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CAREER ISSUES

How do Australian Doctors with Different Pre-medical School Backgrounds Perform as Interns?

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ABSTRACT **Aim:** *To assess whether there is any advantage to be gained with respect to performance in the first year of postgraduate medical training (internship) by selecting medical school candidates with different educational backgrounds. Specifically, we were interested in comparing the performance ratings of interns who entered medical school with secondary (directly from high school) or tertiary (at least one year of a university degree) level educational backgrounds.*

Focus: *We compared the performance ratings of interns according to the subjects or degree undertaken at a secondary or tertiary level, respectively. The effects of age and gender were also examined to determine their influence on performance ratings.*

Method: *All graduates (*N*=235) from the University of Newcastle Medical School, Australia who commenced their intern year in the state of New South Wales from 1993 to 1996 inclusive were eligible for the study. The outcome measure was a score derived from a valid and reliable clinical supervisor rating scale. Independent variables were level of previous educational experience (secondary or tertiary entry), and subjects studied by secondary level entrants (predominantly science or equal proportions of humanities and science) and degree undertaken by tertiary level entrants (arts or science or allied health or nursing).*

Results: *The records of 173 (73% of eligible sample) were included in the analyses. There were no significant differences between the mean ratings of interns with respect to previous educational background, subjects studied at secondary school or degree undertaken. Age and gender did not significantly affect performance ratings.*

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Conclusion: *These data may be useful for medical schools that are considering a shift in admission policy specifically with respect to requirements for level of educational experience and subject or degree prerequisites. Our data suggest that there may be no disadvantage in admitting students with a broad range of pre-medical school educational backgrounds with respect to performance in the early postgraduate years.*

KEYWORDS *Education, premedical students, humanities, educational measurement.*

Introduction

The education of young physicians represents a significant investment for everyone involved in the process, including medical students, medical schools, health care institutions, and society in general. Common sense and the need for efficient use of educational resources dictate that we should consider attributes among applicants that positively impact on their progress through the educational system. Accordingly, medical educators have long been interested in quantifying the relationships between pre-medical school characteristics and performance in medical school and in postgraduate training programs (Dickman *et al*., 1980; Harth *et al*., 1990; Neame *et al*., 1992; Woodward & McAuley, 1983).

Although identifying predictors of ultimate academic success and professional competence is fraught with ethical and policy concerns, this issue will demand attention from medical educators for the foreseeable future. While the body of literature in this area is expanding, the questions being posed and answered are heterogeneous and lead to a range of views on how best to select medical students rationally. Caveats aside, useful questions about the relationship between pre-medical school background and medical school and/or postgraduate performance remain.

In Australia, some medical schools have adopted partially the North American system of entry in which university level training is a prerequisite to medical school admission (Bandaranayka, 1994; Geffen, 1991). This position presumes that a university graduate would be a more mature and motivated medical student. While this assumption may be reasonable, direct evidence form published studies is sparse. In Australia, the current evidence suggests that those coming to medical school directly from secondary school (secondary level entrants) perform as well as, if not better than, mature-age peers with prior university education (tertiary level entrants) during internship (Dickman *et al*., 1980; Harth *et al*., 1990; Neame *et al*., 1992). Other studies have suggested that the literature remains sufficiently open to interpretation and that medical schools should instead target different applicant pools depending on institutional missions and curricular goals (Neame *et al*., 1992).

Further, most observers believe that medical school admissions' committees continue to maintain their historical preference for applicants whose subjects

studied prior to medical school entry are "science-oriented". This is despite evidence indicating that studying arts and humanities, at the very least, does not disadvantage students (Brieger, 1999a,b; Dickman *et al*., 1980; Neame *et al*., 1992; Rolfe *et al*., 1995a).

The University of Newcastle Medical School, New South Wales, Australia has a selection policy that admits candidates with either secondary backgrounds or at least one year of tertiary level training and there are no prerequisites with respect to subjects or degree studied prior to medical school entry. Therefore, we are in a position to assess whether there is any advantage to be gained with respect to postgraduate performance by selecting medical school candidates with specific educational backgrounds.

