

Predicting medical students' rural practice intentions using data from the Medical Schools' Outcome Database

Michael Jones¹, John Humphreys², David Prideaux³

¹Psychology Department, Macquarie University, ²School of Rural Health, Monash University, ³School of Medicine, Flinders University

Abstract

Objective

Assess the feasibility of developing a predictive model for medical students' intention to take up rural practice after graduation based on characteristics of the individual and their circumstances on entry to the program.

Methods

Medical school entry survey data were obtained from the Medical Schools Outcome Database (MSOD) project implemented in every Australian and New Zealand medical school and co-ordinated through Medical Deans Australia and New Zealand. The medical school commencement survey asks about the students' educational and family background, including rural upbringing, present personal circumstances, scholarships and related information, and their practice intentions in terms of location and speciality. Logistic regression modelling was used to develop a predictive model of rural practice intention.

Results

The model findings confirm and extend previous research examining the association of medical student characteristics with intention to take up rural medical practice. The statistically significant independent factors in the model covered the broad areas of student's rural background, financial arrangements, both personal and around their studies, and intentions regarding specialist versus generalist practice upon graduation. Model performance was good with an area under the receiver-operator characteristics curve of 0.86.

Conclusions

Early results from MSOD suggest that it may be possible to identify students entering medical schools who are likely to enter rural practice and therefore target resources at encouraging those individuals in a rural medical career path. Importantly too the model can provide a means for optimising the use of scarce resources available to medical programs, thereby assisting to improve the supply of rural medical practitioners.

Introduction

Australia has an acute shortage of rural and regional medical practitioners.¹⁻⁴ This problem has been a significant social and political issue for several decades in Australia⁵⁻⁷ and in other western countries, such as the USA.⁸ Considerable research has been undertaken on the recruitment and retention of rural general practitioners^{9,10}, with less work undertaken around allied health professionals.¹¹⁻¹³ However, despite more than thirty years of such research¹⁴ and many millions of dollars of government

expenditure¹⁵, the problem of how to attract and retain health care professionals outside urban areas persists.¹⁶ Over the past decade, the Australian government has invested in several expensive national schemes designed to encourage medical student exposure to rural medical practice during medical school programs in Australia¹⁷, including the Rural Undergraduate Support and Co-ordination (RUSC), University Departments of Rural Health (UDRH) and Rural Clinical Schools (RCS) programs.

Most recent research evaluating the value of these programs has been based on small case-studies or one-off research projects.^{17,18,19} While these studies have yielded valuable insights into factors associated with the recruitment and retention of rural medical and allied health practitioners single point-in-time studies have inherent limitations. In 2005 the Medical Deans Australia and New Zealand (MDANZ), formerly the Committee of Deans of Australian Medical schools, established the Medical Schools Outcomes Database (MSOD) with funding from the Federal government. Details of the background to the MSOD project can be found elsewhere²⁰ but briefly, MSOD collects information on entry to medical school with a questionnaire covering medical students' family background, education and upbringing, present circumstances, medical school and career intentions. Further data are collected from each medical school during the course of training, with an exit questionnaire at the end of their university training collecting more information on their experiences and where students have applied for internship in their first year after graduation from medical school. Every medical school in Australia and New Zealand from 2006 onwards participates in this project, so that it represents a unique sample frame from which to supply evidence-based input into policy decisions. To date the overall response rate for the entry questionnaire on which this paper is based exceeds 90%. The information collected provides important input to medical workforce planning and is designed to link with National Health Workforce Taskforce (NHWT) NHWT data to allow long-term follow-up of medical graduates.

This paper investigates the scope for gaining early insight into the likelihood of medical students taking up rural practice after graduation. Evidence obtained may inform the optimal use of resources relating to current expensive rural placement schemes, and help to inform medical schools in the planning of their rural medicine curricula and exposure activities. This unique Australian study parallels a similar one undertaken by Rabinowitz et al²¹ who calculated a crude index of rural practice intention based on adding up individual 'factors' positively associated with rural practice.

Methods

The present study utilises the entry questionnaire from the first three annual cohorts of incoming medical student questionnaires from all medical schools in Australia and New Zealand for a total of n=1,442 students. Completed questionnaires were sent to the secretariat of Medical Deans ANZ for data entry and cleaning. Each medical school was funded to implement the questionnaire dissemination and collection.

Since the aim of the study was to determine the extent to which rural practice intention could be predicted from information about individuals at the time of their entry into medical schools, unconditional logistic regression was used with probability of rural practice intention as the outcome and both numeric and qualitative individual characteristics as predictors.

