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Applicants to medical school: if at first they don't succeed, who tries again and are they successful?

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Abstract

This study compared the profile of those who, after initial failure to be selected, choose to reapply to study medicine with those who did not reapply. It also evaluates the chance of a successful outcome for re-applicants. In 2013, 4007 applicants to undergraduate medical schools in the largest state in Australia were unsuccessful. Those who chose to reapply (n = 665) were compared to those who did not reapply (n = 3342). Results showed that the odds of re-applying to medicine were 55% less for those from rural areas, and 39% more for those from academically-selective schools. Those who had higher cognitive ability and high school academic performance scores in 2013 were also more likely to re-apply. Socio-economic status was not related to re-application choice. Re-applicants' showed significant improvements in selection test scores and had a 34% greater probability of selection than first-time applicants who were also interviewed in the same selection round. The findings of this study indicate that re-testing and re-application improves one's chance of selection into an undergraduate medical degree, but may further reduce the diversity of medical student cohorts in terms of rural background and educational background.

Keywords Retesting · Widening participation · Selection

Introduction

There are people who are so determined to become a doctor that if their first application to enter medical school is unsuccessful, they reapply, sometimes repeatedly. A second application entails re-sitting selection tests and in the high-stakes context of medical student selection, re-testing appears to be widespread (Lievens et al. 2005). For example, between 2006 and 2012 over 11,000 people resat, at least once, the Undergraduate Medical and Health Sciences Admissions Test (UMAT), a test of cognitive ability which is used for

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selection into undergraduate medical degrees in Australia and New Zealand (Andrich et al. 2017). Similarly, at least one-third of those who sit the Medical College Admission Test (MCAT) do so more than once (Zhao et al. 2010).

Although widely considered to be fair practice (van Iddekinge and Arnold 2017), re-testing can produce a significant improvement in scores (Hausknecht et al. 2007). For example, in the context of medical student selection gains have been observed as a consequence of re-testing on the MCAT (Koenig and Leger 1997), the UMAT (Puddey et al. 2014), and the selection tests used in Belgium (Lievens et al. 2005). However, evidence suggests that such gains occur without a commensurate improvement in the candidate's ability in the underlying construct being measured by the test. For example, Lievens et al. (2007) showed that re-test scores (on Belgium's Medical and Dental admission test) were less saturated with general ability than were the initial scores, which in turn significantly reduced criterion validity. Similarly, Andrich et al. (2017) employed a probabilistic Rasch model to analyse re-testing scores on the UMAT. They found that higher scores were only due to repeat candidates answering additional easier, but not more difficult, test items, suggesting that higher scores were not due to improvement in the constructs being measured but to testwiseness. This increase in scores has therefore been the major focus of research on re-testing because, if it results in repeat applicants having a greater likelihood of success despite no real improvement in ability from the first to second testing, the opportunity to retest has consequences for reliability and validity, and thus the legal and moral defensibility in the use of the test (Schleicher et al. 2010).

Nevertheless, little is known as to the full extent that score improvement as a result of re-testing in medical selection actually leads to greater selection success. For example, re-testing increases may primarily reflect regression to the mean (Olenick et al. 2016), with re-applicants thus remaining non-competitive. Therefore, the first aim of this study is to assess the relative chance of success after re-application in order to fully evaluate the benefits and risks of allowing re-testing in a high-stakes context.

More recently, re-testing has also raised concerns regarding its potential to reduce the diversity of selected cohorts. Evidence from the broader body of selection research indicates that re-testing increases the adverse impact of some selection tests on certain disadvantaged groups (van Iddekinge and Arnold 2017). Members of such groups may not only be less likely to re-apply after initial failure but may also obtain smaller gains on re-testing if they do re-apply. For example, van Iddekinge et al. (2011) found that females and younger candidates improved to a greater extent after retesting whereas Black candidates had smaller improvements than other racial groups, supporting Schleicher et al. (2010). Moreover, this negative effect is thought to be more severe in high-stakes contexts. In terms of who re-applies, Hausknecht (2010) found that internal applicants were more likely to reapply than external applicants but that personality did not influence reapplication. In contrast, Barron et al. (2017) showed that conscientiousness did predict the decision to re-apply. However, the demographic profile of who applies is less clear, with limited, if any, research examining how any of these re-testing issues are influenced by other indicators of disadvantage, such socioeconomic status (SES).