The primary aim of this study is to compare the performance ratings of interns who entered medial school with secondary or tertiary level educational backgrounds; the second is to compare the performance ratings of interns according to the subjects or degree undertaken by secondary or tertiary level entrants, respectively. In addition, the effects of age and gender are also examined to determine their influence on performance ratings (Day *et al*., 1980; Pearson *et al*., 1998).

Methods

Participants and Setting

Participants eligible for the study began their intern year in the state of New South Wales between 1993 and 1996 inclusive. Internship in Australia is a pre-registration year of supervised clinical experience. There are five term attachments, each of 10 weeks' duration, that combine to give the intern a broad range of experience of medicine and surgery. An accredited medical practitioner who is responsible for monitoring progress supervises each intern.

Assessment Measures

Outcome Measure. The outcome measure used in this study was a score derived from clinical supervisor ratings. At the conclusion of each of the five clinical attachments throughout the intern year, clinical supervisors evaluate performance of the junior doctor using a validated, standardized rating form (McPherson *et al*., 1986). This form has been in continuous use in New South Wales since 1986, but was modified in 1992 to include an additional competency of "communication skills". Clinical supervisors are asked to rate interns on 13 competencies and an overall rating (Table 1) using a 7-point Likert scale (1=unsatisfactory to 7=outstanding). Evaluation forms are forwarded to the research group, with an assessment code being the only means of identification of the intern.

Table 1. Competencies rated on intern/resident staff evaluation form

Clinical clerking
Communication skills
Diagnostic skills
Clinical judgement
Procedural skills
Patient management
Ability to relate to patient and family
Ability to relate to other professionals
Initiative and enthusiasm
Self-directed learning
Reliability and dependability
Ability and motivation to teach
Achievement of term-specific goals
Overall rating

Independent Variables. The independent measures used in this study were obtained from databases that are maintained for the University of Newcastle Faculty of Medicine & Health Sciences. Upon entry to medical school students are asked to complete a questionnaire voluntarily that details their educational background prior to commencing the course. The variables relevant to this study and the way in which they are categorized are as follows.

- Level of previous educational experience: students entering the course directly from secondary school are classified as secondary level entrants and those who had completed at least one year of tertiary education are classified as tertiary level entrants.
- Subjects studied by secondary level entrants: the method used to classify the subjects studied was that used by Rolfe *et al.* (1995a). In New South Wales during the final two years of secondary school, students select a range of subjects for completion before graduation. Subjects are organized into ''units'', with 12 ''units'' needing to be completed before graduation can occur. One ''unit'' of study is analogous to 40–50-minute lessons per week. Therefore, the more ''units'' a student selects for study in a particular subject area (e.g. English), the greater is the time devoted to being taught that subject in the school week. In the context of this study, to be classified as having a ''predominantly science'' background, secondary level entrants were required to have completed three or more units of science (e.g. biology, chemistry) and no more than two units of humanities (e.g. English, art, music, history) in their final two years of secondary schooling. Those with a ''predominantly humanities'' background, therefore, required a student to have completed at least three units of humanities subjects, but no more than

two units of science in his/her final year of school. If students studied three or more units of science *and* three or more units of humanities subjects they were classified as having "equal proportions of science and humanities".

- Degree undertaken by tertiary level entrants: students entering medical school after having completed at least one year of a tertiary degree were classified according to the degree they studied. An "arts" classification was assigned to participants who had completed at least one year of a degree in the humanities area, which included degrees in commerce, economics, education, history, and English. Those participants who had completed at least one year of a degree in the areas of biology, chemistry, engineering, computer science, etc. were classified as "science". "Allied health" was assigned to students who had completed at least one year of a degree in the allied health fields of physiotherapy, pharmacy, occupational therapy, medical science, etc. The discipline of psychology was the most difficult subject to categorize because it bridges qualitative and quantitative sciences and has a strong humanities tradition as well. For the purposes of this analysis it was included in the allied health category. Finally, due to the relatively high number of students who had previously undertaken a nursing degree, "nursing" was included as a separate category.