Results

Sample characteristics

A total of n=4,112 students were eligible for inclusion in this study. The sample was 55% (n=2,296) female and averaged 20 (SD=5) years of age. While the majority commenced medical studies shortly after high school, 6% were 30 years of age or older suggesting they had another career choice before taking up study in graduate medical schools.

Predictive model and its performance

Figure 1 Graphical depiction of predictive model based on the training sample

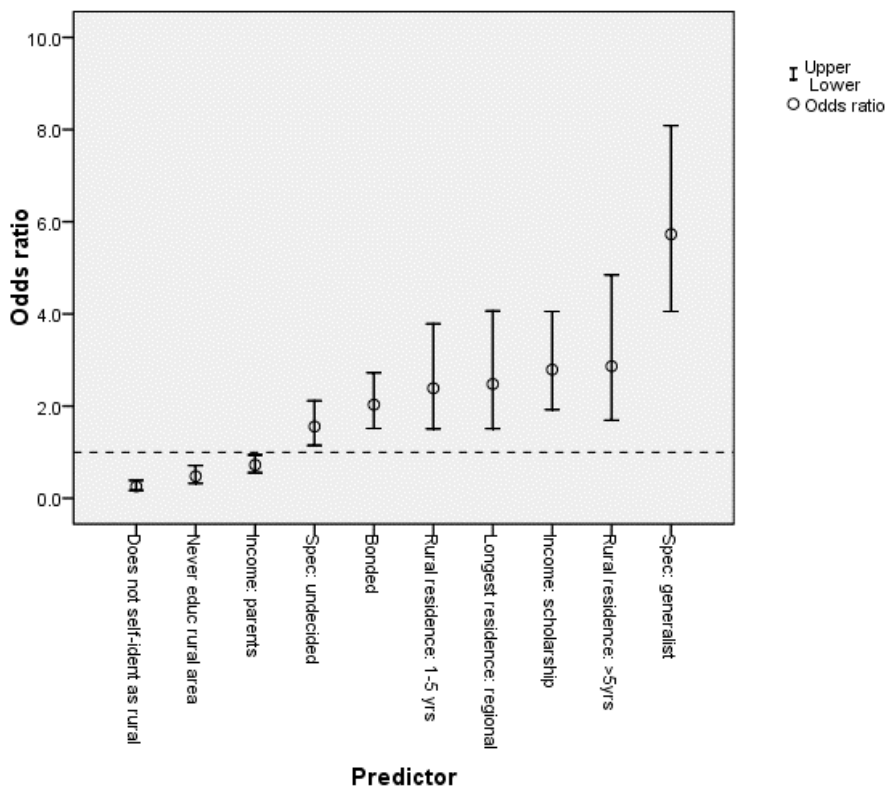


Figure 1 provides a graphical representation of the predictive model developed using the training sample, sorted from most negative to most positive effects. On the vertical axis is the odds ratio which is a measure of the effect that a given predictor has on the probability of rural practice intention. Odds ratios below 1.0 indicate negative effect (i.e. reduced probability) while odds ratios above 1.0 indicate a positive effect (i.e. higher probability). All factors listed on the horizontal axis of Figure 1 have statistically significant and independent effects on the probability of intending to practice in rural areas. The negative factors are “being supported by parents” and “not having previous rural exposure” or “not self-identifying as a rural person”. The positive factors appear to be around “previous exposure to rural life”, either “being undecided about specialty” or “having decided to be a generalist”, and “being on a scholarship” or “being bonded”. In case the model was overly influenced by bonded students it was refitted excluding such students but remains essentially unchanged.

The model has significant discriminatory power with an area under the ROC curve of 0.86 (95% confidence interval 0.84, 0.88).

Discussion

The model incorporates a number of statistically independent predictors of rural intention that centre around the students' rural backgrounds, financial arrangements around their studies and intentions regarding specialist versus generalist practice upon graduation. The strongest predictors of rural practice intention were generalist intentions, length of rural residence and holding a scholarship (but not a bonded arrangement). While the finding of rural background (living and/or education) being a positive predictor of rural intention confirms a body of previous research^{18,21,22}, this paper also adds intentions toward generalist practice and financially supported studies and that intentions towards specialist practice or being supported by parents were negative indicators for rural practice intention.

The value of identifying sentinel indicators of likely behaviour based on the significance of their contribution should not be underestimated. Too often, small-scale medical education studies are duplicated without sufficient robustness to be able to extrapolate more broadly to the population. Because of the scope, robustness and quality of the MSOD data, this particular study overcomes that deficiency and its findings provide a sound base for undertaking more sophisticated research in which the many variables impacting on behaviour can be controlled.