Widening the participation of underrepresented/disadvantaged groups in the medical profession is a global imperative (Nicholson and Cleland 2015). Yet notwithstanding considerable effort, medical schools continue to inadvertently select disproportionately fewer students from low socioeconomic backgrounds (Griffin and Hu 2015) and do not always attract sufficiently large numbers of rural applicants (Hay et al. 2017). It may therefore be that re-testing and reapplication in the context of medical student selection exacerbates the diversity problem within medical schools with regard to SES and rurality. In other words,

it is possible that those from low-SES or rural backgrounds do not benefit as much from re-testing as others (in terms of score increases), or that having failed to gain a place on their first application, they lose all confidence to reapply and thereby miss out on a potentially greater chance of selection. The second major aim of our study is therefore to identify the factors that influence the likelihood of re-application to a medical degree, answering calls (Schleicher et al. 2010; van Iddekinge et al. 2011) for research to identify the types of people (not just medical school applicants) who, after initial failure to be selected, choose to re-test and reapply. The third aim of our research is to investigate whether the difference between initial and repeat test scores is related to any demographic factors among those who reapply to a medical degree.

Using a dataset of all the applicants over 2 years to all three undergraduate medical degrees in the largest state in Australia, this study compares the profile of those who chose to reapply after initial failure with those who did not reapply and whether retesting gains were related to any demographic factors, thereby assessing the extent that re-application acts against efforts to widen participation of under-represented groups in medicine. We are also the first to be able to evaluate medical school re-applicants' chance of a successful outcome.

Methods

Participants and procedure

After ethical approval (H11463), the universities offering undergraduate medical degrees in New South Wales, Australia (three programs in all, henceforth referred to as Program A, Program B, and Program C) provided their application datasets for 2013 and 2014. Data were independently merged and anonymised before analysis. The first set of analyses examined all unsuccessful domestic applicants in 2013 ($n=4007$), comparing those who reapplied in 2014 ($n=665$) with those who did not ($n=3342$), and then evaluated the re-testing results. The second set of analyses compared selection success of the re-applicants with those who were first-time applicants in 2014 ($n=3454$). We did not include international or indigenous applicants, both of whom undergo different selection processes.

Measures

Applicant demographics

Information included gender, age, type of high school attended (public comprehensive, public academically selective,¹ lower-cost independent, higher-cost independent [based on a median split of annual fees]), and residential postcode. Postcode information was used to allocate:

¹ Government run high schools that admit students on the basis of their scores on a cognitive ability selection test. All other schools admit students from the full range of ability, with no selection testing. Selective schools therefore have students who typically obtain high ATAR scores at the end of their high school education, but the curriculum is the same as that in all other government and private high schools.

- (1) Index of Relative Socioeconomic Advantage and Disadvantage (IRSEAD), a decile rating calculated by the Australian Bureau of Statistics (ABS 2013) with scores ranging from '1' = suburbs in the lowest 10% on indicators of SES, to '10' = suburbs in the highest 10%. The IRSEAD summarises information about the economic and social conditions of people and households within a suburb, including factors such as household income, educational level and occupation types.
- (2) Rurality, using the Australian Statistical Geography Standard-Remoteness Areas (ASGS-RA) classification developed by the ABS and obtained from the Australian Government Department of Health Doctor Connect website (Department of Health (Australia), 2017). The 5-point scale ranges from '1' = major city through inner regional, outer regional, remote to '5' = very remote. Given the relatively small numbers in remote and very remote areas, this variable was recoded to '1' = rural (ASGS-RA categories 2–5) and '0' = not rural (ASGS-RA1).

