A Review of Options for Selection into Foundation Training

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1. Executive summary

This literature review and analysis was commissioned by the Medical Schools Council to explore the evidence around high stakes selection processes in order to inform the discussion about a possible change to the selection procedure for foundation posts in the future.

We searched a number of relevant databases and were informed by discussions with colleagues in other professions and countries. We have analysed 197 publications from 1990 – 2009, with about equal amounts relating to medical school selection and selection into post-qualification posts, particularly residency. The majority of papers are from the USA.

The common attributes of selection processes that are discussed and examined in the mainly medical literature are face validity and reliability. A smaller number of authors explored the predictive validity of methods. There is a lack of consensus with results and predictions. The overwhelming message is that a number of different processes are required to ensure validity, reliability and acceptability, but this may be at the expense of feasibility and cost-effectiveness. Methods must also be fair and non-discriminating.

Interviews are still commonly used while the multiple-mini interview process is becoming more prevalent. However some schools do not interview and selection into intern posts in Australia does not involve interviews. Portfolios are not used in medicine unless for assessment.

The non-medical literature (which could not be explored in any great depth in this paper) is beginning to focus on employability skills, based on a job analysis and definition of graduate attributes. These are assessed through written and oral exercises, and the assessment centre is commonplace.

We conclude with recommendations around employability skills, as these seem to be the logical competencies to assess as medical school end-point assessment focuses on ensuring that graduating medical students are competent.

2. Introduction

When an organisation is considering introducing a method of selection for a new position, training post or career pathway, the first thing to decide is the purpose of the selection process. The purpose may be:

- To select the best person/people for a position (or training) in terms of previously defined essential and desirable criteria
- To distinguish between people who are likely to be successful in the position (or training) and those who are more likely to struggle or fail to progress
- To weed out those people who do not have the right attributes for the position – these may be defined in terms of knowledge, skills and attitudes either already in place or with the potential for development
- To rank qualified people so that the highest have more choice as to further training or positions while the lowest are more likely to be assigned to posts, or not be selected at all.

It is the last of the above that is the rationale behind the selection procedure for medical students' progressing into F1 posts and post-qualification training, whereas the top three are the rationale for university selection and, particularly for the purposes of this review, medical school selection. All four to some extent are the basis for registrar selection in the UK and residency selection in the USA and Canada.

Selection into posts often occurs before the summative assessment of the knowledge, skills and attitudes required for the post, but is dependent on that assessment ultimately for final approval. Summative assessment is a marker of the successful completion, or otherwise, of a defined area of study and should be aligned with the objectives and learning activities of the programme. Selection, as an additional process beyond end-point assessment and qualification, should therefore be of added value and evaluate extra domains within candidates, otherwise the selectors could simply use the end-point ranking as available. If the end-point is pass/fail and there are more candidates than positions, the selection process becomes a form of ranking itself and should have the same attributes as optimal assessment processes, ie validity, reliability, acceptability to stakeholders (the selectors and those being selected), feasibility and cost-effectiveness (van der Vleuten 1996), plus fairness. Evidence in relation to suitability for the position should also be sufficient, current and authentic (DOHA 2004). An additional facet of selection processes can be assessment of a candidate's employability and work readiness; this is particularly pertinent for selection into first posts after secondary or tertiary education.

'The use of validated employee selection and promotion procedures is crucial to organisational effectiveness...valid selection procedures can lead to higher levels of individual, group and organisational performance. Valid procedures are also essential for making legally defensible selection decisions' [In this context validity refers to the inferences drawn from the scores during selection procedures] (Iddekinge & Ployhart 2008 p871-872).

As Nayer (1992) wrote in relation to medical schools admissions procedures (as quoted in Salvatori 2001): '*the purpose of admission procedures is to select students who will complete the educational program and go into professional careers, do well in the program, perform creditably in professional practice and possess the traits of character and ethical values desired of a professional person' (p42).*

Wood's editorial in *Medical Education* (Wood 1999) also relates to medical school selection but could apply to any high stakes selection process that will have a bearing on an individual's future: '*…selection should allow equal opportunity to all students who fulfil a set of pre-defined criteria, irrespective of sex or social, ethnic and religious background. Moreover, the process should be transparent and open to scrutiny' (p399).* Wood goes onto highlight the difficulties in pre-defining criteria for selection into a programme that goes on for several years and during which students are expected to mature. This is difficult both for a two year foundation programme, during which the junior doctor is expected to take on more responsibility and to cope increasingly with uncertainty, and a four to five year medical school course. Can we predict that a successful medical student will become a successful F1/F2 doctor? What does successful mean in this context anyway? Recent evidence has shown that the majority of students are not fully prepared for their first day's work as a qualified practitioner, yet the majority matures, though at different rates, during the junior years (Illing et al 2008). Can an end of medical school selection process validly and reliably decide which doctor will be most suited for which post, or should the process solely be to give the more meritorious first pick of positions?

Internationally there is no similar process to what is happening and proposed in the UK in relation to selection for foundation posts. Selection into foundation posts is a national process without a national examination. There are however similarities with selection into intern (PGY1 – postgraduate year 1) in Australia, which at present is not done primarily on merit. In Australia there is also no national examination and applicants have to apply to each state or territory separately. Selection into internship/residency in the USA and Canada relies to some extent on a national selection process following a national examination but with individual programmes making the recruitment decisions.

In terms of the literature relating to selection processes retrieved through standard data bases, the majority of papers focus on medical school selection, and a smaller number on residency selection, with a few on selection into specialist training in the UK. There are a small number of papers from other countries and other professions, but these are rare. Selection procedures for medical school are of interest as many of the measures used can also be adapted for use for foundation programme selection, so their predictive validity and reliability are important. The overall impression from the papers retrieved is that no one system ranks high in all areas, findings are not consistent across papers due to the variation in processes and reporting, and there is virtually no long term follow-up to explore the outcomes of selection methods in terms of future performance.

For professions other than medicine, there are a small number of papers in relation to veterinary medicine and osteopathy. Other professions that rely on academic results and interviews do not appear to publish in this area (eg law – Tingle, personal communication). However there are numerous publications about selection procedures in the business and personnel literature, which can only be touched on in this review.

2. Methods – search strategy

The search was limited to twenty years, 1990 – 2009, papers in English and accessibility. Databases searched included Medline, BREI, ERIC and CINAHL. In addition papers were added through journal scanning and from reference lists of included papers. Grey literature was accessed after discussion with colleagues in other countries involved in selection after medical school.

The search strategies/terms are listed in the appendix as a number of searches were undertaken.

Databases were first scanned for relevance on the basis of title and abstract; non-relevant papers were rejected at this stage. Retrieved papers were also later rejected after reading the full article.

Papers were rejected on the basis of:

- No relevance whatsoever (there were a large number of these due to the selection terms being broad)
- Focus on why applicants choose particular schools, programmes or careers
- Focus on applicant demographics rather than the selection process itself and/or discrimination
- Focus on minority/underrepresented groups
- Focus on numbers only rather than process
- Papers suggesting a change without any hard data
- Some papers were rejected due to inability to retrieve an abstract or full article

Some editorials and opinion pieces have been included where these add to the arguments and analysis of selection.

3. Results

We developed a number of databases due to the number of searches conducted. These are named and described in table 1. In this table duplicates are those papers which have been retrieved in more than one database search. A- G were searches through Ovid (Medline).

Table 1: Summary of data bases searches

NAME	SEARCH	CITATIONS	DELETED	DUPLICATES	FINAL
Medical school admission	A – F1 all	109	68	9	32
Selection only	B – sel only	126	121	3	2
Medical school full search	C – F1 final 3	259	252	2	5
Residency	D - res	300	140	13	47
Residency – Am supp	E – am supp	958	891	11	57
White space	F – white sp	11	7	2	2
Portfolios	G - portfolios	14	14	0	0
BREI selection	H – BREI sel	17	10	5	2
ERIC selection	I – ERIC sel	129	125	2	2
BREI logbooks etc	J	5	5	0	0
ERIC logbooks etc	K	71	71	0	0
CINAHL	L - CIN	215	181	23	11
Journal scanning					33
Grey literature					4

3.1 Types of paper

Papers mainly fell into the following categories (table 2).

- Description of selection process
- Description of why change made to selection process
- Data relating to reliability
- Data relating to predictive validity
- Data relating to correlation between various selection processes
- Survey of selectors/programme directors asking what they think are the most important components of the selection process
- Survey to applicants asking what they think are the most important components of the selection process

Table 2: Categorisation of papers.

Year	Number	Year	Number	Country	Number	Selection to:	Number
1990	4	2000	12	Australia	18	Medical school	90
1991	4	2001	11	Canada	25	Residency/post-qualification	82
1992	6	2002	12	Netherlands	4	Other	25
1993	9	2003	8	UK	23		
1994	4	2004	14	USA	121		
1995	8	2005	17	Other	6		
1996	4	2006	19				
1997	10	2007	23				
1998	3	2008	19				
1999	5	2009	5				

3.2 Overview of results

The literature in relation to selection into the health professions tends to be divided into processes for university entrance (eg medical schools) and those post-qualification. In the non-health professional literature there has been an emphasis on selection centres and validation of selection procedures. A number of mathematical tests has been applied to selection processes to calculate validity and reliability however *'the primary inference of concern in an employment context is that test scores predict subsequent work behaviour...criterion-related validity (has a) fundamental role in evaluating selection systems' (Iddekinge & Ployhart 2008 p873)* - hence the emphasis on predictive validity in this review. Generalisability (G) theory, and the amount of variance this calculates, is commonly used in the literature reviewed. The use of multiple predictors increases the validity of the overall selection system, but these have to be defined in terms of relative importance (Iddekinge & Ployhart 2008).

3.3 Overview – interviews

Foster & Godkin (1998) provided a useful review of the literature in relation to selection by interview into health care in general, and compared structured and semi-structured processes. They comment that interviewing for selection dates back to at least 1915. Papers from the 1980s have shown that the validity of interviews depends on a number of factors including its structure. Structured interviews have a higher validity and evidence shows that they have a predictive validity better than previously thought.

The structure of an interview should include (Foster & Godkin 1998):

- Questions based on an analysis of the job
- The same set of questions to each applicant
- Descriptors to anchor the rating scales for scoring
- Panel independently rating and recording
- Consistency of approach (including time)
- Special attention to being fair and adhering to guidelines

Questions may be based on the candidate's experience or situational (responding to hypothetical situations), or be a combination of both. The authors concluded that the structured interview can be a valid part of job hiring in health care.

4. Medical schools

There are similarities and differences between medical school selection and foundation programme selection. Both select applicants provisionally on the basis of final examinations but for medical schools there are many more applicants than places so selection is truly competitive. There is an extensive literature mainly from North America on various selection processes, while there have been repeated calls for changes to selection over the last twenty years (eg Rolfe & Pearson 1995 – Australia). Attention has also been drawn to the ethical and moral conduct of admissions processes and panels and the need to ensure that they avoid discrimination and bias, and that any irregularities or mistakes in procedure are recognised and dealt with (Self 1990).

A number of selection processes have been used and developed over the past two decades, leading to many papers about the processes, most of which are descriptions of the various selection methods; some include calculations of reliability, measures of acceptability and/or exercises to enhance face validity. A smaller number attempt to include measures of predictive validity, ie an investigation of whether the selection process does indeed select applicants who go onto do well in their medical programmes. However, such prediction is usually confined to performance in medical school assessments including final summative examinations rather than any long term measurement of career success or performance. One study from McMaster (Canada) is the only one to compare the performance of applicants selected and those rejected but later admitted to other medical schools following the selection process against the national licensing examination (LMCC) and the authors found no significant difference in scores (Kulatunga-Moruzi & Norman 2002). The various components of the selection procedures for medical school are listed in Box 1.

- School leaving examinations (eg 'A' levels)
- GPA – grade point average at high school (also GPAX)
- uGPA – grade point average at university (for graduate entry programmes)
- MCAT – medical colleges admission test (for entry to North American medical schools)
- GAMSAT – graduate Australian medical school admission test (for entry to the Australian graduate entry medical schools)
- Application forms (usually electronic) including personal statements
- References
- Interviews
- MMI – multiple mini-interviews

Box 1: Possible components of selection

High marks at either school (for undergraduate entry) or university (for graduate entry) are easily available data to use in the selection process but selectors often also want to gauge non-cognitive attributes that might add to the chances of producing a 'good doctor'. Norman (2004) in an editorial reminded readers of findings suggesting that good marks do correlate positively with 'niceness' and 'charm' - *'it need not be a choice between high marks and nice persons. There are lots of people who have both, and these are the ones we should select' (p79)*. Marks are important but selectors also need to develop and research better measures of the other important factors that contribute to being a good doctor. If, as Bullimore (1992) argued, certain non-cognitive personality traits are unteachable and formed by age 18, it is important to assess such non-cognitive attributes as honesty and conscientiousness as well as cognitive ability during selection. On the other hand there is evidence that students change during medical school and therefore *'the challenge is...to identify those who are most likely to mature in desirable ways' (Albanese et al 2003 p 316)* - a challenge that might also be important in relation to graduating doctors.

A note of caution was expressed in an editorial in the *Internal Medicine Journal* (Gorman et al 2008). The authors acknowledged that the *'quantitative rationale brings comfort and comfort is a sought-after commodity for medical student selection panels as the stakes are high and the competition intense' (p621)*. However they go onto suggest that *'medical school selection defies simple quantitative expression' (p621)*. To try to correlate selection processes with future performance requires agreement as to the nature of that performance and the definition of what is a good doctor. There is as yet *'no quantitative estimate of a good doctor' (p621)*. There is also no statistical analysis that helps define a bad doctor.

Salvatori (2001) has provided a very useful review of the selection for students into higher education for the health professions and included a total of 83 papers from 1982 – 1999, the majority from medical education with a few from other health professions such as nursing and physiotherapy. Most of the papers originated from North America. She concluded that overall GPA was the best predictor of academic performance in all the health professions, though the correlation between GPA and clinical performance was unclear. For medicine, MCAT was also a good predictor of medical school grades and performance in the national licensing examination, though no such test existed for the other professions. There was no consistent data for interviews and written application forms, but interviews performed better as predictors if interviewers were trained and followed explicit guidelines.

As well as school and undergraduate degree outcomes through GPA and academic transcripts, the most common additional processes are still MCAT, GAMSAT and an application form of some description. In 1993, for example, all 126 United States medical schools used different application forms with the questions reflecting the character of the school (Emmett 1993). Of note is that in 1992 in the USA a typical applicant for medical school would apply to 11 schools, and there would be overall 37000 applicants for 163000 medical school places (Mitchell et al 1994). Admissions committees may include lay members as well as faculty (Elam & Johnson 1997) and students and lay members (Marrin 2004). While panels/committees usually make decisions first individually, subsequent group discussion can change 20% of those decisions (Elam et al 2002). The weighting given to the various elements of selection varies between schools. Kreiter (2002) described using a constrained optimization (CO) decision-analysis model for weighting but gave an example based on 25 simulated candidates only. CO combines pre-determined class composition with previously defined optimum applicant attributes to rank candidates.

Interviews come and go in favour and vary from unstructured (less common) to semi-structured to, more recently, the multiple mini interview (MMI). Admissions assessors including lay members have agreed that selection processes should be fair, valid, comprehensive, affordable, diverse, defensible, a public statement of values and accessible (Marrin 2004).

4.1 Predictive validity

In those studies which attempt to correlate the selection process with subsequent performance, predictive validity is measured against various parameters (Box 2). However *'while much effort has been put into selection measures, less has been devoted to effective measure of performance as a student' (Streyffeler et al 2005)*. Thus predictive validity is difficult to measure, particularly if it relies on notable unreliable indicators such as facilitator ratings and firm/attachment grades, rather than more objective assessments such as OSCEs/clinical examinations.

