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A SURVEY STUDY OF TRENDS IN ADULT NEPHROLOGY ADVANCED TRAINING IN AUSTRALIA AND NEW ZEALAND

Trends in Nephrology Advanced Training

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ABSTRACT

Background: There has been considerable growth in nephrology advanced trainee numbers in Australia and New Zealand, with uncertain effects on clinical experience, competence and employment outcomes.

Aim: To review the perceived adequacy and temporal trends of advanced training in nephrology in Australia and New Zealand by evaluating training experiences, personal

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views on important aspects of training and nephrology, career paths and early employment outcomes.

Methods: An online survey was distributed to members of the Australian and New Zealand Society of Nephrology via email in December 2020. Responses were sought from current trainees and from nephrologists qualifying since 2014. Likert scale proportions were calculated and group comparisons made using the Chi-square test.

Results: A total of 88 participants returned the survey yielding a response rate of 32%, with a representative sample of trainees and consultants from across Australia and New Zealand. Training was reported as adequate in most aspects of clinical nephrology, although 88% of respondents felt poorly prepared for entering private practice and 61% reported inadequate training in kidney histopathology. Exposure to clinical procedures was variable, with adequate training in percutaneous kidney biopsy but mostly inadequate training in dialysis access insertion. Sixty-nine percent of nephrologists completed their advanced training entirely in large urban centres and 85% worked in an urban area after training. Only 23% of consultants were engaged in full-time clinical employment in their first year post-training and 78% were undertaking at least one of dual specialty training or a higher degree by research. Demand for subspecialty fellowships was high.

Conclusion: Trainees and nephrologists in Australia and New Zealand are currently satisfied with their training in most aspects of nephrology, however some clinical experiences are perceived as inadequate and early career paths after advanced training are increasingly diverse.

INTRODUCTION

The nephrology workforce in Australia and New Zealand (ANZ) has changed in recent decades with considerable growth in the numbers of trainees and nephrologists in response to past shortages.¹ The rapid increase has uncertain effects on clinical experience, competence and employment outcomes.^{1,2} Several reports have raised concerns about increasingly diluted practical exposure throughout training, observing that over the past two decades basic procedural experience and the number of patients encountered per trainee have declined.^{2,3} Competition for consultant

nephrologist positions in ANZ also appears to be intensifying although employment prospects following completion of training have not been recently examined.³

A consummate advanced training program should provide broad exposure to all aspects of nephrology and equip trainees with a level of competence permitting safe and independent clinical practice, accompanied by reasonable assurances of future job security. We aimed to conduct a comprehensive survey of current and recently graduated adult nephrology trainees in ANZ to evaluate their training experience, values, personal views on important aspects of training and nephrology, career paths and early employment outcomes.

METHODS

We conducted a mixed open- and closed-ended survey through the SurveyMonkey (Portland, OR, USA) internet platform using standardised methodology.⁴ The survey was distributed by the Australian and New Zealand Society of Nephrology (ANZSN) to all active members by email in December 2020. Emails were distributed through ANZSN weekly newsletters and the survey remained open for 6 weeks. After the initial newsletter, reminder emails were delivered at 4 weeks, 2 weeks and 1 week prior to closure. Eligible participants included trainees currently completing the majority of their adult nephrology advanced training in ANZ and consultant nephrologists who have qualified since 2014 and completed the majority of their adult nephrology training in ANZ.

Respondents were directed to one of two online questionnaires relevant to either trainees or consultants. The advanced trainee questionnaire contained 22 questions and the consultant questionnaire contained 29 (Supporting File 1), differing in the inclusion of items covering post-training employment. The surveys comprised varying formats such as Likert scales, fixed yes-no options and free text boxes. Development of survey items was informed by the authors' professional experience and by published literature.¹⁻³ We assessed geographic location based on the Modified Monash Model classification⁵ for Australian respondents and the Statistical Standard for Geographic Areas for New Zealand respondents.⁶ Questionnaire functionality was

tested by the authors before launch using SurveyMonkey in the inactive demonstration mode.

Participation was voluntary and anonymous and approval to conduct the study was granted by the Metro South Human Research Ethics Committee (Metro South HREC/2020/QMS/65868). Data protection was guaranteed by storage of survey responses on a password-protected computer. Results were tabulated and analysed using Microsoft Excel (Redmond, WA, USA) and R (Vienna, AT). Data were summarised using mean, median, and Likert scale score proportions. Groups were compared using the Chi-square test, where P-values less than 0.05 were considered statistically significant. Responses from incomplete surveys were also considered for review. For questions with missing responses, the denominator listed in the results was the number of respondents to that particular question.