We also recorded the number of medical programs each applicant applied to. Applicants can choose to apply to only one program, to two or all three.

Selection test scores

These included:

- (1) Australian Tertiary Admissions Rank (ATAR), a percentile ranking based on academic performance in the final year of high school. This score was the same for both 2013 and 2014. There is evidence for validity (see for example, Griffin et al. 2018).
- (2) UMAT scores for 2013 and 2014. The UMAT consists of three scores, one for each of the subtests (logical reasoning, understanding people, and non-verbal reasoning) assessing different aspects of cognitive ability (see Griffin et al. 2013 and Mercer and Chiavaroli 2006 for details and technical information). We used raw scores not percentile rankings as the latter are cohort-dependent, making comparisons across years less meaningful.
- (3) Interview scores for each program (using an overall score out of 7 for each interview). The overall score was used as this is the format used for selection decisions. Coefficient alphas (using subscores) across both years ranged from .94 to .33 (with scores below .70 at only one program). Interview scores were only available for the subset of applicants who were shortlisted for interview on the basis of their ATAR and UMAT results, with some being interviewed for all three programs (i.e., three interview scores available), or at two or just one program.

Application outcomes

These included:

- (1) Shortlisted for interview ('0' = not shortlisted at any university, '1' = shortlisted for an interview at one or more universities).
- (2) Enrolment status after the 2014 selection process ('0' = not enrolled in a medical degree, '1' = enrolled in a medical degree).

Table 1 Applicant descriptive statistics

	2013 did not reapply	Re-applicants	2014 First-time applicants
% Female	55.4	55.0	55.56
Age	20.04 (3.78)	19.58 (2.49)	18.83 (3.60)
IRSEAD decile	7.16 (2.84)	7.00 (2.96)	7.29 (2.77)
Rural classification			
% RA1	84.8	92.4	84.4
% RA2	9.9	5.8	10.2
% RA3	4.8	1.4	4.5
% RA4	.3	0	.5
% RA5	.2	.5	.3
High school type			
% State selective	25.5	39.0	28.0
% State non-selective	24.3	18.1	22.6
% Independent low cost	17.5	17.5	16.7
% Independent high cost	32.7	25.4	32.7
ATAR	74.80 (39.69)	92.39 (20.52)	95.66 (6.97)
UMAT 1 2013	52.43 (9.65)	53.60 (8.64)	
UMAT 2 2013	52.22 (9.45)	52.83 (8.90)	
UMAT 3 2013	53.76 (9.78)	55.73 (8.51)	
UMAT 1 2014		56.77 (9.31)	53.28 (10.12)
UMAT 2 2014		55.57 (8.36)	52.87 (9.52)
UMAT 3 2014		57.83 (8.75)	53.84 (9.66)
Program A interview 2013	5.34 (1.15)	5.19 (1.13)	
Program B interview 2013	4.54 (.81)	4.50 (.66)	
Program C interview 2013	5.01 (.51)	4.98 (.49)	
Program A interview 2014		5.57 (.88)	5.38 (1.09)
Program B interview 2014		5.15 (.62)	5.12 (.65)
Program C interview 2014		5.39 (.53)	5.41 (.51)

Mean scores with SD in brackets or percentage

Results

Table 1 presents demographic details and selection test results for each of three groups: (1) 2013 applicants who were unsuccessful but did not reapply in 2014, (2) 2013 applicants who were unsuccessful then re-applied in 2014, henceforth “re-applicants”, and (3) 2014 applicants who were applying for the first time, henceforth “first-time applicants”. Overall, applicants had relatively high IRSEAD scores (i.e., high socioeconomic status) and were more likely to come from an urban rather than rural area.