- Academic record at medical school
- Clerkships/clinical rotation grades/marks
- End of year examinations such as OSCE (objective structured clinical examinations)
- National licensing examinations: USMLE in the USA (United States medical licensing examination) previously known as NBME (national board medical examination) - this has three steps. Step 1 in yr 3, step 2 at graduation and step 3 at the end of the intern year; LMCC in Canada
- Residency performance
- Medical career

Box 2: Predictive validity

Ferguson et al (2002) carried out a 'systematic review' of factors that are significantly predictive of performance at medical school up to year 2000. The papers identified included such factors as gender and ethnicity which are not relevant for this analysis. They found 16 papers that examined the predictive validity of interviews, two papers on the predictive validity of personal statements and one paper on the predictive validity of references. As 62 papers included measures of previous academic performance such as MCAT, A levels, and GPA, they were able to carry out a meta-analysis using hierarchical linear modelling. They concluded that previous academic performance is a good rather than perfect predictor of performance at medical school, accounting for 23% of the variance at medical school and 6% during postgraduate training. In terms of interviews, the studies suggested that they were useful for gaining additional information that has some predictive power. The small number of papers on personal statements and references meant that no firm conclusions could be drawn about their utility. Lumb & Vail (2004) correlated the applications of 700 medical students with success at a year 3 OSCE and found the best predictors were school leaving grades and maturity.

Ferguson et al (2003) also looked at the selection process in 1995 at the University of Nottingham and followed the cohort of 176 students. They found that teachers' references did not predict medical school performance but that A level scores were good predictors. This study also looked at personality indicators against performance but this test was not administered until two years into the course affecting validity. The attribute that correlated best with performance was conscientiousness and this raised the question as to whether this should be tested for as part of the admission procedure.

The longest follow-up study by McManus et al (2003) followed 511 doctors for 20 years after graduation from one London medical school. They found that A level grades predicted performance in medical school (finals grades) and time taken to achieve membership of the Royal Colleges, but not higher academic qualifications or publications. However, these results may not be generalisable to today's students due to changes in medical curricula and assessments.

Australia has both undergraduate and graduate entry medical schools. The first selection process is the GPA/school leaving ranking for undergraduate entry followed by MCAT. Graduate entry schools use results of the

undergraduate degree followed by GAMSAT. Some schools interview. Medical schools changed from a policy of only using national matriculation scores after 1999 due to the impression that the scores did not correlate well with intern performance (Marley & Cameron 1999).

4.2 MCAT, GAMSAT & GPA

The MCAT has been widely used in North America for many years, and is mainly seen as a test of cognition and knowledge, rather than such attributes as empathy and integrity (Donnon et al 2007). However Jones & Borges (2001) reporting on 236 students compared their MCAT scores to a battery of non-cognitive instruments on admission to medical school and concluded that the MCAT might reveal more than purely cognitive ability. Students with high MCAT scores might be more creative and self-motivated as there was a correlation of imagination with such high scores. However, the students who failed to be admitted to medical school were not evaluated. MCAT is thought to eliminate high risk candidates but this depends on the cut-off scores (Albanese et al 2005a, 2005b). Cut-off scores for MCAT have been set by looking at marks in USMLE part 1, correlating them with MCAT and then setting the scores for subsequent years. However this method might be flawed as USMLE part 1 has a high success rate and the scores are not themselves predictive of USMLE part 2 (Kreiter 2007).

To check MCAT's predictive validity, Donnon et al (2007) carried out a meta-analysis of 23 studies and found a 0.39 correlation with pre-clinical performance and a 0.60 with the USMLE. Julian et al (2005) looked at the predictive validity of MCAT and uGPA across 14 medical schools selecting students in 1993-1994; 27406 students took step 1 of the USMLE, 26752 step 2, 25173 step 3. They found that MCAT was impressive at predicting performance and concluded that MCAT is better at predicting academic performance than uGPA. However, while this is the most impressive study of this type in terms of numbers and outcomes, it only looks at the performance of students selected and not those rejected by medical schools who subsequently enter another school. Kreiter & Kreiter (2007) used validity generalisation on the results from 29 published studies to assess the predictive validity of uGPA and MCAT and, while confirming that more research was required in this area, concluded that the results suggested that there is evidence that uGPA and MCAT predict clinical skills performance in medical school. A decade earlier Mitchell et al (1994) used results from 114 schools and compared the MCAT and uGPA with year 1 performance, and showed that MCAT was predictive for year 1 GPA (0.66 for MCAT, 0.53 for GPA and 0.73 for both). A smaller study of 88 students from 1992-1993 also found predictive validity of GPA and MCAT with the earlier step 1 NBME and clinical clerkships at medical school (Silver & Hodgson 1997); while Violato & Donnon (2005) found that one subset of MCAT and the GPA correlated with the clinical reasoning part of USMLE part 2 (597 students).

Gilbert et al (2002) found that the writing aspects of the MCAT (similar to an essay and including verbal reasoning, synthesising concepts and ideas, presenting ideas, written communication skills) had a low predictive validity for USMLE part 1 and part 2 for 355 students. (This paper by Gilbert et al also highlights a problem found in several papers – that of missing data for some students as they are followed from the medical school admission process, through their 4-year programme and onto USMLE, so that analyses can only be performed on a sample of the cohort under scrutiny). But the verbal reasoning section of the Scholastic Aptitude Test (SAT – an earlier form of MCAT) predicted good performance in USMLE step 2 for 323 students suggesting that *'high verbal aptitude serves one well, even when coping with complex scientific concepts' (Roth et al 1996 p176)*. MCAT correlates with year 1 medical school performance (Hall & Bailey 1992) and year 1-2 written tests (Streyffeler et al 2005). But GPAs and the MCAT are poor predictors for students from under-represented minorities (Lynch & Wood 1990) and of facilitator scores for listening and respect (Streyffeler et al 2005). uGPA scores may be related to the standard of the applicant's undergraduate institution and therefore there should be some form of adjustment for equity (Didier et al 2006).

The GAMSAT was introduced for the three Australian graduate entry medical schools in 1995 (Aldous et al 1997). There has been disagreement about the predictive validity of the test. The combination of GAMSAT and uGPA scores has been shown in one study to provide the best means of predicting year 1 performance with the GAMSAT as an objective test being the most validated and generalisable part of the selection process (Coates 2008). However another study from the three schools, albeit with a low response rate of 13.6 % of students, suggested that there is no correlation between admissions criteria (GAMSAT and interview) and the clinical reasoning/diagnostic thinking skills of year 1 and 2 students (Groves et al 2007). Meanwhile a third study following 706 students in three consecutive cohorts suggested that the school's selection criteria only modestly

predicted academic performance with the GPA most strongly associated with performance followed by interview score and GAMSAT score (Wilkinson et al 2008). While the selection process to graduate schools did also originally include an interview (Elliott & Epstein 2005), one of the schools has now dropped the interview completely because of the evidence (University of Queensland) and one has been experimenting with the MMI (University of Sydney).

A paper from the Netherlands followed up students entering in 1982-83 well into their careers and found that GPA predicted study success, career development and scientific output (Cohen-Schotanus et al 2006). Up until 2000 students to Dutch medical schools were selected solely on their GPA and allotted to schools via a national lottery. Following this, universities were given options including the lottery, local selection and unrestricted direct access with a high GPA. When one school introduced a selection process for the 10% of entrants with lower GPAs, these students were subsequently shown to be more motivated and to take up more health related extra-curricular activities, though the high GPA students did better academically (Hulsman et al 2007). Erasmus Medical College used a local selection process to select about 20% of its intake with an emphasis on extracurricular activities as entered in an application form, followed by five cognitive tests on a medical topic over four days (Urlings-Strop et al 2009). The main result of this process was a lower drop-out rate compared to students selected by lottery, but otherwise no significant difference in performance in medical school performance except for the 2001(first) cohort.

4.3 Written applications

Some Canadian schools include candidate written submissions in their selection processes, eg the ABS (auto-biographical screening tool), which contains between five and eight questions. Hanson et al (2007) looked at the differences in scoring on the ABS between candidates submitting electronically under controlled conditions and candidates submitting following completion with no observation. Three people rated the submissions of the top ranking 696 applicants to McMaster – a faculty member, a medical student and a community representative. Scores were significantly higher for the candidates who had submitted off-site while inter-rater reliability was lower for this group. Faculty gave the highest scores and students the lowest. This study has implications for the conditions in which essay type applications are completed. Inter-rater reliability for written applications was improved by marking across questions rather than across applicants, ie a marker scores the same questions for different students, rather than the whole tool for individual students (Dore et al 2006).

The predictive validity of essay writing of any type, including that within the MCAT, varies from study to study. Writing correlates better with verbal reasoning tests while lower scores have been shown to predict poorer clinical performance in medical school and residency (Hojat et al 2000).

The UCCA form in the UK has been looked at in terms of whether it is possible to use them to predict if a successful applicant will be subsequently satisfied with a career in medicine. The conclusion, based on forty forms from 1991 and follow-up in 2002, was there was no correlation (McManus et al 2005).

5.4 Letters of recommendation/references

These can be useful for applicant attributes such as honesty and professionalism and are most helpful if they are factual, descriptive and cite examples of specific behaviours (Johnson & Elam 2001). Seven letters given to selection panels at six medical schools found that ranking was similar for each school, though there was an indication of some gender bias in that one letter was rated higher if thought to refer to a female rather than male candidate (Johnson et al 1998). However this study is not well described.

5.5 Interviews

Morris (1999) provided a good review of the interview process though did not outline the search strategy. Many of the papers dated from the 70s and 80s and there is little attempt at synthesis of the data. His conclusion was that there are more questions than answers, but that interviews are more reliable if structured, that interviewers need training and that they should assess independently before pooling results. In the USA 80% of allopathic medicine, optometry and dental schools interview at least 40% of their candidates, with the interview being used to gather information about candidates and verify information in other parts of the selection process, obviously to make

decisions about selection and/or to promote public relations (Turnwald et al 2001a). Interviewers are most likely to be faculty members (Turnwald et al 2001a).

The evidence suggests that interviews are measuring different attributes to written tests, showing no correlation with 'prior scholastic results' (Tutton 1993) and MCAT or GPA scores (Cournaeya 2005). (Tutton's conclusions however are based on piloting an interview on new entrants to medical school rather than on applicants, but comparing with end-of-school grades.) The communication skills of candidates, not surprisingly, often contribute most to the overall impression (Nowacek et al 1996).

Interviews may be conducted one to one (Nowacek et al 1996) by two interviewers (Patrick et al 2001; Stansfield & Kreiter 2007) by panels of three or more, or have three individual interviews (Basco et al 2008). Interviewers often include clinicians, faculty members and sometimes representatives from the community. Medical students are on 74% of admissions committees in the USA (Kondo et al 2000) and may also be partnered with basic scientists as interviewers, though students have been found to be less discriminating than their expert colleagues (Koc et al 2008). The number of interviewers in the USA from minority groups (eg African-American, Native American) remains low (Kondo et al 2000). Shaw et al (1995) recommended that MCAT and GPA scores should not be available to interviewers so that they could independently assess candidates' non-cognitive attributes as pre-knowledge of the candidate appears to affect interview scores.

Inter-rater reliability of a standardized/structured interview was found to be low to moderate (Kreiter et al 2004). Inter-rater reliability has also been measured by the introduction of simulated candidates into a standard interview round who were assessed by different interviewers and results compared (Harasym et al 1996). The reliability was low at .51 and there was significant variability among the interviewers. However low to moderate correlation of interviews with other selection indices suggests that they are gathering information about applicants that the other processes do not (Patrick et al 2001).

The predictive validity of interviews is variable, with diverse results from the papers that follow-up students during medical school. Interviews have been shown to be weakly predictive of performance in early (pre-clinical) medical school examinations (Richardson et al 1998), to have a small but significant correlation with performance in year 4 clinical examinations particularly the interpersonal score (Basco et al 2008) but no relation to clinical performance or patient satisfaction scores on year 3 OSCEs (Basco et al 2000), facilitator ratings (Streyffeler et al 2005) or year 1 performance compared to the GAMSAT (Coates 2008). Brown University (USA) compared students admitted for three years with an interview and for the following three years without an interview and found no significant difference in medical school or first year residency performance (Smith 1991). However residency performance was scored only on a five-point scale between unsatisfactory and superior by residency programme directors with no indication of the validity and reliability of such a measure.

There are about 3500 applicants to McMaster medical school each year of whom the top 425 are invited for interview on the basis of uGPA and a written autobiography. The interview is in the form of a simulated tutorial (which the authors felt tests for exploration and group skills) with an inter-rater reliability of 0.66. Predictive validity is measured against the Canadian national licensing examination (LMCC). The authors concluded that the whole process is a less than perfect predictor of performance in the licensing examination. The simulated tutorial did not correlate with the communication skills score in the LMCC pt II; the uGPA was the best predictor of both academic and clinical performance (Kulatunga-Moruzi & Norman 2002).

A recent Danish paper described the selection process as measuring in four domains: qualifications (CV), motivation (essay), knowledge (test) and semi-structured interview. Results indicated good discriminant validity for the four variables though the process was seen as time and resource intensive. The 25 minute interview had a high inter-rater reliability. The interview and knowledge test were better correlated with ranking than qualifications and motivation, the last could not be trusted in terms of ranking. The overall conclusion from the analysis of data was that the more measures the better for confidence in the veracity of the ranking (O'Neill 2009).

One of the attributes often looked for in potential medical students is altruism, but this is difficult to measure and is often deduced only from a candidate's application form. Bardes et al (2006) suggested that altruism is a trait that might be assessed at interview by probing for sympathy, however there is no objective evidence given that this would work. Cowley (2006) suggested that the interview process should include giving applicants two lists of

discussion topics to prepare on literature and healthcare politics to be able to select students with an increased focus on humanities. Again there is no evidence that this works.

A meta-analysis of papers relating to interviews (but with little description of the interview processes themselves) for four different health profession programmes indicated that interviews poorly predicted academic performance during the courses but had a modest correlation with clinical performance (Goho & Blackman 2006).

Interviews are also commonly used for selection to veterinary college, 84% of schools in the USA using these according to a 2001 survey (Turnwald et al 2001b). The interviews evaluate similar attributes to those for medical school namely communication skills, maturity, motivation and interpersonal skills, as well as knowledge of veterinary practice. Interviews may last between 20 to 45 minutes, with two to three interviewers.

5.6 MMI – multiple mini-interviews

The multiple mini-interview process is a more recent addition to the battery of suggested processes for selection, mainly into medical school. There have been a number of papers on its format and characteristics, the earliest retrieved from 2004. As its name suggests the MMI consists of a number of stations (similar to the OSCE) through which candidates rotate, each station featuring an interaction with an assessor on a different topic/question. The format of the MMI varies from school to school in the number of stations and the number and status of interviewers. Proponents of this method highlight that the process measures both cognitive and non-cognitive skills, including critical thinking, ethical decision making and communication skills and, depending on the content of the stations, knowledge of the healthcare system (Eva et al 2004a). These skills and attributes have been equated to 'entry-level professionalism' (Roberts et al 2009).

The correlation between stations may be low suggesting that they are measuring different attributes and are thus context specific (Eva et al 2004a; Lemay 2007). Students with high GAMSAT and GPAs can 'fail' the MMI again suggesting it is measuring different attributes to these standard measures, though there is a modest correlation with the 'reasoning in humanities and social sciences' section of GAMSAT (Roberts et al 2008). Eva & Reiter (2004b), who themselves have contributed to the empirical data on admission selection, discuss the evidence base for selection in a commentary and highlight that the MMI reduces the impact of chance, allowing good candidates the opportunity to overcome a single poor interview while *'preventing weaker candidates from gaining entry based on a single superior interview' (p 167).* The MMI has been shown at one Canadian medical school to be the best predictor of subsequent performance at OSCE (Eva et al 2004c), clinical clerkships and for clinical reasoning (Reiter et al 2007).

The differences in format are shown by the fact that there may be twelve stations (Rosenfeld et al 2006), ten stations (Brownell et al 2007; Eva et al 2004a; Dodson et al 2009; Harris & Owen 2007), ten stations but with nine interviewers (Lemay 2007), nine stations (Eva et al 2004b), or eight stations (Roberts et al 2008). However to achieve a reliability of 0.8 there should be a minimum of 14 stations with one interviewer per station over two hours (Roberts et al 2008).

Interviewers may include faculty members, medical students and representatives from the community (Brownell wt al 2007); one per station (Eva et al 2004a) or two (Eva et al 20004b). Faculty and community representatives may mark differently, reducing the inter-rater reliability (Eva et al 2004b). From generalisability theory Eva et al (2004b) demonstrated that increasing the number of stations has a greater impact than increasing the number of interviewers per station.