RESULTS

A total of 88 participants responded to the survey, of whom 57 (65%) had completed training and were consultant nephrologists. The estimated response rate was 32%.^{3,7,8} The majority of questionnaires were completed in full (92%).

Participant Characteristics

Participant characteristics are shown in 'Table 1'. The mean and median trainee ages were 32 years (standard deviation [SD] \pm 2.3 years) and 31 years (interquartile range [IQR] 30-34 years) respectively, and consultants' mean and median ages at the end of training were 33 years (SD \pm 1.8 years) and 32 years (IQR 31-36 years) respectively. There was a representation of respondents from across ANZ except Tasmania. Eighty-five percent of respondents were currently working in a metropolitan setting. Many participants migrated to different locations in the course of advanced training. Of Australian consultants, 23% stated that they travelled interstate during training, usually for the purpose of clinical experience. Eighteen percent of consultants across ANZ reported travelling overseas during training. Only 4% of consultants specializing since 2014 were purportedly forced to migrate interstate or overseas to fulfil kidney transplantation exposure requirements. Thirty-one percent of consultants rotated to a regional or rural area during advanced training, of whom 94% considered

it a valuable training experience. Only a third (34%) of respondents believed that a rotation to a regional or rural setting should be mandatory, including 32% of early-career nephrologists compared with 35% of current trainees ($P = 0.75$).

Training Adequacy and Experience

Results for the perceived adequacy of training in core nephrology subjects are shown in 'Figure 1'. Respondents reported adequate experience in most areas of nephrology. Regarding dialysis, for example, the majority of trainees and consultants felt well or very well trained with in-centre haemodialysis (94%) and peritoneal dialysis (78%), but less so in home haemodialysis (56%). Most also described adequate training in the management of acute kidney injury (98%), chronic kidney disease (94%), chronic kidney transplant care (93%), patients in the outpatient setting (91%), acute kidney transplantation (87%), hypertension (86%), glomerulonephritis (69%), and kidney supportive and palliative care (69%). On the other hand, most participants replied as inadequately or very inadequately trained in the evaluation of kidney transplant donors and recipients (56%), interpretation of kidney histopathology (61%), continuous renal replacement therapy (CRRT; 69%), and preparation for private practice management (88%).

Nephrologists and nephrology advanced trainees were the primary performers of percutaneous kidney biopsy in 85% of centres. Experience in kidney biopsy was rated as adequate by 90% of participants and most performed this skill frequently during advanced training: 84% performed greater than 20 biopsies per year. Kidney biopsy was considered an essential skill for nephrologists by 81% of trainees and 77% of consultants ($P = 0.68$). Non-tunnelled haemodialysis catheters (NDC) were primarily inserted by nephrology in 23% of centres, tunnelled haemodialysis catheters (TDC) in 15% of centres, and peritoneal dialysis (PD) catheters in 11% (Figure 2a). There were significant differences between urban and non-urban settings and between Australia and NZ (Figure 2b). Dialysis access procedures were performed more commonly by nephrologists in regional and rural than in metropolitan centres and more commonly in NZ than in Australia. NDC insertion was considered an essential skill by 63% of respondents (Figure 3), including 65% of current trainees and 62% of consultants ($P = 0.80$). However, only 47% of respondents felt adequately trained to perform NDC

insertion: 66% inserted fewer than 10 NDCs per year during advanced training and only 12% inserted greater than 20 per year.

The majority of those surveyed (93%) believed that exposure to acute kidney transplantation should be mandatory during advanced training, including 100% and 89% of trainees and early-career nephrologists respectively ($P = 0.19$). Our qualitative results indicated that few respondents considered transplant rotations too difficult to obtain. Approximately half (54%) of respondents felt that some exposure to interventional nephrology should be mandatory during advanced training, including 58% and 52% of trainees and consultants respectively ($P = 0.57$). Based on qualitative feedback on the discipline of interventional nephrology, recurring comments included the desire for greater independence and reduced overreliance on clinicians from other specialties, particularly with NDCs for acute dialysis, and the importance of establishing a standard experience and understanding of complications across all graduates.