The work reported here also refines the approach taken by Rabinowitz et al.²¹ In that work the authors constructed a simple index of likelihood to enter rural medical practice based on summing the number of predictor variable conditions present within any individual. This is effectively equivalent to an unweighted version of the index derived in this work. The advantage of the weighted index proposed here is that it optimises the index score specifically in relation to rural practice intentions. A potential drawback of such optimisation is over-optimism in index performance. The split-sample validation reported for our data suggests however that this potential is not realised.

As indicated above, one weakness of this study is the use of intention to take-up rural practice rather than actual behaviour as the outcome variable. Until these data become available however, this is the best available surrogate. This limitation can be overcome in the future, since the longitudinal nature of the MSOD project will enable us to monitor the relationship between early stated intentions, medical educational experiences, and actual behaviour.

References

1. Strong, K., Trickett, P., Titulaer, I., & Bhatia, K. (1998). Health in rural and remote Australia: The first report of the Australian Institute of Health and Welfare on rural health (AIHW).
2. Wilkinson D. Selected demographic, social and work characteristics of the Australian general medical practitioner workforce: Comparing capital cities with regional areas. *Aus J Rural Health*. 2000;8:327-34
3. Humphreys J, Jones M, Jones A, Mara P. Workforce retention in rural and remote Australia: determining the factors that influence length of practice. *MJA*. 2002; 176: 472-476
4. London M. Rural health care in New Zealand: Poised for renaissance? *Aus J Rural Health*. 2002; 10:117-124
5. Margolis SA. Retaining rural medical practitioners: Time for a new paradigm? *Rural Rem Health*. 2005;393:1-3
6. National Rural Health Alliance. Healthy regions, healthy people. National Rural Health Alliance. 2006.
7. Sidoti C. Rural health: A human right. *Aus J Rural Health*. 1999;7:202-5.
8. Rabinowitz H and Paynter N. The rural vs urban practice decision. *JAMA*. 2002; 287(1): 113
9. Alexander C. Why doctors would stay in rural practice in the New England Health Area of New South Wales. *Aus J Rural Health*. 1998;6:136-9
10. Hays R, Wynd S, Veitch C, Crossland L. Getting the balance right? GPs who chose to stay in rural practice. *Aus J Rural Health*. 2003;11:193-8

11. Lee S, Mackenzie L. Starting out in rural New South Wales: The experiences of new graduate occupational therapists. *Aus J Rural Health*. 2003;11:36-43
12. Lindeke LL, Jukkala A, Tanner M. Perceived barriers to nurse practitioner practice in rural settings. *J Rural Health*. 2005;21(2):178-81
13. Stratton, TD Dunkin JW, Szigeti E, & Muus KJ. Recruitment barriers in rural community hospitals: A comparison of nursing and nonnursing factors. *Appl Nurs Res*. 1998;11(4):183-9
14. Kegl-Flom, 1977
15. Holub L, Williams B. The General Practice Rural Incentives Program, development and implementation: Progress to date. *Aus J Rural Health*. 1996;4:117-27
16. Australian Medical Workforce Advisory Committee. The medical workforce in rural and remote Australia. 1996.8
17. Laven G, Wilkinson D, Beilby J and McElroy H. Empiric validation of the rural Australian medical undergraduate scholarship 'rural background' criterion. *Aust J Rural Health*. 2005; 13: 137-141
18. Wilkinson D, Laven G, Pratt N and Beilby J. Impact of undergraduate and postgraduate rural training, and medical school entry criterion on rural practice among Australian general practitioners: national study of 2414 doctors. *Medical Education*. 2003; 37:809-814
19. Ranmuthugala G, Humphreys J, Solarsh B, Walters L, Worley P, Wakerman J, Dunbar J and Solarsh G. Where is the evidence that rural exposure increases uptake of rural medical practice. *Aust J Rural Health*. 2007; 15: 285-288
20. Humphreys J, Prideaux D, Kaur B, Brown D, Craig P, Coats A, Beilby J, Glasgow N, Searle J, Jones M and Solomon M. 'From medical school to medical practice'—The development of a national tracking system for medical workforce planning in Australia. Submitted to *Medical Journal of Australia*
21. Rabinowitz H, Diamond J, Veloski J and Gayle J. The impact of multiple predictors on generalist physicians' care of underserved populations. *Am J Pub Health*. 2000; 90(8): 1225-1228
22. Rabinowitz H, Diamond J, Markham F and Paynter N. Critical factors for designing programs to increase the supply and retention of rural primary care physicians. *JAMA*. 2001; 286(9): 1041-1048

Presenter

Michael Jones is currently Head of the Psychology Department at Macquarie University in Sydney. Mike has a background in rural medical workforce research in collaboration with one of his co-authors, Prof John Humphreys of Monash University.