One Canadian medical school reports on a process with similarities to MMI, using medical judgement vignettes with major ethical dilemmas – there are three stations with two 'judges' at each. Face validity was captured through the involvement of experts in writing the vignettes and inter-rater reliability was high at 0.95; however the process was piloted with medical students rather than applicants and with only 29 students (Donnon & Paolucci 2008).

In Australia the MMI was developed at one medical school by considering non-cognitive attributes explored at traditional interviews, together with medical schools accreditation guidelines, and from consultation with interviewers, including community representatives. This process led to a list of 47 statements, which were reduced to six factors by a group of faculty members: love of medicine and learning, groundedness, self-confidence, a

balanced approach, mature social skills, and realism. The ten stations developed subsequently included two group and eight individual interviews (Harris & Owen 2007). Roberts et al (2009) provided data from 686 candidates, 207 interviewers, a bank of 27 MMI questions and 27 440 candidate marks and showed that the MMI does assess cognitive reasoning skills. They also demonstrated that the majority of questions did not discriminate between candidates of varying personal, cultural and academic backgrounds. However they noted that their findings were only generalisable to schools that use the standardised structured approach. In a further qualitative study 37 interviewers were interviewed in focus groups and 442 candidates completed a post-MMI questionnaire (Kumar et al 2009). Participants agreed that the MMI was an independent assessment system, with candidates appreciative of the one-to-one format and multiple assessment opportunities. However they thought that the short (seven minute) stations did not give enough opportunity to discuss their personal values and commitment. Interviewers also felt that the number of stations reduced their stress in making judgements and marking candidates down. But they also had concerns about benchmarking and being able to compare their 'hawkish' or 'dovish' marking with others through discussion, which is a feature of more traditional interview panels.

In Israel they used six individual stations and two group stations with inter-rater reliability of between 0.62 and 0.77. The process was thought to be a fair process by 76% of the 563 candidates but there was no long term follow-up for predictive validity (Ziv et al 2008).

The MMI has been shown to be acceptable to applicants and interviewers (Brownell et al 2007), uses fewer interviewers and takes less time than more traditional panel interviews (Brownell et al 2007). However, the training is resource intensive (Harris & Owen 20007). The MMI should be blueprinted against the qualities that the medical school wishes to attract in students (Eva et al 2004b).

In terms of feasibility, when comparing a 12 station MMI to a traditional interview with three interviewers on the panel, the total numbers of interviewer hours needed for 400 candidates and the traditional process was 1200 as compared to 800 observer hours for the MMI (Rosenfeld et al 2006), though this did not include training. Dodson et al (2009) demonstrated that reducing a ten station MMI from eight minutes to five minutes per station did not affect ranking or scores with a correlation for each format of 0.92.

5.7 Use of other methods

A number of papers reported on the use of different instruments to gauge what are defined as desirable attributes of medical students and doctors. However while the instruments were piloted, there was no long term follow up to check the predictive validity and there was a lack of information as to whether they were used again for selection on a wider scale. Examples are: testing for emotional intelligence (Carrothers et al 1997); screening for dysfunctional behaviour with the Hogan Development Survey (Knights & Kennedy 2006; 2007); PQA (mental agility test) with NACE (testing for narcissm, aloofness, confidence and empathy) (Powis et al 2005); PQA alone (Lumsden et al 2005); successful intelligence,which includes a balance of knowledge with analytical, creative and practical abilities (Sternberg 2008). At Utrecht they have piloted a selection process that involved a three person panel observing candidates explaining disease processes to two different standardized patients, after having been given information about the disease to read prior to the interviews. The candidates were also scored on their explanations of the disease to each other, a process chosen to mimic the problem-based learning of the Utrecht course. Reliability for the three scores was about 0.8 (ten Cate & Smal 2002).

5.8 Other professions

The osteopathic equivalent of the USMLE is the COMLEX-USA, which has two steps. Entry to osteopathic medical school (at graduate level) is based on similar criteria to allopathic medical schools: MCAT, uGPA, interviews. Predictive validity of the process is measured against performance in the COMLEX. One study showed that the undergraduate GPA was the strongest predictor of global academic performance while MCAT appeared to have limited predictive validity based on 434 osteopathic students (Evans & Wen 2007). These results were similar to an earlier study on 63 osteopathic students that found the GPA was the best predictor of COMLEX performance while preadmission scores on MCAT and uGPA did not correlate with examination results (Baker at al 2000). However Dixon (2004) showed a correlation between MCAT, uGPA, performance in the first two years of osteopathic medical school (GPA) and levels 1 and 2 of COMLEX-USA for 174 students.

There was a paucity of papers relating to nursing selection. McLaughlin et al (2007) looked at the correlation between personality and academic performance and, while this study did not specifically explore the selection process, the authors suggested that their results indicate that psychological profiling might make selection more effective. Questionnaires were given to 384 first year nursing students comprising the Occupational Self-Efficacy Scale and a short form of the Eysenck Personality Questionnaire. Follow-up of 350 students over their two year course showed that occupational self-efficacy was an important predictor of students' final marks while 'psychoticism' correlated with early attrition. An earlier paper from Canada (Brown et al 1991) described the use of an autobiographical letter as one component of selection into nursing programmes. Candidates were asked to include details about their personal qualities, reasons for application and their ability to function within the aims of the programme. The letter could be up to two pages long and was assessed by three people: faculty member, community representative and existing senior nursing student. Reliability was calculated based on 12 teams assessing 10 letters, including four controls that were again sent out to the same people four months later. Results were favourable with reader teams scoring consistently. However community assessors had poorer intra-rater reliability at the four month assessment for some applicants. Results must be viewed with caution due to small numbers and fewer assessors being available at four months (63% of original), and there was no follow-up of candidates.

5. Internship and residency selection

Items and processes used for selection of medical students into post-qualification first year posts are shown in Box 3, with approximate weighting included (Jefferis 2007). Box 4 lists post-qualification posts and timing of selection in different countries.

- Final examinations
- USMLE (USA)
- LMCC (Canada

(Need to be passed)

- Application form including personal statements
- Academic transcripts/profile
- Clinical clerkship scores

(20-35% - for these)

- Interviews (35-40%)
- Dean's letter (USA & Canada)/letters of recommendation (35-40%)

- No merit selection but prioritisation process for majority of applicants in Australia

Box 3: Post qualification selection factors for first posts

USA & Canada: students begin selection process in year 3 of their 4 year graduate entry programmes. Start work as interns (year 1 residency) and in their chosen specialty
Selection based on USMLE step 1 (USA) and LMCC (Canada) and other factors (Box 3)
Includes interview

Australia: students start selection process at beginning of final year – selection relates to where they will work during their intern (PGY1) year
Cannot start post until passed final examinations but these do not affect selection location
Students select where they wish to work for the year
Start work as interns/PGY1 (postgraduate year 1) which usually includes 4 x 13 week rotations (eg medicine, surgery, paediatrics, general practice, emergency)

Each state/territory has its own electronic selection process
Priority is given to students who studied in that state, then to interstate students, then to Australians/New Zealanders who had studied abroad, then to international medical graduates
For posts where there is high demand, selection relates to scoring of the personal application form

Selection for specialist training involves an application form and interviews

Box 4: Selection procedures for post qualification training

In common with medical school selection stakeholders expect the selection process to be fair and transparent. However Ginsberg et al (2004) suggested that this is not the case based on their questionnaire study in relation to the internal medicine residency selection process at the University of Toronto. They highlighted the existence of 'rumour mills' that lead candidates to have differing perspectives on the relative weighting of factors involved in the selection compared to selectors. Eva & Reiter (2004), in a commentary on this paper, suggested that such discrepancy can account for candidates' responses in interviews: *'the quality of responses an individual provides in an interview is a reflection not only of that individual but also the accuracy of the individual's interpretation of what the interviewer might consider to be an adequate response' (p169).*

Medical students in the USA and Canada begin to choose their residency programmes in year 3 of their four year courses. They apply electronically to the specialty of their choice indicating the locations/programmes where they would like to work. Each programme then uses different systems to decide which students to shortlist and interview. In 2003 the average medical student in the USA completed 40 applications to residency programmes and had 9.2 interviews (Daly et al 2006). Up to four people may review each application (Pilon & Tendberg 1997) – an enormous investment in time and resources for both the applicants and the selection staff. Yet as Chew et al (2005) wrote: *'Enormous resources are spent on the selection process for radiology residency, yet agreement on criteria, process and outcome remains elusive' (p379)*. Weingarten et al (1997) piloted the use of an analytic hierarchy process (AHP) to aid the selection of residency to a surgery programme to which 100 students applied each year for four posts. AHP allows a selection committee to weight criteria, facilitating consensus building. This study was small and there appears to be no follow-up data. In selection for orthopaedics, Turner et al (2006) developed QCST (quantitative composite scoring tool) which allotted points for certain criteria to aid selection prior to interview – the highest points were related to junior clinical clerkship honours grades, letters of recommendation, class rank and USMLE step 1 scores. This score had some predictive value for residency outcomes with the authors' proviso that there is not an agreed definition of what constitutes a successful residency outcome.

The electronic residency application scheme (ERAS) was introduced from 1995 in the USA, after 469 programme directors supported its introduction in an earlier survey (Wagoner 1992), and was deemed acceptable and feasible though with some initial software problems relating to uploading letters of recommendation and personal statements (Mandel et al 1997). By 2001 it was being used for 407 internal medicine residency programmes annually without problems (Adams 2001).

White et al (2002) recommended that the desired outcomes and societal goals should be considered when deciding on selection processes and that efforts should be made to explore the characteristics of candidates that are most predictive of residency performance and development of the desired outcome competencies. Worryingly, in relation to applicants to family medicine residency programmes, 73 of 150 programme directors reported that they had encountered 602 cases of deception in relation to personal statements in the previous five years (Grover et al 2001). Moreover 82% of urology programme directors thought that applicants had 'lied' during the selection process and 44 applicants admitted 'dishonesty' in an anonymous questionnaire (Teichman et al 2000).

In the USA there is a series of national examinations during medical school. Originally called the NBME (national board medical examination) and more recently the USMLE (the United States Medical Licensing Examination), which was introduced in 1992 (O'Donnell 1993), these assessments form part of the criteria used to select medical students onto residency programmes. As this is a nationwide examination all American students may be compared to each other. Thus when considering applications, the selection panel do not yet have the final year assessment

results but rather step 1 of the USMLE (previously NBME) taken in year 3. The debate continues as to whether these examinations predict performance during residency. In 1993 Berner et al reviewed NBME/the early years of USMLE scores against performance and concluded (without much data given in the paper) that there was generally a correlation but that these should not be the only selection measure. Dawkins et al (2005) also found no correlation between pre-residency and during-residency performance in psychiatry.

An extensive literature review of residency selection was undertaken by Lee et al (2008) in the USA as a precursor to changing the process for ophthalmology residency. They concluded that the current system was reliant on cognitive easy to measure parameters such as USMLE step 1, medical school grades and reputation of the medical school. They agreed with Hamel et al (2007) that the USMLE was not intended as a selection tool but rather as a licensure examination and that it really should be a pass/fail assessment rather than being graded. Their recommendations for change, based on the evidence, included standardisation of academic scores and dean's letters, and structured interviews.

Balentine et al (1999) produced a useful review of the application process for emergency medicine, and commented that 'no precise correlation can be made between performance in medical schools and achievement during residency, although there seems to be a correlation between academic performance in medical school and board certification examinations', ie the national examination USMLE at the end of all graduate medical programmes. This review was not systematic and did not give details of the search strategy used but showed that residency selection usually included medical school grades, performance in board certification examinations, letters of recommendation (including the medical school dean's letter) and an interview. There also appeared to be little correlation between board examinations and subsequent residency performance. Measuring performance in medical schools and trying to compare this with residency is fraught with difficulty. While the national examinations are standardised across the country, clinical clerkship evaluations differ from school to school and are therefore not a reliable or objective indicator of performance (Takayama 2006). Even standardised student evaluation forms would have limited predictive validity unless faculty improved efforts to standardise clerkship objectives, expectations and performance measures across schools (DaRosa 1991). This still resonates with the UK experience, where clerkships and rotations are often not reliably assessed within the same school let alone between schools. Non-cognitive factors assessed through interview and dean's letters are thought to play a significant role in determining the best match between a student and a residency programme (Mallott 2006), though members of selection committees often disagree in their ranking of applicants (Thordason 2007).

There are a number of papers reporting survey data in respect of what selectors feel are the important components of the process. A survey to 96 residency directors found that 84% felt the interview to be the most important process and 83% felt the dean's letter to be of no value (Proven & Cuttress 1995). Both family medicine and obstetrics/gynaecology directors also felt the interview to be most valuable method of ranking applicants (Taylor 1995) while a survey to radiology residency directors in 1993 found that 92% of 134 directors thought that the best indicators for selection were class rank and medical school grades with only 53% rating letters of recommendation/dean's letters (Grantham 1993). Emergency medicine directors rated first a student's grade on the emergency rotation at medical school, followed by interview, clinical grades and lastly letters of recommendation (Crane 2000). Internal medicine directors considered NBME part 1 scores and the reputation of the medical school to be more important (Fine 1995). General surgery programme directors rated the interview, a demonstrated interest in surgery, letters of recommendation and USMLE step 1 scores more highly than basic science knowledge and clinical research activity (Melendez 2008). A survey of 40 neuropsychology programme directors found that they felt the most important criterion for selection was clinical experience rather than performance at interview (Mittenberg et al 2000). For oral and maxillofacial residency, which accepts both dental students and students with a dual medical/dental degree, 71 of 106 programme directors who responded to a survey stated that dental school rank, dental school basic science grades and dental school clinical grades were the most important selection criteria (Spina et al 2000). For physical medicine and rehabilitation (PM&R) programme directors (66/75), the most important criterion was the score during the PM&R clerkship at medical school, with the interview being the most useful process of assessing candidates, followed by letters of recommendation from PM&R faculty members (DeLisa et al 1994).

Plastic surgery programme directors (these super specialist residency programmes start after initial specialisation) rated high quality letters of recommendation, performance on intern rotations and interviews (Janis 2008). Orthopaedic programme directors and residents surveyed about resident selection criteria had significantly different opinions about the most important of these. Residents felt that a letter of recommendation from an

orthopaedic surgeon was the most important, followed by USMLE I score and rank in medical school. The directors preferred that an applicant had done a rotation at the director's program as a medical student, followed by USMLE I score, and rank in medical school (Bernstein 2002).

In Canada Bandiera & Regehr (2003) piloted a structured application assessment instrument on 50 applicants to an emergency medicine residency programme. The instrument was designed and then revised after comments from potential assessors. The desirable characteristics of residents were assessed from a variety of sources: CV 35% weighting, P L (personal letter) 35%, AT (academic transcript) 15%, three RL (letters of reference/recommendation) 15%. Each application was graded by three assessors independently. The grading was then compared with that from subsequent interviews, with a correlation of 0.744. The inter-rater reliability was highest with the CV, with the PL being lowest. However the predictive validity of the exercise was not explored. A standardised candidate assessment form was used by 12 orthopaedic residency programmes for 66 applicants and was found to have good reliability within a programme but not across programmes (Gilbart 2001).

5.1 Predictive validity

The ideal criteria for selection are those that are predictive of performance during residency, but the literature findings are not consistent in terms of which criteria are helpful. Borowitz et al (2000) asked ten faculty members to rate 69 paediatric residents for knowledge, skills and attitudes, and compared the ratings to the residents' previous ranking on the national board examinations, thus investigating the predictive validity of these assessments. They found little correlation between this rating and ranking on NBME part 1, and weak but significant correlation between rating and residency interview scores. They concluded that *'none of the traditional measures of medical school performance predicted residency performance' (p259).* Seven years later McCaskill et al (2007) did find a correlation between USMLE step 1, but not step 2, and performance on paediatric board examinations, though the three paediatric in-training scores had no additional impact on prediction. A study of otolaryngology residents found that programme directors' rating of the residents' performance correlated with the residents' academic performance at medical school however the directors' rating appeared to be subjective and no objective measurement of how the rating was arrived at was given in the paper (Calhoun et al 1997). Other studies have found a lack of correlation between USMLE and residency performance in orthopaedics (Black 2006; Carmichael 2005) and surgery (Brothers 2007) while some have shown a relationship, eg in radiology (Boyse 2002) and ENT (Daly et al 2006). There has also been a failure of academic scores to predict performance in orthopaedics (Dirschl 2006). Emergency medicine residents' performance was found to be better if they had been to a 'top tier' medical school and had 'distinctive talents' (Hayden 2005). In a study of 46 international medical graduates (IMGs) entering internal medicine residency, recent clinical experience and performance on standardised examinations were the two selection criteria most predictive of IMGs 1st year performance as residents (Part 1993).

