not beyond that. In other words, we also need to research what happens to doctors after they have left medical school, and try to show how their medical school experiences affect their later professional development.

However, in order to select graduate applicants with higher levels of cognitive abilities, the educational policymakers may need to introduce appropriate interventions.

Acknowledgements

The authors wish to acknowledge the contribution of the medical students of TUMS without their kind co-operation this study would not have been possible.

Declaration of interest: This study was project funded by Tehran University of Medical Sciences research deputy under the number 88-02-76-8814. Drs Bore, Munro and Powis declare a commercial interest in the PQA battery of tests.

Glossary

Reliability: Trust in the accuracy or provision of one's results; in the case of tests, it is an expression of the precision, consistency and reproducibility of measurements.

Validity: In the case of assessment, validity means the degree to which a measurement instrument truly measures what it is intended to measure.

For full definitions, see <http://www.mededworld.org/Glossary.aspx>

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