Differences between 2013 applicants who did and did not reapply in 2014

Demographics

Chi square tests showed no significant differences between the re-applicants and those who did not reapply in terms of gender (Chi-sq(1) = .03, $p = .86$) and IRSEAD ($t(3654) = 1.28$, $p = .20$). Compared to those who did not reapply, re-applicants were significantly younger ($t(4000) = 3.02$, $p < .001$) and more likely to live in New South Wales (NSW) rather than interstate (Chi-sq(1) = 157.79, $p < .001$). Re-applicants were also less likely to live in a rural area, with just 8% of the unsuccessful rural applicants reapplying compared to 20.5% of those from major cities (Chi-sq(1) = 50.85, $p < .001$). Re-applicants were significantly more likely to have attended an academically-selective high school (Chi-sq(3) = 50.69, $p < .001$).

Applications

Re-applicants applied to more medical programs in 2013 than those who did not reapply ($M = 2.20$ ($SD = .81$) vs. 1.89 ($SD = .83$), $t(4005) = 8.95$, $p < .001$).

2013 selection test results

Re-applicants had significantly higher ATAR scores compared to the 2013 applicants who did not reapply ($t(1800) = -15.38$, $p < .001$). They also had significantly better UMAT 1 and UMAT 3 scores [$t(1020) = -3.07$, $p < .01$, $t(1044) = -5.24$, $p < .001$ respectively] but not UMAT 2 scores ($t(3799) = -1.53$, $p = .13$). Re-applicants were also more likely to have been shortlisted for interview in 2013 (25.4% interviewed) than those who did not reapply (14.3% interviewed). However, of those interviewed, there were no significant differences in 2013 interview scores between re-applicants and those who did not reapply ($t(277) = .90$, $p = .37$; $t(166) = .25$, $p = .80$; $t(421) = .55$, $p = .59$ for Programs A, B and C respectively).

Data were not available for interstate applicants who successfully enrolled in their home state, so the above analyses were repeated using only applicants from NSW, and revealed the same pattern of significance. Using NSW applicants only, a logistic regression (Table 2) predicting re-application was conducted. With all variables in the analysis, rural location remained significant, where rurality reduced the odds of re-applying by 55%. ATAR and the number of programs applied to in 2013 were also significant predictors. Having attended an academically-selective school increased the odds of re-application by 39% ($p = .056$ in NSW-only analysis, $p < .001$ in total sample analysis). SES was also significant, but with those of higher SES somewhat *less* likely to reapply when all other variables were taken into account ($\text{ExpB} = .96$).

Re-testing outcomes

UMAT results are only valid for 1 year. Confirming prior research (Puddey et al. 2014), re-testing resulted in a significant score improvement (see Table 1) for all three UMAT subtests: UMAT 1, $t(653) = 11.50$, $p < .001$; UMAT 2, $t(653) = 9.22$, $p < .001$; UMAT 3, $t(653) = 6.77$, $p < .001$, with lower scores in 2013 predicting the greatest gains in 2014

Table 2 Logistic regression predicting likelihood of reapplying

	B	S.E.	Wald	Exp(B)
Constant	−3.66**	.808	20.47	.03
Age in 2014	−.08*	.026	8.53	.93
Gender	−.14	.120	1.41	.87
Rural (1 = yes, 0 = no)	−.81**	.257	9.81	.45
High school (1 = selective, 0 = no)	.33!	.171	3.66	1.39
High school (1 = low cost independent, 0 = no)	.30	.193	2.49	1.36
High school (1 = high cost independent, 0 = no)	.19	.184	1.09	1.21
IRSEAD	−.05*	.020	5.01	.96
UMAT 1 (logical reasoning)	.01	.009	.77	1.01
UMAT 2 (understanding people)	.01	.007	2.06	1.01
UMAT 3 (non-verbal reasoning)	.01	.008	2.53	1.01
Australian Tertiary Admission Rank (ATAR)	.02**	.003	50.87	1.02
No. programs applied in 2013	.28**	.078	13.03	1.33
No. programs interviewed in 2013	−.09	.095	.80	.92