Loftus et al (1992) looked at three different methods of ranking 124 medical students: deans' letters, a criterion points system based on medical school tests scores and extra curricular activities, and a norm based ranking with students divided into quartiles. The ranking was correlated with end of year 1 residency performance. All three methods had a similar predictive validity with modest correlations, but there was no description of how residency performance was assessed. Ranking of 107 applicants for obstetrics & gynaecology residency with the ERAS screen followed by a structured interview with six interviewers showed a correlation with end of year 1 residency performance (Olawaiye et al 2006).

Peskun et al (2007) took a slightly different approach by looking at the predictive validity of the medical school selection process and ranking later during family medicine residency selection for five cohorts of students. The residency applicants were first ranked through the normal process of academic transcripts, letters of reference and interview. The ranking was then compared to medical school admission data – uGPA, MCAT and interview. A further correlation was made with performance during medical school – OSCE, clerkship grades and ward evaluations. Residency rank in family medicine correlated significantly with medical school admission interviews. There was no correlation with uGPA/MCAT and ranking, though the uGPA and MCAT did correlate with the final medical school grade. Residency ranking was also predicted by the year 2 OSCE score. These findings suggest that residency selection could use existing student selection data rather than another interview process.

For otolaryngology applicants were most likely to be successful if they had excellent medical school academic records, including high grades in clinical clerkships (Calhoun & Martinez 1990). For plastic surgery residency

programme directors felt that applicants who had achieved high academic honours and demonstrated leadership qualities were most likely to succeed in their training (LaGrasso 2008).

5.2 Interviews

Interviews are seen by most applicants as a fundamental part of the process. A survey of 53 applicants to an internal medicine residency found that 86% thought the interview necessary, while 60% thoughts that involving residents as interviewers would be beneficial, the most acceptable model being two thirty minute interviews (Milne et al 2001). For family medicine rotations, 51% of programme directors thought that interviews were the most important component (Galazka et al 1994). A survey of 40 residency directors and 30 employers of physicians showed agreement that interviews are critical to support decision making about hiring – *'interviews really tell'* (Villanueva et al 1995). However one study relating to 263 applicants to a residency programme showed a moderate correlation between applicant scores based on the ERAS pre-interview and scores post-interview, suggesting that the interview did not add a great deal to the selection process (Argeles et al 2006).

Bandiera & Regehr (2004) piloted a structured interview for 16 applicants to an emergency medicine residency. Questions were asked in four domains: personal characteristics (PC), suitability for emergency medicine (EM), suitability for specialty residency programme (PR) and trainability (TR). There were two interviewers for each of the domains with inter-rater reliability of between 0.37 to 0.69 for each domain. The results suggested that the interviewers based their rating on a global perspective rather than specific details and did not discriminate amongst the various attributes. There was no follow-up of successful applicants to check predictive validity.

Hamel et al (2007) piloted an interview for 26 applicants to an ophthalmology residency based on the CanMEDS criteria. Each student was interviewed by four panels of two interviewers (one faculty member and one resident) with a reliability of 0.84. Residents on interview panels have been shown to give higher scores than faculty members but this did not affect the candidates' ranking showing that residents are useful additions to selection panels and help alleviate problems with recruiting sufficient interviewers (Milne et al 2003). But again the successful applicants were not followed up to correlate subsequent performance with the interview process. Knowing an applicant's USMLE scores prior to interview may bias interviewers (Smilen 2001) suggesting that interviewers should be blinded to candidates' achievements to give candidates a better opportunity to display their communication skills, emotional stability and fitness for the residency programme (Swanson 2005).

Other residencies that have reported on the use of interviews, in particular for assessing non-cognitive attributes, are: anaesthesiology (Altmaier 1997); paediatrics (Altmaier 1990); radiology (Altmaier 1992), ENT (Daly 2006). Only PM&R (physical medicine and rehabilitation) programme directors have been reported as considering candidates' ability to work with a team during the interview (DeLisa et al 1994). One surgery residency programme has trialled a critical incident technique through structured interviews with faculty and residents interviewing though the paper gave only qualitative findings (Edwards 1993). In Thailand interviews for residency selection correlated better with clinical performance than letters of recommendation (Khongphattanayothin 2002). Applicants were more likely to be satisfied with their residency rotation if they felt that the interview process had been honest (Laskin 2003).

The MMI process was used for family medicine residency application by Hofmeister et al (2008) following an OSCE. The majority of the 71 international medical graduate applicants found the procedure to be acceptable, particularly the content of the stations.

In the UK a process for selection of junior doctors for SHO posts in paediatrics was labelled MMI although there were only three stations of five minutes each with two interviewers per station. The stations were developed to test insight, reflection, communication skills and clinical knowledge. The paper gave minimal data analysis but summarised that the procedure was rated as a fair and reliable tool by both the 96 candidates and the interviewers (Humphrey et al 2008).

5.3 OSCE

Taylor et al (2005) administered a 12 station OSCE to 265 new medical graduates to investigate whether this type of clinical examination could predict performance during internship. The OSCE stations were scored by the simulated patients involved. The interns' performance was assessed by the residency director's evaluation form against the six defined competencies of a physician at this level. They found that step 2 of the USMLE (in particular the interpersonal score) and medical school GPA were better predictors than the OSCE. However such types of testing need to be approached with caution as new medical graduates may not perform in the same way as candidates for job selection – ie *'applicants and incumbents may think and behave differently when completing predictor measures – applicants are likely to have higher levels of test-taking motivation...and may take assessments more seriously (Iddekinge & Ployhart 2008 p894).*

Any use of an OSCE type examination for selection would need careful consideration in terms of standard setting for ranking or grading. Different medical school faculty members have been shown to set standards for the same OSCE stations at varying levels with poor inter-school reliability (Boursicot et al 2006). Therefore any use of an OSCE for national selection would mean that there should be a national examination with national standard setting to ensure that all students were assessed similarly. This obviously also has implications for assessor and simulated patient training.

5.4 Letters of recommendation & deans' letters

While letters of recommendation can be used to provide details of students' non-cognitive attributes, too often they merely reiterate the cognitive-based grades of other assessments (Lee et al 2008). They do not predict future performance for radiology (Boyse 2002) though faculty evaluation of personal characteristics (at interview) and letters of reference are likely to predict subsequent resident clinical performance in surgery (Brothers 2007). For ENT residency letters of recommendation, if they mentioned an exceptional trait, were good predictors of subsequent residency ranking (Daly et al 2006); while deans' letters have also been shown to correlate well with ranking (Sklar & Tandberg 1995), though an applicant's self assessment of ranking was only weakly correlated (Sklar & Tandberg 1995). A study of 532 deans' letters from 99 medical schools in the USA found that some deans suppressed negative information in their letters which they thought might adversely affect the residency selection process of their students (Edmond 1999). Gayed et al (1991) found that the letters of recommendation for international medical graduates were useless to help assess applicants. Recommendations were better if they were on a standardised form rather than being free text (McCabe 1993). Note that the official name of deans' letters is now the medical student performance evaluation (MPSE) (Lee et al 2008).

5.5 Other methods

Baker (1993) described a computer assisted candidate selection process (CARCS) to combine the assessment of cognitive and non-cognitive attributes. Goldberg et al (2008) administered a manual dexterity test to 113 fourth year medical students applying for surgical residency and found it correlated well with objective measures of medical school cognitive performance such as class rank and USMLE scores. Self et al (2000) suggested that as evidence exists confirming a relationship between moral reasoning and superior clinical performance, moral reasoning tests could be used in the selection process.

5.6 Post residency fellowship

Only one American paper looked at selection to post residency fellowship in pathology, the application process starting in year 2 of the residency. The paper is really an opinion piece about the timing of selection and the ethical issues associated with it and does not discuss the process itself (Domen & Wehler, 2008).

5.7 UK – specialist training

There were very few papers on selection to specialist training programmes in the UK and these were generally published within the last few years. The Medical Training Application Service (MTAS) was introduced in 2007 for applications to specialist training on the basis of 150-word answers to short listing questions with less weighting to past experience, higher qualifications or publications. The rationale was that the two year post-graduation foundation programme is generic for all doctors and that the selection process should therefore concentrate on identifying those who will be successful in the specialty, with equal opportunity for all candidates. One paper described selection to public health training in Wales and the East of England using MTAS (biographical questions for 150 word answers focusing on commitment to the specialty, technical skills and personal skills) for short listing (Pashayun et al 2007). Each application form was assessed by two public health consultants. Shortlisted applicants were then interviewed - three interviews of twenty minutes' each. There were also numerical and verbal reasoning tests. If these procedures were passed, candidates then moved onto six assessment stations of which four were competency based, one was a presentation and the last a group exercise. The correlation between short listing scores and the interviews was acceptable (0.60). Short listing identified two out of six and 10 out of 11 doctors who were subsequently appointed in Wales and the East of England respectively. Thus the MTAS facilitated short listing process discriminated acceptably between candidates later deemed suitable and those not appointable. However this paper does not look at subsequent performance as a specialist registrar.

Selection for general surgery training in Ireland involves short listing from a structured application form (which includes a biography, awards gained and experience). Gallagher et al (2008) then administered a 10 station OSCE type assessment which focussed on surgical technical skills and a structured interview of 20 minutes to the top 16 applicants. There was a strong correlation between the clinical examination and the overall score for the whole process. However the study did not follow-up the successful candidates to check their performance during training. In an earlier British pilot study for surgical training with small numbers, psychometric measures were found to have a significant role in aiding selection (Gilligan et al 1996).

Rao (2007) described the SCRIPT (structured interviews for psychiatry training) which included two clinical vignettes with three to four raters per interview panel. SCRIPT administered to 114 SHO applicants for specialist training had an inter-rater reliability of 0.75 but there was no follow-up for predictive validity.

The concept of the assessment centre appears frequently in non-medical literature (see below); however Patterson et al (2005) and Randall et al (2006) described the use of such a centre for the selection of SHOs into general practice and paediatric postgraduate training respectively. For the general practice vocational training selection, the authors assessed 188 candidates attending the selection centre, of whom 140 were successful in gaining a place. The assessment centre process included a series of work related simulation exercises of between 20 and 40 minutes: simulated consultation, group exercise, written exercise, competency based structured interview, medical interview with questions relating to clinical practice. Assessors had a full day's training. Three months into practice, the performance of 46 registrars was appraised by their trainers. There was a significant positive correlation between total competency rating and the centre rating of job performance. Thus there is some evidence of predictive validity. However less than 50% of the successful doctors were evaluated due to some being in hospital rotations at the time of the study, performance was gauged after only three months, and obviously no assessment could be made of the rejected doctors.

For paediatrics (Randall et al 2007) firstly a multi-source, multi-method job analysis was undertaken to define the competency domains for paediatric training. This process resulted in the development of three exercises with high content and face validity to be undertaken by candidates at the assessment centre: simulated consultation, group exercise and reflective written exercise. There was also a structured interview with three interviewers per applicant. In the described assessment, 27 candidates were competing for ten posts and the whole process lasted 8.5 hours. All assessors/interviewers received three hours training. The results showed that 19 of the 27 applicants would have received the same outcome with either the interview or exercises; however three candidates who would have been selected by interview were rejected on the basis of the exercises, showing that the latter did have some discriminating features for some of the SHOs. The candidates were satisfied with the process as they felt it gave them the opportunity to show their abilities compared to other selection processes they had undergone in the past. This paper is comprehensive but there is no follow-up of candidates to check predictive validity.

6.8. Other professions

Applicants to veterinary ophthalmology residencies are selected through a process involving rating of academic achievement, including publication or presentation of information, gaining an advanced degree and having good communication skills, though the selection is still seen as subjective (Davidson 2004).

Frantsve et al (2003) administered a standardised personality measure (AOL) to 47 applicants to dental school and found that the scores were unrelated to faculty scoring via the selection process. For professional psychology programmes the clinical experience of applicants was thought to be the most important factor (Lopez 1997). For dietetics programmes more serious consideration was given to applicants who had shown leadership qualities through extracurricular activities or who had had the opportunity to develop and improve these skills (Moore 1995).

A sole paper from France describes the introduction of a selective national competitive examination for undergraduate dental students applying for postgraduate residency programmes (Villat et al 2004).

7. Assessment centres

The management and personnel literature includes a number of papers from the USA about the use of assessment centres for the selection of applicants into the police, fire service, military, government and education, as well as for current employees in this area applying for leadership roles. One definition of assessment centre is:

'An assessment centre consists of a standardised evaluation of behaviour based on multiple inputs. Several trained observers and techniques are used. Judgements about behaviour are made, in major part, from specifically developed assessment simulations. These judgements are pooled in a meeting among the assessors or by a statistical integration process...the discussion results in evaluation of the performance of the assessees on the dimensions/competencies or other variables that the assessment centre is designed to measure' (Joiner 2000, p319).

The essential elements of the centre are (Joiner 2000):

- Job analysis – relevant behaviours and performance indices must be defined thoroughly
- Behavioural classification – into knowledge, skills, competencies etc
- Assessment techniques – to evaluate the defined indices
- Multiple assessments – may include tests, interviews, psychometrics, simulations
- Simulations – must be job-related
- Assessors – multiple
- Assessor training – is important
- Recording behaviour – assessors must be able to observe and record accurately for later discussion (may use audio and video)
- Reports from assessors
- Data integration

Coulton and Feild (1995) carried out a literature review of assessment centres to evaluate their usefulness in the selection of entry-level police officers. They highlighted one concern raised by opponents that applicants undergoing simulations based on the job might have no previous experience of such situations. The suggestion was made, therefore, that the simulations should be exercises similar to real life experiences of the candidates and test responses to interpersonal conflicts. For leadership and promotion, simulations based on the job itself could be used. The advantages of centres are that they allow observers to evaluate how candidates might perform in real-life workplace situations. Coulton and Feild (1995) reported on earlier validity studies from the use of centres for selecting managers in other fields rather than law enforcement and concluded that the scores generated by the technique are valid. A major disadvantage is however cost.

A comparison of the outcome of an assessment centre process with an evaluation of 55 candidates' personnel records and supervisors' judgments showed that both the assessment centre and records were valid predictors of

management potential (Lowry 1994). There was a high degree of correlation between the two measures. However the assessment centre allowed observation and evaluation of interpersonal behaviour not available from the records, while the records included additional information. The conclusion was that both methods shouls be used, but that there should be standardisation of the records within organisations. Records were more useful if they included the results of annual appraisals. Supervisor scores were the least reliable.

A more recent paper by Caldwell et al (2003) looked at the predictive validity of assessment centres and listed reasons why centres could perform badly based on examples from the literature:

- Poor planning and lack of resources
- Inadequate job analysis
- Weakly defined dimensions (what is being measured).

8. The concept of employability

Within the personnel and management literature the concept of employability has become an important consideration in selection processes. There is an emphasis not just on job-specific skills but on both generic skills (which may be labelled as generic graduate attributes for university students) and skills required to be an employee.

Employability skills have been defined as: '*... skills required not only to gain employment, but also to progress within an enterprise so as to achieve one's potential and contribute successfully to enterprise strategic directions' (*ACCI/BCA 2002 p3). Another term is workplace readiness. The specific skills are listed in Box 5 (DEST 2004 p vi-vii), and competences defined for employability in Box 6 (van der Heidje & van der Heijden 2006). As can be seen these may also apply to Foundation posts (by substituting customer with patient, and company with NHS).