Statistical Analysis

Data in the following areas were analyzed using the Statistical Package for the Social Sciences, Version 6.1 for Windows (SPSSx, 1990).

Outcome Measure. Previous research has suggested that intern competence falls into two theoretical dimensions: "clinical competence" and "personal characteristics". We carried out factor analysis to confirm this binary structure. Our analysis identified a unifactorial model with a single factor solution that accounted for 72% of the variance among ratings. Further, research has indicated that using an intern's rating from a series of different attachments gives a more powerful predictor of overall performance. However, the full complement of five term appraisals for each intern is difficult to obtain because of circumstances such as maternity and other forms of approved leave. Given the above, all analyses were performed using data from doctors who were evaluated three or more times (multiple ratings) during the intern year. Mean annual ratings were subsequently calculated for interns with multiple ratings, by averaging the scores for the 13 competencies.

Representativeness of Study Population. Subjects with fewer than three intern ratings and/or missing data with respect to previous educational experience were excluded from the study population. Frequency distributions of all variables were calculated to assess whether assigned categories had sufficient numbers for data analysis. Subsequently, demographic characteristics of the study population were compared to non-participants. One-way between-subjects analysis of

variance (ANOVA) examined the difference in mean age and continuity-corrected chi-square analysis examined the differences in gender.

Performance Ratings and Level of Previous Educational Experience, Subjects Studied by Secondary Level Entrants and Degree Undertaken by Tertiary Level Entrants. Three separate one-way between-subjects ANOVAs compared the mean performance ratings of interns according to: secondary or tertiary level experience, secondary level study in science or science and humanities combined; and tertiary level study in arts, science, allied health or nursing. The same three analyses were also performed with age and gender as covariates (Analysis of Covariance—ANCOVA) to assess the effects of the two sociodemographic variables on outcomes.

Results

Representativeness of the Study Population

There were 235 graduates from the University of Newcastle medical course who undertook internship in the state of New South Wales in 1993–1996 inclusive. The records of 59 were excluded from data analyses as they had fewer than three intern ratings and/or incomplete information on previous educational experience. Frequency distributions of variables indicated that all assigned categories had sufficient numbers for data analyses (at least 10 subjects in each), with the exception of one classification in the variable relating to subjects studied by secondary level entrants. Only three entrants were classified as having ''predominantly humanities'' subjects and were also excluded from all analyses. Therefore, the records of 173 interns (73% of the eligible study population) were used in the study. The study sample was 65% female and had a mean age of 27.5 years (range 23–44 years). There were no significant differences in the age or gender of the study population and non-participants.

Performance Ratings and Level of Previous Educational Experience, Subjects Studied by Secondary Level Entrants and Degree Undertaken by Tertiary Level Entrants

Table 2 displays the mean intern ratings and 95% confidence intervals according to the three analyses performed. The results indicate that there is no significant difference between the mean ratings of interns with respect to previous educational background (secondary or tertiary level), subjects studied at secondary school (predominantly science or equal proportions of humanities and science) or degree undertaken (arts or science or allied health or nursing). ANCOVA revealed no significant differences in the performance ratings of interns in the three analyses. Age and gender did not significantly adjust the intern performance ratings.

Table 2. Mean intern performance ratings and 95% confidence intervals according to previous educational background, subjects and degree studied

	N	Mean	95% CI	*p*
Educational background				
Secondary level entry	110	5.27	5.18 : 5.36	0.4586
Tertiary level entry	63	5.22	5.11 : 5.32	
Subjects studied at secondary level				
Predominantly science	22	5.36	5.14 : 5.57	0.2937
Equal proportions of humanities and science	88	5.23	5.13 : 5.34	
Previous tertiary degree				
Arts	11	5.24	4.95 : 5.53	0.1619
Science	29	5.20	5.02 : 5.38	
Allied health	12	5.46	5.22 : 5.69	
Nursing	11	4.99	4.54 : 5.43	