Employment Outcomes

Employment outcomes in the first year following completion of adult nephrology training are presented in 'Figure 4'. Eighty-three percent of respondents desired work in a metropolitan setting after training while 17% preferred employment in a regional or rural area. Of those that spent some training time in a regional or rural area, 25% practiced in such a setting in their first year as a consultant compared with just 6% of those who had never rotated outside a metropolitan centre during training ($P = 0.04$). After training 96% of consultants obtained positions in their preferred location, with respect to a metropolitan versus non-metropolitan setting, however 26% had migrated interstate within their first 2 years post-training.

Practice mix preferences were heterogeneous and the preferred practice mix was procured by only 68% of consultants in their first year post-training. Most of those surveyed desired either full-time public clinical practice following advanced training (21%), part-time public practice combined with a higher degree by research (21%), or planned to progress to fellowship or other registrar roles (25%). Exclusively private practice was not desired by any survey participants. Some employment differences existed between genders. Female respondents comprised 75% of consultants entering part-time employment, 65% of those entering research roles, and 40% of

those moving on to fellowship or other registrar positions. Thirteen percent of female consultants were working in non-urban settings post-training compared with 17% of male consultants ($P = 0.61$).

There was evidence of underemployment after training with 35% of consultants wishing to have more hours of clinical work in their first year as a consultant than what they were actually able to secure. This finding was more common in urban (38%) than regional or rural areas (11%) ($P = 0.08$). Only 23% of nephrologists proceeded to undertake full-time clinical practice in their first year following advanced training, without additional specialisation or a higher degree by research (HDR). Thirty-six percent undertook HDR, usually for career advancement, including 41% of consultants employed in metropolitan centres compared with 11% of those in regional or rural areas ($P = 0.06$). Dual training in another medical specialty was pursued by 42% of participants, generally as a professional or personal preference, constituting 34% of consultants in metropolitan centres compared with 56% regionally ($P = 0.09$). The most frequent combinations were dual specialisation with general medicine (27%), intensive care medicine (5%), obstetric medicine (5%), and palliative care (3%).

Participants were asked whether they would prefer an advanced training program composed of the current model of 3 core years of training or the previous curriculum consisting of 2 core years and a 1-year elective rotation. Seventy-six percent stated that they prefer the current format of 3 core years of nephrology. Most participants (89%) wanted more subspecialty fellowships to be made available after advanced training. The main fellowships listed were transplantation (56%), glomerulonephritis (47%), and interventional nephrology (38%).

DISCUSSION

Our workforce survey aimed to identify the perceived adequacy and outcomes of the current nephrology training program in ANZ. Although the number of nephrologists and advanced trainees continues to rise, the majority remain satisfied with their knowledge and clinical training in most of the core components of nephrology. Deficiencies are perceived in some aspects of the curriculum, such as the kidney transplant evaluation and kidney pathology. Trainee exposure to procedural

nephrology is highly variable, with satisfactory training in performing kidney biopsy but mostly insufficient training in dialysis access insertion. Seventy-eight percent of consultants are seeking further post-fellowship development through HDR or dual training in another specialty outside nephrology. Less than a quarter of nephrologists in ANZ obtain full-time clinical consultant employment early in their careers and few appear to be entering private practice or practice in regional or rural areas.

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Approximately 20 years ago governing agencies recognised a shortfall of physicians across various specialties in ANZ, particularly in nephrology, prompting measures to increase numbers.¹ Shortage was attributable to the rising burden of CKD, increased part-time employment and flexible work arrangements, application of fatigue management and safe-working-hours policies, increasing sub-specialisation, and larger demand for research-oriented physician-scientists.² Jobs have also become increasingly associated with administrative responsibilities unrelated to education or clinical practice.¹⁵ Responsive steps included higher numbers of university students, international medical graduates and entrants to Royal Australasian College of Physicians (RACP) specialty programs.^{1-3,8,9} Consequently, there are now more advanced trainees and consultants in ANZ than ever before. Adult nephrologists increased by 27% over the past 5 years and nephrology trainees by 96% over 10 years, representing one of the fastest growth rates of all medical disciplines in Australia.^{7,9,10} This trajectory outpaces growth of the patient population and exceeds forecast demand.^{1,2,8}