- *Communication* skills that contribute to productive and harmonious relations between employees and customers;
- *Team work* skills that contribute to productive working relationships and outcomes;
- *Problem-solving* skills that contribute to productive outcomes;
- *Initiative and enterprise* skills that contribute to innovative outcomes;
- *Planning and organising* skills that contribute to long-term and short-term strategic planning
- *Self-management* skills that contribute to employee satisfaction and growth;
- *Learning* skills that contribute to ongoing improvement and expansion in employee and company
- operations and outcomes;
- *Technology* skills that contribute to effective execution of tasks

Box 5: Employability skills

- Occupational expertise
- Anticipation and optimisation
- Personal flexibility
- Corporate sense
- Balance

Box 6: Employability competences

The rationale for assessing employability skills in selection processes is that the universities assess subject specific skills (eg medicine, nursing) but do not necessarily examine for employability. Employability skills are assessed in a number of ways including through assessment centres, psychometric tests (see for example O'Neill 1997) and sometimes additionally through an applicant's portfolio which acts as an employability skills profile. Commercial selection agencies favour the assessment of employability skills.

Current interest in the management literature focuses on person-organisation (P-O) fit and person-job (P-J) fit, where the former is the degree of compatibility between a candidate and the organisation and the latter the match between a person's abilities and the demands or attributes of a job (Sekiguchi 2004). There is a lot of research in

this area. Sekiguchi's (2004) review highlighted the two stages of selection – the initial screening (which often concentrates on job qualifications) and choice (which some suggest focuses on P-O fit).

8.1 Portfolios

The Department of Education, Science and Training (DEST) in Australia carried out a review of the literature and concluded that this strongly supported the development of a portfolio approach for collecting and recording information about employability skills, however no evidence was presented in terms of experience and follow-up of portfolio use in actual selection processes:

'At its most basic level, the portfolio approach provides a mechanism for individuals to store information they have collected, for the purpose of recognising and recording their employability skills.
The strengths of a portfolio approach include its capacity to operate across sectors, to incorporate formal and informal evidence from a wide range of sources and remain relevant over a life-time...
Stakeholders recognised that the process of creating and maintaining a portfolio itself develops and demonstrates some employability skills, such as planning and organising, communication and self-management. Thus, the process is itself a career development activity and could form part of a career development program (DEST 2004 p viii).

Portfolios are labour-intensive to construct and have problems with inter-rater reliability when used for summative assessment, the contents also require independent verification for authenticity (DOHA 2004). They do not directly measure skills but serve as a means of collecting and demonstrating evidence of skills attainment.

As demonstrated by the lack of 'hits' in the searches for portfolios when combined with selection in the medical and health professional literature, publications in this area focus on the use of portfolios as summative and formative assessment tools in undergraduate and postgraduate courses rather than as aides in selection. The DEST review also focused on how universities may assess employability skills with portfolios and gave examples of their use.

8.2 Selection processes for graduates

Branine (2008) carried out a survey of 700 UK-based employers who recruit graduates (eg finance, engineering, IT, pharmaceuticals, local authority) with a response rate of just over 50%. Of these 62% had an application form designed specifically for graduates and 27% required CVs. The interview was the most commonly used method following short listing, with the majority using two interviews, and over 60% two or more interviewers. Over half the respondents used assessment centres and 72% aptitude tests. While 90% asked for references, 34% only required these once an offer had been made. From these data and a review of the literature Branine (2008) concluded that '*the process has generally become more rigorous and sophisticated...employers are more interested in the attitude and personality of applicants that in the type or level of qualifications acquired' (p513).*

The Australian Association of Graduate Employers, a grouping of organisations that recruits graduates for employment in banking, insurance, customs and excise, state services, the mining industry and other industries, gathered data on recruitment practices and found a common set of processes. These included steps to filter large numbers of applicants and then to assess different qualities and abilities. The stages are show in Box 7 (Precision Consultancy 2007).

- Initial assessment of academic results
- Online applications – this may target communication and reasoning, as well as awareness of the organisation
- Phone interviews of about 20 minutes
- Assessment centres
- Personality testing – vary considerably, usually used to map results to competencies/values of organisation
- Interviews-usually final stage

Box 7: Business/industry recruitment processes

Van der Heidje & van der Heijden (2006) developed measurement scales for employability competencies and tested their psychometric properties with 314 employees and 334 supervisors. The five dimensions showed considerable variation in both objective and subjective career success, suggesting good predictive validity. However there is no follow-up of this validated employability measurement instrument in this paper.

9. Conclusion & recommendations

This review has explored the evidence for selection processes mainly in relation to medicine – selection into medical schools and post-qualification training posts. A few papers related to selection for other health professions. We also considered the literature in terms of employability skills and assessment centres. The majority of papers originated in the USA.

Of note is the wide variation in the processes and the evidence pertaining to them. The lack of consensus on methods and their correlation with future performance is borne out by the continual publication of papers in this field. Evidence relating to prediction is difficult because of different ways of defining and measuring performance, changes in assessment and selection processes and few long-term follow-up studies.

As well as validity and reliability, selection processes should be fair and, if candidates perceive the process to be fair, giving them a good change to provide evidence of their attributes and achievements, the process is more likely to be acceptable. Selection methods should be based on a job analysis to enhance face vailidity – what do we want successful candidates to do and display? If part of the necessary knowledge and skills are assessed during training (eg summative assessments), then the selection process should concentrate on other attributes that are not assessed such as employability. Summative assessment at medical school aims to show that a student is competent to become an intern; however it does not measure performance – the ability to do the job everyday under authentic working conditions. Thus it seems logical that foundation selection should be based on indicators of performance and employability.

The more ways of testing, the more likely that a good fit between candidate and job will be achieved, hence the popularity of assessment centres. However the more ways of testing, the more expensive and time-consuming, and such testing may only be of value where there is a large number of applicants for a smaller number of places.

When considering the various factors that can contribute to selection processes the literature suggests the following:

Assessment of knowledge and skills – there is some evidence that this may predict subsequent performance at medical school, and some evidence that national examinations predict subsequent residency performance. However there is a lack of valid measurement of performance as well as definition of what makes a 'good doctor'. Residency performance is usually based on the programme director's opinion and there is little description of how this is formed.

Application forms, 'white space' – structured forms achieve greater reliability. Scoring may be affected by the conditions in which the forms are completed, ie whether this is under examination conditions or unsupervised when applicants may receive outside help. Personal statements may need to be checked for authenticity as there have been instances of deception. Assessors should mark across questions rather than across candidates to increase reliability.

Portfolios – there is a lack evidence of their use in selection rather than assessment. They are, however, widely used in selection outside medicine in combination with other methods.

Interviews – appear to measure attributes other than those assessed in written examinations, but again structure is key, as is selector training, context and time. The MMI is showing useful results in terms of reliability but there are no long term follow-up studies to determine predictive validity as yet. Different institutions run different formats in terms of number and length of stations making analysis difficult.

Assessment centres and multiple methods – if multiple methods are used, consideration has to be given to weighting of the components. Assessment centres are widely used by recruitment into government posts, business, management and for promotion. The key is the preliminary job analysis.

Employability skills – there are a number of commercial organisations that offer tests for these which include psychometrics. (In NSW the body that selects doctors for PGY1 positions is planning to use an employability skills assessment in the future as medical student numbers increase.)

For selection into foundation year to be cost effective, acceptable and valid the best solution would appear to be, assuming that candidates have passed their summative assessments, that allocation is on the basis of choice but that where there is competition for places, a form of employability assessment should be used. This could be done through an assessment centre, or through employability skills assessment (written and exercises based on the job analysis) plus or minus an interview, depending on numbers and resources. Interviews should be structured, with more than one assessor. The process should be evaluated for predictive validity.

10. References

ACCI/BCA (Australian Chamber of Commerce and Industry & Business Council of Australia) (2002). Employability Skills for the Future. Canberra, Department of Education, Science and Training,.

Adams, L. J., S. Brandenburg, et al. (2001). "National survey of internal medicine residency programs of their 1st-year experience with the electronic residency application service and national resident match program changes." Teaching & Learning in Medicine **13**(4): 221-6.

Albanese, M. A., P. Farrell, et al. (2005). "Statistical criteria for setting thresholds in medical school admissions." Advances in Health Sciences Education **10**(2): 89-103.

Albanese, M. A., P. Farrell, et al. (2005). "A comparison of statistical criteria for setting optimally discriminating MCAT and GPA thresholds in medical school admissions." Teaching & Learning in Medicine **17**(2): 149-58.

Albanese, M. A., M. H. Snow, et al. (2003). "Assessing personal qualities in medical school admissions." Academic Medicine **78**(3): 313-21.

Aldous, C. J., S. R. Leeder, et al. (1997). "A selection test for Australian graduate-entry medical schools.[see comment]." Medical Journal of Australia **166**(5): 247-50.

Altmaier, E. M., R. P. From, et al. (1997). "A prospective study to select and evaluate anesthesiology residents: phase I, the critical incident technique." Journal of Clinical Anesthesia **9**(8): 629-36.

Altmaier, E. M., G. McGuinness, et al. (1990). "Defining successful performance among pediatric residents." Pediatrics **85**(2): 139-43.

Altmaier, E. M., W. L. Smith, et al. (1992). "The predictive utility of behavior-based interviewing compared with traditional interviewing in the selection of radiology residents." Investigative Radiology **27**(5): 385-9.

Argeles, P. C., P. M. Weiss, et al. (2006). "Electronic residency application service scores: do they correlate with the rank order list for the match?" Journal of Reproductive Medicine **51**(6): 471-4.

Australian Government, D. o. E., Science and Training (DEST) (2004). Employability skills. Canberra, Commonwealth of Australia.

Baker, H. H., M. K. Cope, et al. (2000). "Relationship of preadmission variables and first- and second-year course performance to performance on the National Board of Osteopathic Medical Examiners' COMLEX-USA Level 1 examination." Journal of the American Osteopathic Association **100**(3): 153-61.

Baker, J. D., 3rd, M. K. Bailey, et al. (1993). "Selection of anesthesiology residents." Academic Medicine **68**(2): 161-3.

Balentine, J., T. Gaeta, et al. (1999). "Evaluating applicants to emergency medicine residency programs." Journal of Emergency Medicine **17**(1): 131-4.

Bandiera, G. and G. Regehr (2003). "Evaluation of a structured application assessment instrument for assessing applications to Canadian postgraduate training programs in emergency medicine." Academic Emergency Medicine **10**(6): 594-8.

Bandiera, G. and G. Regehr (2004). "Reliability of a structured interview scoring instrument for a Canadian postgraduate emergency medicine training program." Academic Emergency Medicine **11**(1): 27-32.

Bardes, C. L. (2006). "Is medicine altruistic? A query from the medical school admissions office." Teaching & Learning in Medicine **18**(1): 48-9.

Basco, W. T., Jr., G. E. Gilbert, et al. (2000). "The ability of a medical school admission process to predict clinical performance and patients' satisfaction.[see comment]." Academic Medicine **75**(7): 743-7.

Basco, W. T., Jr., C. J. Lancaster, et al. (2008). "Medical school application interview score has limited predictive validity for performance on a fourth year clinical practice examination." Advances in Health Sciences Education **13**(2): 151-62.

Berner, E. S., C. M. Brooks, et al. (1993). "Use of the USMLE to select residents" Academic Medicine **68**(10): 753-9.

Bernstein, A. D., L. M. Jazrawi, et al. (2002). "An analysis of orthopaedic residency selection criteria." Bulletin of the Hospital for Joint Diseases **61**(1-2): 49-57.

Black, K. P., J. M. Abzug, et al. (2006). "Orthopaedic in-training examination scores: a correlation with USMLE results." Journal of Bone & Joint Surgery - American Volume **88**(3): 671-6.

Borowitz, S. M., F. T. Saulsbury, et al. (2000). "Information collected during the residency match process does not predict clinical performance.[see comment]." Archives of Pediatrics & Adolescent Medicine **154**(3): 256-60.

Boursicot, K. A., T. E. Roberts, et al. (2006). "Standard setting for clinical competence at graduation from medical school: a comparison of passing scores across five medical schools." Advances in Health Sciences Education **11**(2): 173-83.

Boyse, T. D., S. K. Patterson, et al. (2002). "Does medical school performance predict radiology resident performance?" Academic Radiology **9**(4): 437-45.

.

Branine, M. (2008). "Gradaute recruitment and selection in the UK." career Development International **13**(6): 497-513.

Brothers, T. E. and S. Wetherholt (2007). "Importance of the faculty interview during the resident application process." Journal of Surgical Education **64**(6): 378-85.

Brown, B., Carpio, B, Roberts, J. (1991). "The use of an autobiographical letter in the nursing admissions process: initial reliability and validity." Canadian Journal of Nursing Research **23**(2): 9-20.

Brownell, K., J. Lockyer, et al. (2007). "Introduction of the multiple mini interview into the admissions process at the University of Calgary: acceptability and feasibility." Medical Teacher **29**(4): 394-6.

Bullimore, D. W. (1992). "Selection interviewing for medical school admission." Medical Education **26**(5): 347-9.

Caldwell, C., G. C. Thornton, III, et al. (2003). "Ten classic assessment center errors: challenges to selection validity." Public Personnel Management **32**(1): 73-73.

Calhoun, K. H., J. A. Hokanson, et al. (1997). "Predictors of residency performance: a follow-up study." Otolaryngology - Head & Neck Surgery **116**(6 Pt 1): 647-51.

Calhoun, K. H., S. A. Martinez, et al. (1990). "The resident selection process in otolaryngology-head and neck surgery." Archives of Otolaryngology -- Head & Neck Surgery **116**(9): 1041-3.

Carmichael, K. D., J. B. Westmoreland, et al. (2005). "Relation of residency selection factors to subsequent orthopaedic in-training examination performance." Southern Medical Journal **98**(5): 528-32.

Carrothers, R. M., S. W. Gregory, Jr., et al. (2000). "Measuring emotional intelligence of medical school applicants.[see comment]." Academic Medicine **75**(5): 456-63.

Chew, F. S., E. R. Ochoa, Jr., et al. (2005). "Spreadsheet application for radiology resident match rank list." Academic Radiology **12**(3): 379-84.

Coates, H. (2008). "Establishing the criterion validity of the Graduate Medical School Admissions Test (GAMSAT)." Medical Education **42**(10): 999-1006.

Cohen-Schotanus, J., A. M. Muijtjens, et al. (2006). "The predictive validity of grade point average scores in a partial lottery medical school admission system." Medical Education **40**(10): 1012-9.

Coulton, G. F. and H. S. Field (1995). "Using assessment centers in selecting entry-level police officers: Extravagance or justified." Public Personnel Management **24**(2): 223-223.

Courneya, C. A., K. Wright, et al. (2005). "Medical student selection: choice of a semi-structured panel interview or an unstructured one-on-one interview." Medical Teacher **27**(6): 499-503.

Cowley, C. (2006). "Polemic: five proposals for a medical school admission policy.[erratum appears in J Med Ethics. 2006 Oct;32(10):611]." Journal of Medical Ethics **32**(8): 491-4.

Crane, J. T. and C. M. Ferraro (2000). "Selection criteria for emergency medicine residency applicants." Academic Emergency Medicine **7**(1): 54-60.

Daly, K. A., S. C. Levine, et al. (2006). "Predictors for resident success in otolaryngology." Journal of the American College of Surgeons **202**(4): 649-54.

DaRosa, D. A. and R. Folse (1991). "Evaluation of a system designed to enhance the resident selection process." Surgery **109**(6): 715-21.

Davidson, H. J. (2004). "Residency selection perceptions held by diplomates of the American College of Veterinary Ophthalmologists and veterinary ophthalmology residency applicant data." Journal of Veterinary Medical Education **31**(3): 289-94.

Dawkins, K., R. D. Ekstrom, et al. (2005). "The relationship between psychiatry residency applicant evaluations and subsequent residency performance." Academic Psychiatry **29**(1): 69-75.

DeLisa, J. A., S. S. Jain, et al. (1994). "Factors used by physical medicine and rehabilitation residency training directors to select their residents." American Journal of Physical Medicine & Rehabilitation **73**(3): 152-6.

Didier, T., C. D. Kreiter, et al. (2006). "Investigating the utility of a GPA institutional adjustment index." Advances in Health Sciences Education **11**(2): 145-53.

Dirschl, D. R., E. R. Campion, et al. (2006). "Resident selection and predictors of performance: can we be evidence based?" Clinical Orthopaedics & Related Research **449**: 44-9.

Dixon, D. (2004). "Relation between variables of preadmission, medical school performance, and COMLEX-USA levels 1 and 2 performance." JAOA: Journal of the American Osteopathic Association **104**(8): 332.