Discussion

There are limitations to educational research conducted on intern performance. While researchers have used a variety of strategies to evaluate trainee competencies, including simulated clinical encounters, direct observation and chart auditing, each strategy has its own set of limitations and many are resource intensive (Norcini *et al*., 1987). The use of supervisor rating scales to assess intern performance has advantages in terms of time and cost. The rating scale used in this study has been shown to be valid and reliable. Moreover, recent research has shown that this rating scale discriminates between intern groups with different educational and demographic backgrounds (Barnsley *et al*., 1994; Rolfe *et al*., 1995b). However, supervisor rating scales have been criticized for their insensitivity in distinguishing between different dimensions of performance—a phenomenon called the ''halo effect''. While using a mean annual rating calculated from multiple supervisors mitigates the ''halo effect'' associated with global ratings, it does not eliminate it altogether (Rolfe *et al*., 1995b).

The size of our data set in this study was necessarily limited because the supervisor rating scale used as the outcome measure was modified in 1992. Our sample was, therefore, restricted to ratings obtained from Newcastle graduates who were interns between 1993 to 1996 inclusive. We did, however, achieve a 73% response rate and the study population did not differ from those excluded from the study with respect to age or gender.

There may be several possible explanations as to why no significant differences were found between pre-medical school characteristics and intern performance. One reason is what might be called a ''survivor effect''. Variation in performance of interns is limited by the rigorous medical school admission criteria and then by evaluation mechanisms that are in place during

undergraduate medical training. Simply stated, by the time interns in this study completed medical school, the range of scores that they provide will have been restricted to the upper portion of a "performance" distribution. Recent research has also indicated that Newcastle graduates perform well during internship, thus further restricting the range of scores on the outcome measure in this study (Rolfe *et al*., 1995b, 1996). If these factors do, in some way, influence performance they may attenuate by the time of graduation. Indeed, they may be more readily identifiable earlier in the medical training process. Future research assessing our three study aims using outcome variables that reflect performance within medical school will address this issue. A negative study also raises the possibility of a type II error. In the analysis that compared secondary entrants with those who entered with at least one year of tertiary study, we were able to detect differences of 0.35 of a point on the 7-point Likert scale. We had less power, however, for the analyses relating to subjects studied at secondary level and type of tertiary degree undertaken—having only sufficient power to detect differences of 0.65 and 0.95, respectively. Although the issue of what constitutes a clinically important difference between groups is difficult, it is fair to assume that supervisors could discriminate a difference in performance of 1 point on a 7-point scale.

This study could be strengthened in several ways. Accumulating additional data prospectively may increase the power of the study and enable the inclusion of those who had a predominantly humanities background. In addition, future research on data of this kind should examine the relationship between measures of "within" medical school performance and pre-medical school educational emphasis. Closer inspection of performance in the first two years of medical school, for example, where one might anticipate a larger range of scores, would be especially useful. Finally, future research could usefully evaluate the potential impact of other sociodemographic variables on intern performance.

Conclusion

Despite the potential problems with our study, we can draw some useful conclusions from our results. Our study showed that there were no significant differences in the intern performance ratings between those who entered medical school directly from secondary school or those who came from university programs. There were also no differences found between those who entered medical school with different subject or degree profiles. Similarly age and gender did not influence the results despite literature which suggests intern performance on some competencies varies according to these characteristics (Rolfe *et al*., 1995b; Day *et al*., 1980). The lack of a relationship between these admission variables, perhaps intuitively thought to be predictive of better residency performance, is interesting. At the very least our study gives added

credence to the longstanding criticism directed at medical school admissions criteria that historically have given preference to students with strong science backgrounds, or that have given added weight to the science grade point average or MCAT science scores. Further, while graduate entry programs may be worthwhile, they may not necessarily be able to be justified on the assumption that ''mature-age entrants make better doctors''. In the current climate of rapid educational change our results may prove useful to medical schools involved with accelerated joint degree (BA–MD) programs, as well as those who are considering changes in their admission policies.