We identified little evidence that the rising number of advanced trainees has diluted training adequacy in the fundamental areas of nephrology, with no major deterioration in satisfaction with training compared with reports spanning the past 2 decades.³ Competency in home dialysis therapies and kidney supportive care have actually improved significantly.⁶ Advanced training in ANZ now appears to provide superior perceived experience with home-based dialysis than in the United States,¹¹ although further improvement in home therapies training is still required. Although the relative proportion of training sites performing kidney transplantation has fallen, from a significant majority 20 years ago to 44% today, experience with acute and chronic transplant medicine seems adequate and comparable to past studies.^{2,3,12} These results may reflect the program change implemented by the RACP in 2014 to strengthen exposure specific to nephrology, in which it mandated 3 years of core

advanced training to replace the previous model of 2 years of core training plus a 1-year elective.³ The high perceived adequacy of kidney transplant experience is also preserved by ready access to transplant terms and the fact that they comprise a mandatory aspect of training in ANZ.

Several important knowledge areas are not well covered by the advanced training program. There is reportedly inadequate experience in interpretation of kidney histopathology, CRRT, and the pre-transplant evaluation. These specific shortcomings are in fact longstanding and have improved little in many years.³ In its current form it is unlikely that the program will see any change in this area. The training pathway does not ensure contact with pathology labs or transplant assessment clinics and there is no expectation for learning or understanding their content. While various extracurricular courses covering this material are available to trainees, they are largely voluntary and none are assessed by the RACP. Regarding CRRT, this treatment is predominately prescribed by critical care physicians in ANZ and most nephrology registrars do not undertake placements in intensive care units.

The performance of clinical procedures in nephrology is declining. Percutaneous kidney biopsy remains a standard competency that is done frequently, but most sites are not performing dialysis access interventions. Reduced experience has been particularly marked for temporary NDC placement. NDC insertion was still a typical procedure for nephrologists in ANZ only a decade ago but the number of catheters placed per year by trainees and consultants is now small and most feel poorly trained in this skill.³ Interest in procedural nephrology is mixed and nephrology departments are increasingly delegating access interventions to other providers such as the intensive care unit and interventional radiology, possibly because of superior facilities and expertise.³ A formal skills development program is lacking and rising trainee numbers offers fewer practical opportunities per trainee. The scope of nephrology is continually changing and structural reform will be necessary if interventions are to remain central to the specialty.

Nephrologists are increasingly seeking further skills and qualifications beyond completion of their RACP fellowship. There has been a particular rise in the number pursuing a Doctor of Philosophy (PhD) over the past 20 years.^{3,13} Our results also show that subspecialty fellowships, such as in transplantation, glomerular diseases or

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interventional nephrology, are highly desirable and demand for exposure to these fields is unmet. The move to post-specialisation training is ostensibly driven by diluted advanced training experience coupled with greater competition for consultant employment. To this effect several recommendations were endorsed in the Report of the Workforce Review Committee of the ANZSN in 2017.¹ Major recommendations included reduced nephrology trainee numbers, structured coursework and fellowship programs, and better organisation of advanced training rotations.

Early in their careers, nephrologists are predominantly working in metropolitan public hospitals. The nephrology workforce in ANZ is characterised by an oversupply of specialists in urban areas and an undersupply in regional and rural areas, with relatively low uptake of private practice.^{1,14} Few participants of our survey sought advanced training or consultant employment outside urban locations and none desired a full-time career in private practice. This is a complex issue and although there are clearly many lifestyle and financial reasons that guide work preferences, career choices are unlikely to change under the current system. Regional or rural areas encompass 28% of the ANZ population but are nonetheless serviced by only 10% of advanced training posts.^{11,15} Regarding private practice, new consultants are poorly prepared for it by their training, and registrar positions rarely incorporate the private sector. The complexity of nephrology patients may also dissuade nephrologists from private hospital settings because of less support from colleagues compared with larger public institutions.¹⁶

Increased trainee numbers may have worsened the competitiveness for consultant employment. Many nephrologists in ANZ are not achieving their desired type or volume of work in their first year of post-training employment and the proportion entering full-time clinical practice has declined over time, from 43% between 2002 and 2014 to less than a quarter in our study.³ Whether full-time practice pertains exclusively to nephrology or incorporates work in other disciplines is uncertain. Furthermore, a quarter of early-career nephrologists are relocating interstate after training. Only around half of nephrologists who obtain a higher degree remain active in research thereafter,³ suggesting that many complete HDR simply to secure employment, after which research is no longer prioritised. It is worth noting that 56% of clinicians in our study were female, which has steadily increased from 25% of the nephrology

workforce in 2007.¹³ The degree to which gender balance is implicated in changing practice patterns is unclear. Career paths and outcomes merit further study.