Dodson, M., B. Crotty, et al. (2009). "The multiple mini-interview: how long is long enough?" Medical Education **43**(2): 168-174.

Domen, R. E. and A. B. Wehler (2008). "An examination of professional and ethical issues in the fellowship application process in pathology.[see comment]." Human Pathology **39**(4): 484-8.

Donnon, T. and E. O. Paolucci (2008). "A generalizability study of the medical judgment vignettes interview to assess students' noncognitive attributes for medical school." BMC Medical Education **8**: 58.

Donnon, T., E. O. Paolucci, et al. (2007). "The predictive validity of the MCAT for medical school performance and medical board licensing examinations: a meta-analysis of the published research." Academic Medicine **82**(1): 100-6.

Dore, K. L., M. Hanson, et al. (2006). "Medical school admissions: enhancing the reliability and validity of an autobiographical screening tool." Academic Medicine **81**(10 Suppl): S70-3.

Edmond, M., M. Roberson, et al. (1999). "The dishonest dean's letter: an analysis of 532 dean's letters from 99 U.S. medical schools." Academic Medicine **74**(9): 1033-5.

Edwards, J. C., M. L. Currie, et al. (1993). "Surgery resident selection and evaluation. A critical incident study." Evaluation & the Health Professions **16**(1): 73-86.

Elam, C. L. and M. M. Johnson (1997). "An analysis of admission committee voting patterns." Academic Medicine **72**(10 Suppl 1): S72-5.

Elam, C. L., T. D. Stratton, et al. (2002). "Review, deliberation, and voting: a study of selection decisions in a medical school admission committee." Teaching & Learning in Medicine **14**(2): 98-103.

Emmett, R. I. (1993). "A descriptive analysis of medical school application forms." Academic Medicine **68**(7): 564-9.

Eva, K., W, Reiter, H, I, Rosenfeld. J, Norman, G, R. (2004b). "The ability of the multiple mini-interview to predict clerkship performance in medical school." Academic Medicine **79**(10): S40-S42.

Eva, K. W., H. I. Reiter, et al. (2004c). "The relationship between interviewers' characteristics and ratings assigned during a multiple mini-interview." Academic Medicine **79**(6): 602-9.

Eva, K. W., Reiter, H, I. (2004). "Where judgement fails: Pitfalls in the selection process for medical personnel." AHSE **9**: 161-174.

Eva, K. W., J. Rosenfeld, et al. (2004a). "An admissions OSCE: the multiple mini-interview." Medical Education **38**(3): 314-26.

Evans, P. and F. K. Wen (2007). "Does the medical college admission test predict global academic performance in osteopathic medical school?" Journal of the American Osteopathic Association **107**(4): 157-62.

Ferguson, E., D. James, et al. (2002). "Factors associated with success in medical school: systematic review of the literature." BMJ **324**(7343): 952-7.

Ferguson, E., D. James, et al. (2003). "Pilot study of the roles of personality, references, and personal statements in relation to performance over the five years of a medical degree.[see comment]." BMJ **326**(7386): 429-32.

Fine, P. L. and R. A. Hayward (1995). "Do the criteria of resident selection committees predict residents' performances?" Academic Medicine **70**(9): 834-8.

Foster, C., Godkin, L. (1998). "Employment selection in health care: The case for structured interviewing." Health Care Management Review **23**(1): 46-51.

Frantsve, L. M. E., D. M. Laskin, et al. (2003). "Personality and gender influences on faculty ratings and rankings of oral and maxillofacial surgery residency applicants." Journal of Dental Education **67**(11): 1252-9.

Galazka, S. S., G. E. Kikano, et al. (1994). "Methods of recruiting and selecting residents for U.S. family practice residencies." Academic Medicine **69**(4): 304-6.

Gallagher, A., G, Neary, P, Gillen, P, Lane, B, Whelan, A, Tanner, W, A, Tryanor, O. (2008). "Novel method for assessment and selection of trainees for higher surgical training in general surgery. ." Australia and New Zealand Journal of Surgery **78**: 282-290.

Gayed, N. M. (1991). "Residency directors' assessments of which selection criteria best predict the performances of foreign-born foreign medical graduates during internal medicine residencies." Academic Medicine **66**(11): 699-701.

Gilbart, M. K., M. D. Cusimano, et al. (2001). "Evaluating surgical resident selection procedures." American Journal of Surgery **181**(3): 221-5.

Gilbert, G. E., W. T. Basco, Jr., et al. (2002). "Predictive validity of the Medical College Admissions Test Writing Sample for the United States medical licensing examination steps 1 and 2." Advances in Health Sciences Education **7**(3): 191-200.

Gilligan, J. H., T. Treasure, et al. (1994). "Incorporating psychometric measures in selecting and developing surgeons." Journal of Management in Medicine **10**(6): 5-16.

Ginsburg, S., Schreiber, M, Regehr, G. (2004). "The lore of admission policies: Contrasting formal and informal understandings of the residency selection process." AHSE **9**: 137-145.

Goho, J. and A. Blackman (2006). "The effectiveness of academic admission interviews: an exploratory meta-analysis." Medical Teacher **28**(4): 335-40.

Goldberg, A. E., J. P. Neifeld, et al. (2008). "Correlation of manual dexterity with USMLE scores and medical student class rank." Journal of Surgical Research **147**(2): 212-5.

Gorman, D., J. Monigatti, et al. (2008). "On the case for an interview in medical student selection." Internal Medicine Journal **38**(8): 621-623.

Grantham, J. R. (1993). "Radiology resident selection: results of a survey." Investigative Radiology **28**(1): 99-101.

Grover, M., F. Dharamshi, et al. (2001). "Deception by applicants to family practice residencies." Family Medicine **33**(6): 441-6.

Groves, M. A., J. Gordon, et al. (2007). "Entry tests for graduate medical programs: is it time to re-think?[see comment]." Medical Journal of Australia **186**(3): 120-3.

Hall, F. R. and B. A. Bailey (1992). "Correlating students' undergraduate science GPAs, their MCAT scores, and the academic caliber of their undergraduate colleges with their first-year academic performances across five classes at Dartmouth Medical School." Academic Medicine **67**(2): 121-3.

Hamel, P., H. Boisjoly, et al. (2007). "Using the CanMEDS roles when interviewing for an ophthalmology residency program." Canadian Journal of Ophthalmology **42**(2): 299-304.

Hanson, M. D., K. L. Dore, et al. (2007). "Medical school admissions: revisiting the veracity and independence of completion of an autobiographical screening tool." Academic Medicine **82**(10 Suppl): S8-S11.

Harasym, P., H, Woloschuk, W, Mandin, H, Brundin-Mather, R. (1996). "Reliability and validity of interviewers' judgements of medical school candidates." Academic Medicine **71** (1 Supplement): S40-S42.

Harris, S. and C. Owen (2007). "Discerning quality: using the multiple mini-interview in student selection for the Australian National University Medical School." Medical Education **41**(3): 234-41.

Hayden, S. R., M. Hayden, et al. (2005). "What characteristics of applicants to emergency medicine residency programs predict future success as an emergency medicine resident?" Academic Emergency Medicine **12**(3): 206-10.

Hofmeister, M., J. Lockyer, et al. (2008). "The acceptability of the multiple mini interview for resident selection." Family Medicine **40**(10): 734-40.

Hojat, M., J. B. Erdmann, et al. (2000). "A validity study of the writing sample section of the medical college admission test." Academic Medicine **75**(10 Suppl): S25-7.

Hulsman, R. L., J. S. van der Ende, et al. (2007). "Effectiveness of selection in medical school admissions: evaluation of the outcomes among freshmen." Medical Education **41**(4): 369-77.

Humphrey, S., S. Dowson, et al. (2008). "Multiple mini-interviews: opinions of candidates and interviewers." Medical Education **42**(2): 207-13.

Janis, J. E. and D. A. Hatef (2008). "Resident selection protocols in plastic surgery: a national survey of plastic surgery program directors." Plastic & Reconstructive Surgery **122**(6): 1929-39; discussion 1940-1.

Jefferis, T. (2007). "Selection for specialist training: what can we learn from other countries?" BMJ **334**(7607): 1302-4.

Johnson, M. and C. Elam (2001). "Letters of recommendation: comparing perceptions of premedical advisors and admission committee members." Academic Medicine **76**(6): 651.

Johnson, M., C. Elam, et al. (1998). "Medical school admission committee members' evaluations of and impressions from recommendation letters." Academic Medicine **73**(10 Suppl): S41-3.

Joiner, D. A. (2000). "Guidelines and ethical considerations for assessment center operations." Public Personnel Management **29**(3): 315-315.

Jones, B. J. and N. J. Borges (2001). "The contribution of noncognitive characteristics in predicting MCAT scores." Academic Medicine **76**(10 Suppl): S52-4.

Julian, E. R. (2005). "Validity of the Medical College Admission Test for predicting medical school performance." Academic Medicine **80**(10): 910-7.

Khongphatthanayothin, A., V. Chongsrisawat, et al. (2002). "Resident recruitment: what are good predictors for performance during pediatric residency training?" Journal of the Medical Association of Thailand **85 Suppl 1**: S302-11.

Knights, J. A. and B. J. Kennedy (2006). "Medical school selection: Screening for dysfunctional tendencies." Medical Education **40**(11): 1058-64.

Knights, J. A. and B. J. Kennedy (2007). "Medical school selection: impact of dysfunctional tendencies on academic performance." Medical Education **41**(4): 362-8.

Koc, T., C. L. E. Katona, et al. (2008). "Contribution of medical students to admission interviews." Medical Education **42**(3): 315-321.

Kondo, D. G. and V. E. Judd (2000). "Demographic characteristics of US medical school admission committees.[see comment]." JAMA **284**(9): 1111-3.

Kreiter, C. D. (2002). "The use of constrained optimization to facilitate admission decisions." Academic Medicine **77**(2): 148-51.

Kreiter, C. D. (2007). "A commentary on the use of cut-scores to increase the emphasis of non-cognitive variables in medical school admissions." Advances in Health Sciences Education **12**(3): 315-9.

Kreiter, C. D. and Y. Kreiter (2007). "A validity generalization perspective on the ability of undergraduate GPA and the Medical College Admission Test to predict important outcomes." Teaching & Learning in Medicine **19**(2): 95-100.

Kreiter, C. D., P. Yin, et al. (2004). "Investigating the reliability of the medical school admissions interview." Advances in Health Sciences Education **9**(2): 147-59.

Kulatunga-Moruzi, C. and G. R. Norman (2002). "Validity of admissions measures in predicting performance outcomes: the contribution of cognitive and non-cognitive dimensions." Teaching & Learning in Medicine **14**(1): 34-42.

Kumar, K., Roberts, C, Rothnie, I, du Fresne, C, Walton, M. (2009). "Experiences of the multiple mini-interview: a qualitative analysis." Medical Education **43**: 360-367.

Illing, J., Morrow, G. Et al (2008). 'How prepared are medical graduates to begin practice?" London: GMC.

Laskin, D. M., R. J. Lesny, et al. (2003). "The residents' viewpoint of the matching process, factors influencing their program selection, and satisfaction with the results." Journal of Oral & Maxillofacial Surgery **61**(2): 228-33.

Lee, A. G., K. C. Golnik, et al. (2008). "Re-engineering the resident applicant selection process in ophthalmology: a literature review and recommendations for improvement." Survey of Ophthalmology **53**(2): 164-76.

Lemay, J.-F., J. M. Lockyer, et al. (2007). "Assessment of non-cognitive traits through the admissions multiple mini-interview." Medical Education **41**(6): 573-9.

Loftus, L. S., L. Arnold, et al. (1992). "First-year residents' performances compared with their medical school class ranks as determined by three ranking systems." Academic Medicine **67**(5): 319-23.

Lopez, S. J., M. E. Oehlert, et al. (1997). "Selection criteria for APA-accredited internships stratified by type of site and competitiveness." Psychological Reports **80**(2): 639-42.

Lowry, P. E. (1994). "Selection methods; Comparison of assessment centers with personnel records evaluations." Public Personnel Management **23**(3): 383-383.

Lumb, A., B, Vail, A, (2002). "Comparison of academic, application form and social factors in predicting early performance on the medical course." Medical Education **38**: 1002-1005.

Lumsden, M. A., M. Bore, et al. (2005). "Assessment of personal qualities in relation to admission to medical school.[see comment]." Medical Education **39**(3): 258-65.

Lynch, K. B. and M. K. Woode (1990). "The relationship of minority students' MCAT scores and grade point averages to their acceptance into medical school." Academic Medicine **65**(7): 480-2.

Mallott, D. (2006). "Interview, Dean's Letter, and Affective Domain Issues." Clinical Orthopaedics & Related Research **449**: 56-61.

Mandel, L. P., L. R. Spadoni, et al. (1997). "One residency's experience with the electronic residency application service." Family Medicine **29**(3): 209-12.

Marley, J. and I. Carman (1999). "Selecting medical students: a case report of the need for change.[see comment]." Medical Education **33**(6): 455-9.

Marrin, M. L., K. A. McIntosh, et al. (2004). "Use of the paired-comparison technique to determine the most valued qualities of the McMaster Medical Programme Admissions Process." Advances in Health Sciences Education **9**(2): 129-35.

McCabe, B. J., J. D. Blagg, Jr., et al. (1993). "Retrospective analysis of the use of a standardized reference form in admissions to a dietetics internship program." Journal of the American Dietetic Association **93**(2): 158-62.

McCaskill, Q. E., J. J. Kirk, et al. (2007). "USMLE Step 1 Scores as a Significant Predictor of Future Board Passage in Pediatrics." Ambulatory Pediatrics **7**(2): 192-195.

McLaughlin, K., Moutray, M, Muldoon, M. (2007). "The role of personality and self-efficacy in the selection and retention of successful nursing students: a longitudinal study." Journal of Advanced Nursing **61**(2): 211-221.

McManus, I., C, Smithers, E, Partridge, P, Keeling, A, Fleming, P, R. (2003). "A levels and intelligence as predictors of medical careers in UK doctors: 20 year prospective study. ." British Medical Journal **327**: 139-142.

McManus, I. C., S. Iqbal, et al. (2005). "Unhappiness and dissatisfaction in doctors cannot be predicted by selectors from medical school application forms: a prospective, longitudinal study." BMC Medical Education **5**: 38.

Melendez, M. M., X. Xu, et al. (2008). "The importance of basic science and clinical research as a selection criterion for general surgery residency programs." Journal of Surgical Education **65**(2): 151-4.

Milne, C. K., L. M. Bellini, et al. (2003). "Residents as members of intern selection committees: can they partially replace faculty?" Teaching & Learning in Medicine **15**(4): 242-6.

Milne, C. K., L. M. Bellini, et al. (2001). "Applicants' perceptions of the formal faculty interview during residency recruitment." Academic Medicine **76**(5): 501.

Mitchell, K., R. Haynes, et al. (1994). "Assessing the validity of the updated Medical College Admission Test." Academic Medicine **69**(5): 394-401.

Mittenberg, W. S., R. S. Petersen, et al. (2000). "Selection criteria for clinical neuropsychology internships." Clinical Neuropsychologist **14**(1): 1-6.

Moore, K. K. (1995). "Criteria for acceptance to preprofessional dietetics programs vs desired qualities of professionals: an analysis." Journal of the American Dietetic Association **95**(1): 77-81.

Morris, J., G. (1999). "The value and role of the interview in the student selection admissions process: a review." Medical Teacher **21**(5): 473-481.

Norman, G. (2004). "The morality of medical school admissions." Advances in Health Sciences Education **9**(2): 79-82.

Nowacek, G. A., B. A. Bailey, et al. (1996). "Influence of the interview on the evaluation of applicants to medical school." Academic Medicine **71**(10): 1093-5.

O'Donnell, M. J., S. S. Obenshain, et al. (1993). "Background essential to the proper use of results of step 1 and step 2 of the USMLE.[see comment]." Academic Medicine **68**(10): 734-9.

O'Neil Jnr, H., F. (Ed) (1997). Workplace readiness: Competencies and assessment. New York, Routledge.

O'Neill, L., Korsholm, L, Wallstedt, B, Eika, B, Hartvigsen, J (2009). "Generalisability of a composite student selection programme." Medical Education **43**: 58-65.