N.B. Only NSW re-applicants ($n=545$) and those who did not reapply ($n=1807$), with re-applicants coded 1

IRSEAD Index of Relative Socio Economic Advantage and Disadvantage

** $p < .01$; * $p < .05$; ! $p = .056$

($r = -.32$, $-.51$ and $-.45$ respectively). However, 33.3%, 40.8% and 43.9% of re-applicants showed no improvement or had lower scores on UMAT 1, UMAT 2, and UMAT 3 respectively. While younger re-applicants showed significantly greater improvement on UMAT 1 ($r = -.19$, $p < .01$), no other demographic factor, nor ATAR scores, were related to the degree of improvement in UMAT performance.

Just over half (53.1%) of re-applicants were not shortlisted for interview in any year for any program, and a further 8.2% who were interviewed in 2013 were not shortlisted in 2014. That is, 61.4% of re-applicants did not make it to interview at their second application despite repeating the UMAT test. However, 141 (28.4%) who were not interviewed in 2013 did get shortlisted for interview in 2014. After taking UMAT scores into account, no demographic variable was related to the chance of being shortlisted for interview.

Repeating an interview resulted in a significant score increase for each program (Program A, $t(24) = 2.67$, $p = .014$; Program B, $t(27) = 6.56$, $p < .001$; Program C, $t(63) = 5.32$, $p < .001$), although 39%, 20% and 11% achieved the same or lower interview score in 2014 at Program A, B, and C respectively. Interview score gains were unrelated to any demographic variable.

Enrolment outcomes

Of all the re-applicants, only 19.7% ($n = 133$) achieved enrolment in a medical degree after the 2014 selection process. However, when considering only those who were shortlisted for interview, 51.8% of re-applicants achieved enrolment compared to 38.4% of first-time applicants. In other words, re-applicants had a 34% greater probability (relative risk) of being enrolled provided they were shortlisted for interview ($\text{Chi-sq}(1) = 14.08$; $p < .001$).

With regard to those enrolled in 2014, there were no demographic differences between re-applicants and first-time applicants, except for age ($t(429)=4.43$, $p < .001$).

Discussion

This study aimed to provide a better understanding of the group of people who, after initially failing to obtain a place in medical school, will reapply the following year. In particular, we investigated whether any demographic factors predicted either the propensity to re-apply or the size of any re-testing gains in order to assess the potential for disadvantage. We also sought to identify if re-applicants had a greater chance of success than first-time applicants because of an improvement in selection test scores after re-testing. Although these issues currently “lack empirical scrutiny” they could provide information that “gives researchers insight into the mechanisms underlying practice effects and informs practitioner discussions concerning retesting policies” (Hausknecht 2010, p. 300).

The findings indicate that the practice of re-application is influenced by some, but not all, demographic factors; results that nonetheless have potential implications for the diversity of medical student cohorts. Specifically, age, rurality, and high school type predicted the odds of re-applying after initial failure. Interestingly, re-applicants had a similar gender and SES profile as those who didn’t reapply (although, when all other factors were controlled, low-SES background applicants had slightly *greater* odds of re-applying). However, ours was a limited measure of SES that may not have captured true disadvantage.

In contrast, rural and educational background did affect the odds that someone would try for a second time to get into a medical degree. Those from rural backgrounds were significantly *less* likely to reapply compared to those from major cities (regardless of how well they had performed in their initial selection tests), a significant finding given that attracting rural students has implications for medical workforce planning (Jones et al. 2009). Whilst rural applicants were seemingly not negatively impacted by the selection process (perhaps due to targeted selection pathways), this finding suggests that after one failure they are more inclined than their urban counterparts to give up. Apart from their own self-efficacy, they may also lack parental encouragement—given the evidence that rural parents have lower educational aspirations for their children compared to parents living in urban areas (Baxter et al. 2011). The financial cost of moving to university is also a known disincentive for rural students to engage in tertiary study (Richardson and Friedman 2010), a socio-economic factor that may have been masked in the current study. Indeed, others (Nicholson and Cleland 2017; Watson et al. 2016) have highlighted the need to strengthen rural students’ educational aspirations by developing their social capital and learning efficacy, and by providing appropriate support.