Many valuable insights into the trends and perceived adequacy of training can be gleaned from our study although there are limitations and caution should be observed before drawing firm conclusions. The data collected is subjective and vulnerable to recall bias. The survey's small sample size limits generalisability, while it is also subject to selection bias and participation bias by not representing views of those who did not participate.¹⁷⁻¹⁹ Full-time employment figures may have been distorted by excluding physicians with greater clinical workloads and hence less time to participate in our survey. The response rate of 32% is commensurate with other studies of this type albeit suboptimal, and although the questionnaire was limited to ANZSN members, 84% of nephrologists and trainees are subscribed members and therefore most are accounted for.¹ Our study participants corresponded with published figures with respect to age, gender, practice rurality and stage of training.²⁰ Although participants were broadly representative of the ANZ nephrology workforce, there was an overrepresentation from Queensland and an underrepresentation from Tasmania and Western Australia.²⁰

CONCLUSION

The advanced training program is fundamental to the development of experienced and proficient nephrologists. Its adequacy should be evaluated regularly such that the program can continue to evolve with the needs of the profession, providing trainees with sufficient clinical exposure and preparation for independent consultant practice. Most trainees and early-career nephrologists in ANZ are satisfied with their overall training experience. However, there is an increasing tendency towards post-fellowship training and pursuits outside clinical nephrology, with signs of underemployment. A coordinated approach to nephrology workforce planning is necessary with appropriate alignment of trainee numbers with available consultant positions.

REFERENCES

1. Workforce Review Committee of the Australian and New Zealand Society of Nephrology [internet]. Sydney: ANZSN; 2017. Report of the Workforce Review Committee of the ANZSN 2017; 2017 Feb [cited 2020 Dec 30]; [about 2 screens]. Available from: <https://www.nephrology.edu.au/workforce-report.asp>
2. Amos L, Toussaint N, Phoon R, Elias T, Levidiotis V, Campbell S, et al. Increase in nephrology advanced trainee numbers in Australia and associated reduction in clinical exposure over the past decade. *Intern Med J* 2012; 43(3): 287-93.
3. Beaton T, Krishnasamy R, Toussaint N, Phoon R, Gray N. Nephrology training in Australia and New Zealand: a survey of outcomes and adequacy. *Nephrology* 2017; 22: 35-42.
4. Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of internet surveys (CHERRIES). *J Med Internet Res* 2004; 6(3): e34.
5. Department of Health. Modified Monash Model. Canberra: Australian Government; 2019 June. 2p. Report No.: 1.
6. Stats NZ Tatauranga Aotearoa [internet]. Wellington: Stats NZ; 2017. Statistical standard for geographic areas 2018; 2017 Dec [cited 2020 Dec 30]; [about 2 screens]. Available from: <https://www.stats.govt.nz/methods/statistical-standard-for-geographic-areas-2018>
7. Health Workforce Australia. Health Workforce 2025; medical specialties. Adelaide: Health Workforce Australia; 2012. 229 p. No.: 3.
8. Member Services of the RACP. RACP member statistics and insights. Melbourne: Royal Australasian College of Physicians; 2020 January. 74p. Report No.: 1.
9. Medical Board of Australia [Internet]. Barton ACT: MBA; c2015-2020. Registration data; c2015-2020 [cited 2020 June 13]; [about 2 screens]. Available from: <https://www.medicalboard.gov.au/News/Statistics.aspx>
10. Playford D, May J, Ngo H, et al. Decline in new medical graduates registered as general practitioners. *Med J Aus* 2020; 212(9); 421-22.