Olawaiye, A., J. Yeh, et al. (2006). "Resident selection process and prediction of clinical performance in an obstetrics and gynecology program." Teaching & Learning in Medicine **18**(4): 310-5.

Part, H. M. and R. J. Markert (1993). "Predicting the first-year performances of international medical graduates in an internal medicine residency." Academic Medicine **68**(11): 856-8.

Pashayan, N., Duff, C, Mason, B, W. (2007). "Selection into specialry training in public health: performance of the Medical Training Application Service shortlisting." Journal of Public Health **29**(4): 331-337.

Patrick, L. E., E. M. Altmaier, et al. (2001). "A structured interview for medical school admission, Phase 1: initial procedures and results." Academic Medicine **76**(1): 66-71.

Patterson, F., Ferguson, E, Norfolk, T, Lane, P. (2005). "A new selection system to recruit general practice registrars: preliminary findings from a validation study." British Medical Journal **330**: 711-714.

Peskun, C., A. Detsky, et al. (2007). "Effectiveness of medical school admissions criteria in predicting residency ranking four years later." Medical Education **41**(1): 57-64.

Pilon, S. and D. Tandberg (1997). "Neural network and linear regression models in residency selection." American Journal of Emergency Medicine **15**(4): 361-4.

Powis, D. A., M. Bore, et al. (2005). "Development of the personal qualities assessment as a tool for selecting medical students." Journal of Adult and Continuing Education **11**(1): 3-14.

Precision Consultance (2007). Graduate Employability Skills. Barton, Commonwealth of Australia.

Provan, J. L. and L. Cuttress (1995). "Preferences of program directors for evaluation of candidates for postgraduate training." CMAJ Canadian Medical Association Journal **153**(7): 919-23.

Randall, R., H. Davies, et al. (2006). "Selecting doctors for postgraduate training in paediatrics using a competency based assessment centre." Archives of Disease in Childhood **91**(5): 444-448.

Rao, R. (2007). "The Structured Clinically Relevant Interview for Psychiatrists in Training (SCRIPT): A New Standardized Assessment Tool for Recruitment in the UK." Academic Psychiatry **31**(6): 443-446.

Reiter, H. I., K. W. Eva, et al. (2007). "Multiple mini-interviews predict clerkship and licensing examination performance." Medical Education **41**(4): 378-84.

Richardson, P. H., B. Winder, et al. (1998). "Grade predictions for school-leaving examinations: do they predict anything?" Medical Education **32**(3): 294-7.

Roberts, C., M. Walton, et al. (2008). "Factors affecting the utility of the multiple mini-interview in selecting candidates for graduate-entry medical school." Medical Education **42**(4): 396-404.

Roberts, C., Zoanetti, N, Rothnie, I. (2009). "Validating a multiple mini-interview question bank assessing entry-level reasoning skills in candidates for graduate-entry medicine and dentistiry programmes." Medical Education **43**: 350-359.

Rolfe, I. E., S. Pearson, et al. (1995). "Time for a review of admission to medical school?" Lancet **346**(8986): 1329-33.

Rosenfeld, J. M., H. I. Reiter, et al. (2008). "A cost efficiency comparison between the multiple mini-interview and traditional admissions interviews." Advances in Health Sciences Education **13**(1): 43-58.

Roth, K. S., W. T. Riley, et al. (1996). "Prediction of students' USMLE step 2 performances based on premedical credentials related to verbal skills." Academic Medicine **71**(2): 176-80.

Salvatori, P. (2001). "Reliability and validity of admissions tools used to select students for the health professions.[see comment]." Advances in Health Sciences Education **6**(2): 159-75.

Scott, T. (1993). "Pick the right person using the assessment center process." JEMS: Journal of Emergency Medical Services **18**(9): 58.

Sekiguchi, T. (2004). "Person-organisation fit and person-job fit in employer slection: a review of the literature." Osaka Keidai Ronshu **54**(6): 179-196.

Self, D. J. (1990). "Moral dilemmas in medical school admission." Academic Medicine **65**(3): 179-83.

Self, D. J. and D. C. Baldwin, Jr. (2000). "Should moral reasoning serve as a criterion for student and resident selection?" Clinical Orthopaedics & Related Research(378): 115-23.

Shaw, D. L., D. M. Martz, et al. (1995). "Influence of medical school applicants' demographic and cognitive characteristics on interviewers' ratings of noncognitive traits." Academic Medicine **70**(6): 532-6.

Silver, B. and C. S. Hodgson (1997). "Evaluating GPAs and MCAT scores as predictors of NBME I and clerkship performances based on students' data from one undergraduate institution.[see comment]." Academic Medicine **72**(5): 394-6.

Sklar, D. P. and D. Tandberg (1995). "The value of self-estimated scholastic standing in residency selection." Journal of Emergency Medicine **13**(5): 683-5.

Smilen, S. W., E. F. Funai, et al. (2001). "Residency selection: should interviewers be given applicants' board scores?" American Journal of Obstetrics & Gynecology **184**(3): 508-13.

Smith, S. R. (1991). "Medical school and residency performances of students admitted with and without an admission interview." Academic Medicine **66**(8): 474-6.

Spina, A. M., T. A. Smith, et al. (2000). "A survey of resident selection procedures in oral and maxillofacial surgery." Journal of Oral & Maxillofacial Surgery **58**(6): 660-6; discussion 666-7.

Stansfield, R. B. and C. D. Kreiter (2007). "Conditional reliability of admissions interview ratings: extreme ratings are the most informative." Medical Education **41**(1): 32-8.

Sternberg, R. J. (2008). "Assessing students for medical school admissions: is it time for a new approach?" Academic Medicine **83**(10 Suppl): S105-10.

Streyffeler, L., Altmaier, E, M, Kuperman, S, Patrick, L, E. (2005). "Development of a medical school admissions interview phase 2: Predictive validity of cognitive and non-cognitive attributes." Medical Education Online **10**: 14.

Swanson, W. S., M. C. Harris, et al. (2005). "The impact of the interview in pediatric residency selection." Ambulatory Pediatrics **5**(4): 216-20.

Takayama, H., R. Grinsell, et al. (2006). "Is it appropriate to use core clerkship grades in the selection of residents?" Current Surgery **63**(6): 391-6.

Taylor, C. A., L. Weinstein, et al. (1995). "The process of resident selection: a view from the residency director's desk." Obstetrics & Gynecology **85**(2): 299-303.

Taylor, M. L., A. V. Blue, et al. (2005). "The relationship between the National Board of Medical Examiners' prototype of the Step 2 clinical skills exam and interns' performance." Academic Medicine **80**(5): 496-501.

Teichman, J. M., K. D. Anderson, et al. (2000). "The urology residency matching program in practice." Journal of Urology **163**(6): 1878-87.

ten Cate, O. and K. Smal (2002). "Educational assessment center techniques for entrance selection in medical school." Academic Medicine **77**(7): 737.

Thordarson, D. B., E. Ebramzadeh, et al. (2007). "Resident selection: how we are doing and why?" Clinical Orthopaedics & Related Research **459**: 255-9.

Turner, N. S., W. J. Shaughnessy, et al. (2006). "A quantitative composite scoring tool for orthopaedic residency screening and selection." Clinical Orthopaedics & Related Research **449**: 50-5.

Turnwald, G. H., M. M. Spafford, et al. (2001a). "Veterinary school admission interviews, part 2: survey of North American schools." Journal of Veterinary Medical Education **28**(3): 122-30.

Turnwald, G. H., M. M. Spafford, et al. (2001b). "Veterinary school admission interviews, part 1: literature overview." Journal of Veterinary Medical Education **28**(3): 111-21.

Tutton, P. J. (1993). "Medical school entrants: semi-structured interview ratings, prior scholastic achievement and personality profiles." Medical Education **27**(4): 328-36.

Urlings-Strop, L. C., T. Stijnen, et al. (2009). "Selection of medical students: a controlled experiment." Medical Education **43**(2): 175-183.

van der Heidje, C., M, ven der Heijden, B, I, J, M. (2006). "A competence-based and multidimensional operationalization and measurement of employability." Human Resource Management **45**(3): 449-476.

Van der Vleuten, C., P., M. (1996). ‘’The assessment of professional competence: theoretical developments, research and practical implications. ‘’ Advances in Health Science Education **1**: 41-67.

van Iddekinge, C., H, Ployhart, R, E. (2008). "Developments in the criterion-related valdiation of selection procedures: A critical review and recommendations for practice." Personnel Psychology **61**: 871-925.

Violato, C. and T. Donnon (2005). "Does the medical college admission test predict clinical reasoning skills? A longitudinal study employing the Medical Council of Canada clinical reasoning examination." Academic Medicine **80**(10 Suppl): S14-6.

Wagoner, N. E. and J. R. Suriano (1992). "Recommendations for changing the residency selection process based on a survey of program directors." Academic Medicine **67**(7): 459-65.

Weingarten, M. S., F. Erlich, et al. (1997). "A pilot study of the use of the analytic hierarchy process for the selection of surgery residents." Academic Medicine **72**(5): 400-2.

White, A. A., 3rd (2002). "Resident selection: are we putting the cart before the horse?[see comment]." Clinical Orthopaedics & Related Research(399): 255-9.

Wilkinson, D., J. Zhang, et al. (2008). "Medical school selection criteria and the prediction of academic performance.[see comment]." Medical Journal of Australia **188**(6): 349-54.

Wood, D., F (1999). "Medical school selection - fair or unfair?" Medical Education **33**: 399-401.

Ziv, A., O. Rubin, et al. (2008). "MOR: a simulation-based assessment centre for evaluating the personal and interpersonal qualities of medical school candidates." Medical Education **42**(10): 991-8.

APPENDIX – search terms

A. Medical school admission (F1 all)

(This was an initial search with a simple search criterion)

Search on Medline with following terms:

Medical school admission

B. Selection only

(This was an initial search with a simple search criterion)

Search on Medline with following terms:

Medical school selection

C. Full search – F1 final 3

Limited to Europe including UK
Search yielded 263 hits but 4 of these were duplicates which were eliminated in EndNote.

Ovid MEDLINE(R) 1950 to February Week 4 2009
Searches Results
1 exp Education, Medical/ 102521
2 Schools, Medical/ 17508
3 exp Students, Medical/ 14881
4 medical school*.ab,ti. 17921
5 medical student*.ab,ti. 16327
6 specialist registrar*.ab,ti. 341
7 Foundation year.ab,ti. 58
8 (F1 adj10 foundation).ab,ti. 5
9 (resident or residents or residency).ab,ti. 68955
10 6 or 3 or 7 or 9 or 2 or 8 or 1 or 4 or 5 180706
11 Admission test*.ab,ti. 349
12 GAMSAT.ab,ti. 6
13 Graduate Australian Medical School Admissions test.ab,ti. 5
14 Non-cognitive.mp. or noncognitive.ab,ti. [mp=title, original title, abstract, name of substance word, subject heading word] 708
15 (OSCE adj5 examination).ab,ti. 407
16 Objective Structured Clinical Examination.ab,ti. 526
17 (MCAT adj5 Admission).ab,ti. 87
18 Mutliple College admission test.ab,ti. 0
19 Multiple mini-interview*.ab,ti. 15
20 (MMI adj5 multiple).ab,ti. 14
21 (USMLE adj5 united).ab,ti. 106
22 United States Medical Licensing Examination.ab,ti. 143
23 assessment centre*.ab,ti. 73
24 recommendation letter*.ab,ti. 17
25 autobiographical submission.ab,ti. 2
26 autobiographical screening.ab,ti. 2
27 ((personal or interpersonal) adj attribute*).ab,ti. 377
28 personal qualities.ab,ti. 198
29 exp Interview/ or Interview*.mp. 156230
30 or/11-29 158333
31 (GB or UK or Great Britain or United Kingdom).ab,ti. 61713
32 (England or Scotland or Wales or Ireland).ab,ti. 43110

33 (Spain or Portugal or France or Germany or Denmark or Sweden or Norway).ab,ti. 121975
34 33 or 32 or 31 214979
35 34 and 30 and 10 623
36 limit 35 to (english language and humans and yr="1990 - 2009") 485
37 exp Aged/ or exp Patient Admission/ or Patient admission*.mp. 1776422
38 exp Diagnosis/ 4641905
39 exp Neoplasms/ 1992998
40 38 or 39 or 37 6620020
41 36 not 40 263

D. Residency (Res)

Ovid search shows 309 his but when imported in EndNote there were 9 duplicates which have been removed.
No alert set up so far.
Ovid MEDLINE(R) 1950 to February Week 4 2009

#Searches Results

1 selection.ab,ti. 1678952
2 (residency or internship).ab,ti. 120213
3 1 and 2 4794
4 limit 3 to (english language and humans and yr="1990 - 2009") 309

E. Residency – American supplement

Minor adjustments to search strategy compared with original Final 3 - resident/s removed, residency/internship added.

America, Canada, Australia added to locations. GB etc refs removed as would have been traced in previous search.

Ovid MEDLINE(R) 1950 to February Week 4 2009

No duplicates this time

Searches Results
1 exp Education, Medical/ 102521
2 Schools, Medical/ 17508
3 exp Students, Medical/ 14881
4 medical school*.ab,ti. 17921
5 medical student*.ab,ti. 16327
6 specialist registrar*.ab,ti. 341
7 Foundation year.ab,ti. 58
8 (F1 adj10 foundation).ab,ti. 5
9 residency.mp. or internship*.ab,ti. [mp=title, original title, abstract, name of substance word, subject heading word] 30470
10 exp "Internship and Residency"/ 26285
11 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 131844
12 Admission test*.ab,ti. 349
13 GAMSAT.ab,ti. 6
14 Graduate Australian Medical School Admissions test.ab,ti. 5
15 Non-cognitive.mp. or noncognitive.ab,ti. [mp=title, original title, abstract, name of substance word, subject heading word] 708
16 (OSCE adj5 examination).ab,ti. 407
17 Objective Structured Clinical Examination.ab,ti. 526
18 (MCAT adj5 Admission).ab,ti. 87
19 Mutliple College admission test.ab,ti. 0
20 Multiple mini-interview*.ab,ti. 15
21 (MMI adj5 multiple).ab,ti. 14
22 (USMLE adj5 united).ab,ti. 106

23 United States Medical Licensing Examination.ab,ti. 143
24 assessment centre*.ab,ti. 73
25 recommendation letter*.ab,ti. 17
26 autobiographical submission.ab,ti. 2
27 autobiographical screening.ab,ti. 2
28 ((personal or interpersonal) adj attribute*).ab,ti. 377
29 personal qualities.ab,ti. 198
30 exp Interview/ or Interview*.mp. 156230
31 or/12-30 158333
32 exp United States/ 892328
33 United states of america.ab,ti. 1460
34 exp Canada/ 90888
35 exp Australia/ 71016
36 35 or 33 or 32 or 34 1038128
37 11 and 36 and 31 1832
38 limit 37 to (english language and humans and yr="1990 - 2009") 1177
39 Aged/ or exp Patient Admission/ or Patient admission*.mp. [mp=title, original title, abstract, name of substance word, subject heading word] 1768965
40 exp Diagnosis/ 4641905
41 exp Neoplasms/ 1992998
42 39 or 40 or 41 6616980
43 38 not 42 986
44 exp Great Britain/ 238165
45 (GB or UK or Great Britain or United Kingdom).ab,ti. 61713
46 (England or Scotland or Wales or Ireland).ab,ti. 43110
47 exp Europe/ 858384
48 (Spain or Portugal or France or Germany or Denmark or Sweden).mp. or Norway.ab,ti. [mp=title, original title, abstract, name of substance word, subject heading word] 327412
49 46 or 45 or 44 or 48 or 47 948127
50 43 not 49 958
51 from 50 keep 1-958 958

F. White space

Ovid MEDLINE(R) 1950 to February Week 4 2009

Searches Results
1 exp Education, Medical/ 102521
2 Schools, Medical/ 17508
3 exp Students, Medical/ 14881
4 medical school*.ab,ti. 17921
5 medical student*.ab,ti. 16327
6 specialist registrar*.ab,ti. 341
7 Foundation year.ab,ti. 58
8 (F1 adj10 foundation).ab,ti. 5
9 residency.mp. or internship*.ab,ti. [mp=title, original title, abstract, name of substance word, subject heading word] 30470
10 exp "Internship and Residency"/ 26285
11 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 131844
12 Admission test*.ab,ti. 349
13 GAMSAT.ab,ti. 6
14 Graduate Australian Medical School Admissions test.ab,ti. 5
15 Non-cognitive.mp. or noncognitive.ab,ti. [mp=title, original title, abstract, name of substance word, subject heading word] 708
16 (OSCE adj5 examination).ab,ti. 407
17 Objective Structured Clinical Examination.ab,ti. 526
18 (MCAT adj5 Admission).ab,ti. 87