In a recent article on the origins of the science versus liberal arts debate, historian and physician Gert Brieger outlines this debate's long historical roots and makes a compelling case that it represents a false dichotomy (Brieger, 1999a,b). At its best, medicine has always sought to integrate the sciences and the humanities in the care of patients. The challenge to medical educators to nurture the development of a learned physician requires nothing less.

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References

BANDARANAYAKA, R. (1994). Doctors in training. *Medical Journal of Australia*, *160*, 391–392.

BARNSLEY, L., CAMERON, R., ENGEL, C.E., FELETTI, G.I., HAZELL, P., MCPHERSON, J., MURPHY, L.B., PEARSON, S-A., POWIS, D.A., ROLFE, I., SMITH, A.J., SAUNDERS, N.A. & WALLIS, B.J. (1994). Ratings of performance of graduates from traditional and nontraditional medical schools. *Teaching and Learning in Medicine*, *6*, 179–184.

BRIEGER, G.H. (1999a). The plight of premedical education: myths and misperceptions—Part 1: the ''premedical syndrome''. *Academic Medicine*, *24*, 41–44.

BRIEGER, G.H. (1999b). The plight of premedical education: myths and misperceptions—Part 2: science ''versus'' the Liberal Arts. *Academic Medicine*, *74*, 1217–1221.

DAY, S.D., NORCINI, J., SHEA, J. & BENSON, J.A. (1980). Gender differences in the clinical competence of residents in internal medicine. *Journal of General Inernal Medicine*, *4*, 309–312.

DICKMAN, R., SARNACKI, R., SCHIMPFHAUSER, F. & KATZ, L. (1980). Medical students from natural science and nonscience undergraduate backgrounds. Similar academic performance and residency selection. *Journal of the American Medical Association*, *243*, 2506–2509.

GEFFEN, L. (1991). The case of graduate schools of medicine in Australia. *Medical Journal of Australia*, *155*, 737–740.

HARTH, S., BIGGS, J. & THONG, Y. (1990). Mature-age entrants to medical school: a controlled study of sociodemographic characteristics, career choice and job satisfaction. *Medical Education*, *2*, 488–498.

MCPHERSON, J., ENGEL, C., SAUNDERS, N. & FELETTI, G. (1986). Development of an instrument for evaluation of intern behavior and performance. *Evaluation Newsletter*, *10*, 5–26.

NEAME, R., POWIS, D. & BRISTOW, T. (1992). Should medical students be selected only from recent school-leavers who have studied science? *Medical Education*, *26*, 433–440.

NORCINI, J., WEBSTER, G., GROSSO, L., BLANK, L. & BENSON, J. (1987). Rating of residents' clinical competence and performance on certificate examination. *Journal of Medical Education*, *62*, 457–462.

PEARSON, S., ROLFE, I. & HENRY, R. (1998). The relationship between assessment measures at Newcastle medical school (Australia) and performance ratings during internship. *Medical Education*, *32*, 40–45.

ROLFE, I., PEARSON, S., POWIS, D. & SMITH, A. (1995a). Time for a review of admission to medical school? *The Lancet*, *346*, 1329–1333.

ROLFE, I.E., ANDREN, J.A., PEARSON, S., HENSLEY, M. & GORDON, J. (1995B). Clinical competence of interns. *Medical Education*, *29*, 225–230.

ROLFE, I., PEARSON, S. & BARNSLEY, L. (1996). Attitudes of doctors toward community medicine: differences between graduates from innovative and traditional medical schools. *Teaching and Learning in Medicine*, *8*, 77–82.

SPSSx (1990). *Statistical package for the social sciences (computer program)*. Chicago: SPSS Inc.

WOODWARD, C. & MCAULEY, R. (1983). can the academic background of medical graduates be detected during internship. *Canadian Medical Association Journal*, *129*, 567–569.