11. Gupta N, Taber-Hight E, Miller B. Perceptions of home dialysis training and experience among US nephrology fellows. *Am J Kidney Dis* 2020; 77(5): 713-718.
12. Royal Australasian College of Physicians [internet]. Melbourne: RACP; 2020. Accredited sites for advanced training; 2020 Jun [cited 2021 Mar 24]; [about 3 screens]. Available from: https://www.racp.edu.au/docs/default-source/trainees/accredited-settings/at-nephrology-accredited-sites-aus-os.pdf?sfvrsn=4f440b1a_44
13. Lane C. The Australian Nephrology Workforce Survey 2007. Sydney. Australian and New Zealand Society of Nephrology; 2007. 95p. Report No.: 1.
14. Freed G, Turbitt E, Allen A. Public or private: where do specialists spend their time? *Aust Health Rev* 2017; 41(5): 541-45.
15. Australian Institute of Health and Welfare [internet]. Canberra ACT: AIHW; 2018. Australia's Health 2018; 2018 [cited 2021 Mar 25]; [about 4 screens]. Available from: <https://www.aihw.gov.au/getmedia/0c0bc98b-5e4d-4826-af7f-b300731fb447/aihw-aus-221-chapter-5-2.pdf.aspx#:~:text=Around%207%20million%20people%E2%80%94about,people%20living%20in%20major%20cities>
16. Tonelli M, Wiebe N, Manns B, et al. Comparison of the complexity of patients seen by different medical subspecialists in a universal health care system. *JAMA Network Open* 2018; 1(17): e184852.
17. Lane C, Healy C, Ho MT, et al. How to attract a nephrology trainee: quantitative questionnaire results. *Nephrology* 2008; 13: 116-23.
18. Williams S, Temple-Smith M, Chondros P, et al. Are we preparing Victorian general practice registrars to be confident in all aspects of primary care paediatrics? *AJGP* 2020; 49(11): 759-66.
19. Barrios R, Ibeas J, Tey R, et al. Diagnostic and interventional nephrology in Spain: a snapshot of current situation. *J Vasc Access* 2019; 20(2): 140-45.

20. Department of Health [Internet]. Canberra: Australian Government; 2017. Nephrology 2016 Factsheet; 2017 Oct [cited 2021 June 25]; [about 2 screens]. Available from: <https://hwd.health.gov.au/webapi/customer/documents/factsheets/2016/Nephrology.pdf>

APPENDIX

Supporting File 1: Example of survey template distributed to recently qualified nephrologists.

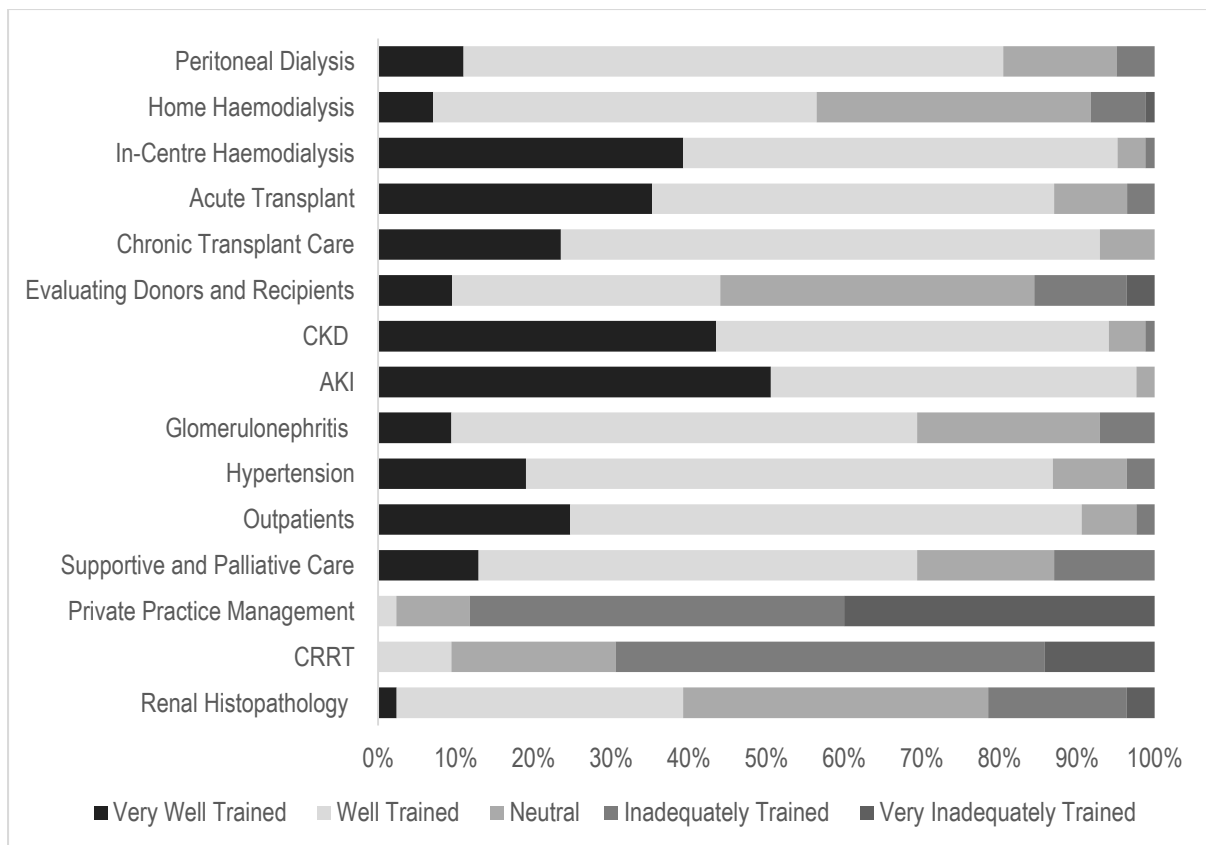
Table 1: Participant Characteristics. HDR – higher degree by research.