19 Mutliple College admission test.ab,ti. 0
20 Multiple mini-interview*.ab,ti. 15
21 (MMI adj5 multiple).ab,ti. 14
22 (USMLE adj5 united).ab,ti. 106
23 United States Medical Licensing Examination.ab,ti. 143
24 assessment centre*.ab,ti. 73
25 recommendation letter*.ab,ti. 17
26 autobiographical submission.ab,ti. 2
27 autobiographical screening.ab,ti. 2
28 ((personal or interpersonal) adj attribute*).ab,ti. 377
29 personal qualities.ab,ti. 198
30 exp Interview/ or Interview*.mp. 156230
31 or/12-30 158333
32 exp United States/ 892328
33 United states of america.ab,ti. 1460
34 exp Canada/ 90888
35 exp Australia/ 71016
36 35 or 33 or 32 or 34 1038128
37 exp Great Britain/ 238165
38 (GB or UK or Great Britain or United Kingdom).ab,ti. 61713
39 (England or Scotland or Wales or Ireland).ab,ti. 43110
40 exp Europe/ 858384
41 (Spain or Portugal or France or Germany or Denmark or Sweden).mp. or Norway.ab,ti. [mp=title, original title, abstract, name of substance word, subject heading word] 327412
42 39 or 38 or 37 or 41 or 40 948127
43 42 or 36 1936429
44 personal statement*.ab,ti. 50
45 Free text.ab,ti. 714
46 medical scenario*.ab,ti. 27
47 white space.ab,ti. 34
48 46 or 45 or 44 or 47 825
49 11 and 43 and 31 and 48 13
50 limit 49 to (english language and humans and yr="1990 - 2009") 11

G. Portfolios

See note at end for saved strategy and alert

Ovid MEDLINE(R) 1950 to March Week 1 2009
Searches Results
1 exp Education, Medical/ 102656
2 Schools, Medical/ 17522
3 exp Students, Medical/ 14909
4 medical school*.ab,ti. 17945
5 medical student*.ab,ti. 16355
6 specialist registrar*.ab,ti. 342
7 Foundation year.ab,ti. 59
8 (F1 adj10 foundation).ab,ti. 5
9 (resident or residents or residency).ab,ti. 69094
10 6 or 3 or 7 or 9 or 2 or 8 or 1 or 4 or 5 180958
11 learning portfolio.mp. 23
12 portfolio*.ab,ti. 1332
13 12 not 11 1309
14 Log book*.ab,ti. 164
15 academic transcript*.ab,ti. 6
16 13 or 15 or 14 1477
17 16 and 10 241
18 select*.ab,ti. 824014

19 18 and 17 30
20 limit 19 to (english language and humans and yr="1990 - 2009") 19

Previously conducted search just using "learning portfolio". These results excluded form the above list.

Strategy saved amended to include "learning portfolios" and saved as !F1- Portfolios 2 - 120309". Alert set up.

H. BREI selection

British Education Index 1975 - 160309. Search limited to 1990 onwards.
Strategy saved on Dialog-datastar. Alert set up.

```
BREI    1   (MEDICAL ADJ (EDUCATION OR SCHOOL$1 OR STUDENT$1)).TI,AB.
      RESULT        809
BREI    2   (SPECIALIST ADJ REGISTRAR$1).TI,AB.
      RESULT          2
BREI    3   (FOUNDATION ADJ YEAR).TI,AB. AND (MEDICINE OR MEDICAL).TI,AB
      RESULT          0
BREI    4   (RESIDENT OR RESIDENTS OR RESIDENCY).TI,AB.
      RESULT        108
BREI    5   (INTERN$1 OR INTERNSHIP$1).TI,AB.
      RESULT         66
BREI    6   1 OR 2 OR 3 OR 4 OR 5
      RESULT        973
BREI    7   (ADMISSION ADJ TEST*).TI,AB.
      RESULT          0
BREI    8   GAMSAT.TI,AB. AND GRADUATE.TI,AB.
      RESULT          1
BREI    9   (GRADUATE ADJ AUSTRALIAN ADJ MEDICAL ADJ SCHOOLS ADJ ADMISSI
          ON ADJ TEST).TI,AB.
      RESULT          0
BREI   10   (NON-COGNITIVE OR NONCOGNITIVE).TI,AB.
      RESULT          6
BREI   11   (OSCE ADJ ADJ5 ADJ EXAMINATION).TI,AB.
      RESULT          0
BREI   12   (OBJECTIVE ADJ STRUCTURED ADJ CLINICAL ADJ EXAMINATION).TI,AB.
      RESULT         13
BREI   13   (MCAT ADJ ADJ5 ADJ ADMISSION).TI,AB.
      RESULT          0
BREI   14   (MULTIPLE ADJ COLLEGE ADJ ADMISSION ADJ TEST*).TI,AB.
      RESULT          0
BREI   15   (MULTIPLE ADJ MINI ADJ INTERVIEW*).TI,AB.
      RESULT          0
BREI   16   (MMI ADJ 5 ADJ MULTIPLE).TI,AB.
      RESULT          0
BREI   17   (USMLE ADJ ADJ5 ADJ UNITED).TI,AB.
      RESULT          0
BREI   18   (UNITED ADJ STATES ADJ MEDICAL ADJ LICENSING ADJ EXAMINATION).TI,AB.
      RESULT          0
BREI   19   (ASSESSMENT ADJ (CENTRE$1 OR CENTER$1)).TI,AB.
      RESULT         30
BREI   20   (RECOMMENDATION ADJ LETTER$1).TI,AB.
      RESULT          0
BREI   21   (AUTOBIOGRAPHICAL ADJ (SUBMISSION$1 OR SCREENING)).TI,AB.
      RESULT          0
BREI   22   ((PERSONAL OR INTERPERSONAL) ADJ (ATTRIBUTE$1 OR QUALIT$3)).TI,AB.
```

```
      RESULT         21
BREI   23   (INTERVIEW$1 OR SELECTION).TI,AB.
      RESULT       1662
BREI   24   7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17
          OR 18 OR 19 OR 20 OR 21 OR 22 OR 23
      RESULT       1726
BREI   25   (GB OR UK OR GREAT ADJ BRITAIN OR UNITED ADJ KINGDOM OR ENGL
          AND OR SCOTLAND OR WALES OR IRELAND OR SPAIN OR PORTUGAL OR
          FRANCE OR GERMANY OR DENMARK OR SWEDEN OR NORWAY).TI,AB.
      RESULT       7322
BREI   26   (UNITED ADJ STATES OR USA OR CANADA OR AUSTRALIA).TI,AB.
      RESULT       1802
BREI   27   25 OR 26
      RESULT       8836
BREI   28   6 AND 24 AND 27
      RESULT          2
BREI   29   6 AND 24
      RESULT         29
```

I. ERIC selection

```
ERIC 1960 - 160309.  Search limited to 1990 onwards.
Strategy saved on Dialog-datastar.  Alert set up.
----------------------------------------------------------------------
ERIC    1   (MEDICAL ADJ (EDUCATION OR SCHOOL$1 OR STUDENT$1)).TI,AB.
      RESULT       2502
ERIC    2   (SPECIALIST ADJ REGISTRAR$1).TI,AB.
      RESULT          0
ERIC    3   (FOUNDATION ADJ YEAR).TI,AB. AND (MEDICINE OR MEDICAL).TI,AB.
      RESULT          0
ERIC    4   (RESIDENT OR RESIDENTS OR RESIDENCY).TI,AB.
      RESULT       4381
ERIC    5   (INTERN$1 OR INTERNSHIP$1).TI,AB.
      RESULT       2663
ERIC    6   1 OR 2 OR 3 OR 4 OR 5
      RESULT       9187
ERIC    7   (ADMISSION ADJ TEST*).TI,AB.
      RESULT          0
ERIC    8   GAMSAT.TI,AB. AND GRADUATE.TI,AB.
      RESULT          0
ERIC    9   (GRADUATE ADJ AUSTRALIAN ADJ MEDICAL ADJ SCHOOLS ADJ ADMISSI
          ON ADJ TEST).TI,AB.
      RESULT          0
ERIC   10   (NON-COGNITIVE OR NONCOGNITIVE).TI,AB.
      RESULT        159
ERIC   11   (OSCE ADJ ADJ5 ADJ EXAMINATION).TI,AB.
      RESULT          0
ERIC   12   (OBJECTIVE ADJ STRUCTURED ADJ CLINICAL ADJ EXAMINATION).TI,A
          B.
      RESULT         53
ERIC   13   (MCAT ADJ ADJ5 ADJ ADMISSION).TI,AB.
      RESULT          0
ERIC   16   (MULTIPLE ADJ COLLEGE ADJ ADMISSION ADJ TEST*).TI,AB.
      RESULT          0
ERIC   17   (MULTIPLE ADJ MINI ADJ INTERVIEW*).TI,AB.
      RESULT          0
ERIC   18   (MMI ADJ 5 ADJ MULTIPLE).TI,AB.
```

RESULT 0
ERIC 19 (USMLE ADJ ADJ5 ADJ UNITED).TI,AB.
RESULT 0
ERIC 20 (UNITED ADJ STATES ADJ MEDICAL ADJ LICENSING ADJ EXAMINATION).TI,AB.
RESULT 17
ERIC 21 (ASSESSMENT ADJ (CENTRE$1 OR CENTER$1)).TI,AB.
RESULT 217
ERIC 22 (RECOMMENDATION ADJ LETTER$1).TI,AB.
RESULT 16
ERIC 23 (AUTOBIOGRAPHICAL ADJ (SUBMISSION$1 OR SCREENING)).TI,AB.
RESULT 0
ERIC 24 ((PERSONAL OR INTERPERSONAL) ADJ (ATTRIBUTE$1 OR QUALIT$3)).TI,AB.
RESULT 455
ERIC 25 (INTERVIEW$1 OR SELECTION).TI,AB.
RESULT 40195
ERIC 26 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 16 OR 17 OR 18 OR 19
OR 20 OR 21 OR 22 OR 23 OR 24 OR 25
RESULT 40951
ERIC 27 (GB OR UK OR GREAT ADJ BRITAIN OR UNITED ADJ KINGDOM OR ENGL
AND OR SCOTLAND OR WALES OR IRELAND OR SPAIN OR PORTUGAL OR
FRANCE OR GERMANY OR DENMARK OR SWEDEN OR NORWAY).TI,AB.
RESULT 19322
ERIC 28 (UNITED ADJ STATES OR USA OR CANADA OR AUSTRALIA).TI,AB.
RESULT 33625
ERIC 29 27 OR 28
RESULT 49813
ERIC 30 6 AND 26 AND 29
RESULT 133

J- BREI log books

BREI 1975 - 160309 . LImited to 1990 onwards. No hits so downloaded 5 relating to just log books etc, whatever discipline.
Search not save - used ERIC strategy. No alert set up.
No. Database Search term Info added since Results
CP [Clipboard] 0 -
1 British Education Index - 1975 to date
(MEDICAL ADJ (EDUCATION OR SCHOOL$1 OR STUDENT$1)).TI,AB. 1990 809 show titles
2 British Education Index - 1975 to date
(SPECIALIST ADJ REGISTRAR$1).TI,AB. 1990 2 show titles
3 British Education Index - 1975 to date
(FOUNDATION ADJ YEAR).TI,AB. AND (MEDICINE OR MEDICAL).TI,AB. 1990 0 -
4 British Education Index - 1975 to date
(RESIDENT OR RESIDENTS OR RESIDENCY).TI,AB. 1990 108 show titles
5 British Education Index - 1975 to date
(INTERN$1 OR INTERNSHIP$1).TI,AB. 1990 66 show titles
6 British Education Index - 1975 to date
1 OR 2 OR 3 OR 4 OR 5 1990 973 show titles
7 British Education Index - 1975 to date
(log ADJ book*).TI,AB. 1990 0 -
8 British Education Index - 1975 to date
logbook$1.TI,AB. 1990 4 show titles
9 British Education Index - 1975 to date
(academic ADJ transcript$1).TI,AB. 1990 1 show titles
10 British Education Index - 1975 to date
(white ADJ space).TI,AB. 1990 0 -
11 British Education Index - 1975 to date

(free ADJ text).TI,AB. 1990 2 show titles
12 British Education Index - 1975 to date
(National ADJ ranking ADJ exam$1).TI,AB. 1990 0 -
13 British Education Index - 1975 to date
7 OR 8 OR 9 OR 10 OR 12 1990 **5** show titles
14 British Education Index - 1975 to date
6 AND 13 1990 **0** -

K – ERIC log books
ERIC - 1966 to 160309. Limited to 1990 onwards. 1 hit only.
Strategy saved on Dialog-datastar but no alert set up.
Search history:
No. Database Search term Info added since Results
CP [Clipboard] 0 -
1 ERIC - 1966 to date
(MEDICAL ADJ (EDUCATION OR SCHOOL$1 OR STUDENT$1)).TI,AB. 1990 2502 show titles
2 ERIC - 1966 to date
(SPECIALIST ADJ REGISTRAR$1).TI,AB. 1990 0 -
3 ERIC - 1966 to date
(FOUNDATION ADJ YEAR).TI,AB. AND (MEDICINE OR MEDICAL).TI,AB. 1990 0 -
4 ERIC - 1966 to date
(RESIDENT OR RESIDENTS OR RESIDENCY).TI,AB. 1990 4381 show titles
5 ERIC - 1966 to date
(INTERN$1 OR INTERNSHIP$1).TI,AB. 1990 2663 show titles
6 ERIC - 1966 to date
1 OR 2 OR 3 OR 4 OR 5 1990 9187 show titles
10 ERIC - 1966 to date
(log ADJ book*).TI,AB. 1990 0 -
11 ERIC - 1966 to date
logbook$1.TI,AB. 1990 37 show titles
12 ERIC - 1966 to date
(academic ADJ transcript$1).TI,AB. 1990 14 show titles
15 ERIC - 1966 to date
(white ADJ space).TI,AB. 1990 20 show titles
16 ERIC - 1966 to date
(free ADJ text).TI,AB. 1990 56 show titles
20 ERIC - 1966 to date
(National ADJ ranking ADJ exam$1).TI,AB. 1990 0 -
21 ERIC - 1966 to date
10 OR 11 OR 12 OR 15 OR 20 1990 71 show titles
22 ERIC - 1966 to date
6 AND 21 1990 **1** show titles

L- CINAHL
CINAHL via Ebsco
Search ID# Search Terms Actions
S27 S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9 or S10 or S11 or S12 or S13 or S14 or S15 or S16 or S17 or S18 or S19 or S20 or S21 or S22 or S23 or S24 or S25 or S26 (219)
S26 academic transcript* (1)
S25 National ranking exam* (0)
S24 ((log book*) or (logbooks)) and student* (14)
S23 free text and medical student* (10)
S22 white space (9)
S21 interview* and medical student* and selection (15)
S20 personal qualities and medical student* (3)

S19 ((personal OR interpersonal) AND attribute*) and medical student* (16)
S18 ((personal OR interpersonal) AND attribute*) and (doctor* OR (medical student*)) (41)
S17 autobiographical AND (submission or screening) (4)
S16 recommendation letter* (2)
S15 assessment cent* and select* (18)
S14 assessment cent* and medical student* (0)
S13 United states Medical Licensing examination (19)
S12 United states Medical Licensing examinationion (0)
S11 USMLE (28)
S10 MMI and interview (8)
S9 Multiple mini interview (8)
S8 Multiple college admissions test (0)
S7 Multiple college admission test (0)
S6 MCAT AND admission (8)
S5 (OSCE and Examination) and medical student* (52)
S4 TX (Non-cognitive or noncognitive) and TX (test* OR exam*) and medical student* (4)
S3 TX Graduate Australian Medical School admissions test (1)
S2 TX Gamsat (2)
S1 TI admission test and TI nursing (1)