In contrast, re-applicants were *more* likely to have attended an academically-selective high school, even after holding high school academic performance constant. We did not capture data on ethnicity, but academically-selective schools have a very high proportion of students from migrant and non-English speaking backgrounds (Ho 2017), so this finding may indicate a cultural effect given that among some cultures and migrant groups, a career in medicine is highly regarded (Robb et al. 2007). Alternatively, or even strengthening this socialisation effect, academically-selective schools may develop their own “culture” of high achievement and competition, where having a career in medicine could be seen as an indicator of success. It appears that these social influences continue for at least 1 year after leaving high school and despite engaging in alternative programs of study in the interim. As noted above, those

from rural areas (where there are few, if any, academically-selective high schools) may not benefit from home or school influences that promote re-application. Re-application (with the associated re-testing) is also thought to be a stressful process making the decision to do so even more difficult (Barron et al. 2017). As a practical strategy to address this imbalance, universities might give targeted feedback and encouragement to rural applicants who were “near misses” to encourage their re-application.

The results indicate that when deciding whether to reapply, people have made relatively valid judgements about their chance of success in the next selection round using known information. That is, those with higher ATAR and UMAT test scores were more likely to have reapplied, even though they had to repeat the UMAT. They also made application to more medical programs, suggesting a motivation effect. Interestingly, re-applicants were no different to those who chose not to reapply in terms of their 2013 interview scores. Feedback on interview performance is not provided by any program, and perhaps re-applicants are less able to self-assess on this aspect of their selection testing so that those with low interview scores were not de-motivated to re-apply.

Regardless of the factors that influenced the propensity to re-apply, no demographic variable was related to the size of improvement in interview scores and only age predicted improvement in UMAT scores. This result supports van Iddekinge et al. (2011) and Schleicher et al. (2010) who both found that younger applicants improved to a greater extent, although we did not replicate their results regarding females.

This is the first study to provide evidence of how re-application increases one's chances of entry into medicine. Re-testing on both the UMAT and selection interviews resulted, on average, in improved scores. For more re-applicants than would be statistically expected, this led to selection into a medical degree. Despite the perceived fairness of allowing re-testing in this high stakes context (van Iddekinge and Arnold 2017), these results suggest the possibility of associated risk. First, there is the potential to further disadvantage the already-disadvantaged rural applicant. Second, in light of recent evidence (Andrich et al. 2017) indicating that higher scores resulting from re-testing on the UMAT do not reflect improvements in the cognitive abilities it measures, there is the risk that re-applicants who are selected may not have sufficient cognitive ability to cope with the academic demands of a medical degree. In other words, if, as indicated by Andrich et al. (2017), the first score is a better representation of true ability (and second score reflective of practice effect), the re-applicants who were selected may actually be less able than those who were selected on their first application. Likewise, the re-applicants who were selected in 2014 had low interview scores in 2013 and despite their practice advantage, these re-applicants only reached the level of performance of first-time applicants. Their actual level of non-cognitive ability could therefore also be lower than that required for good medical practice. However, further research is required to establish the meaning of score change in interviews, with factors such as a reduction in test anxiety a possibility (Lievens et al. 2005).

The advantage conferred by re-testing thus has fairness implications for first-time applicants. It also indicates an unnecessary cost to the tertiary system. The majority of re-applicants selected in 2014 had enrolled in an alternative university degree for a year, taking a competitive place, and incurring a cost to higher education before withdrawing to study medicine.

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