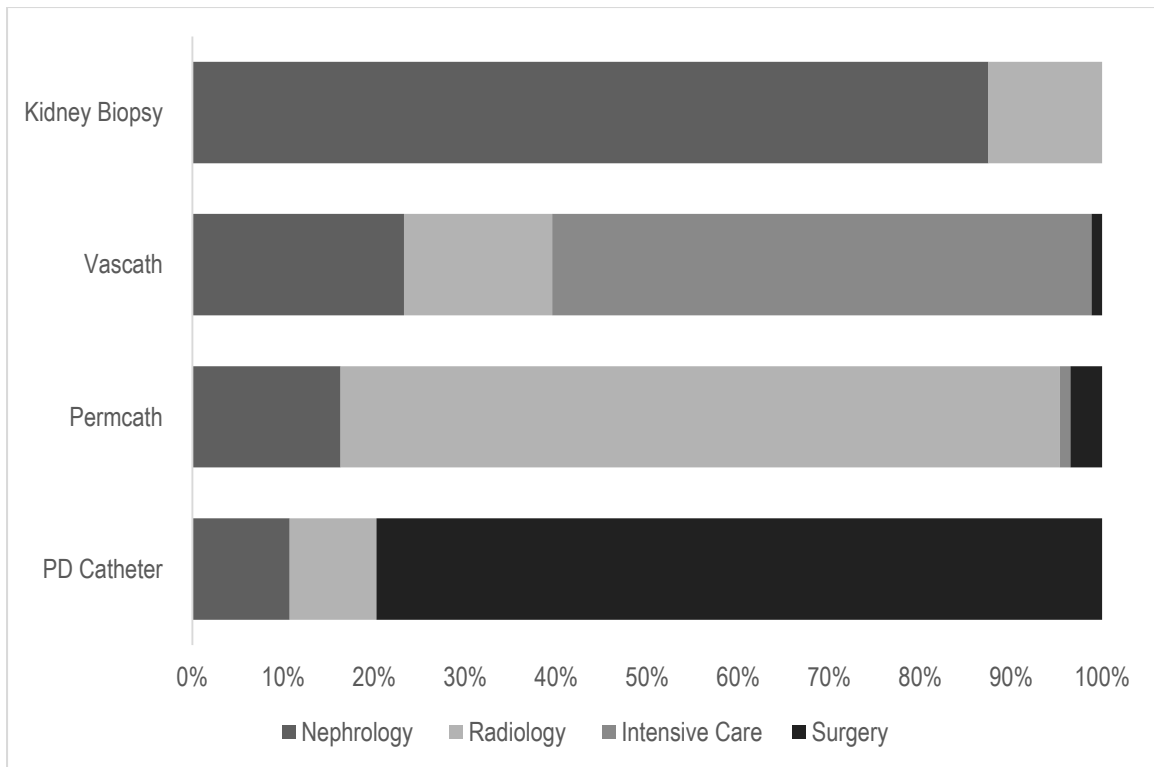
Figure 1: Adequacy of training for common subjects in nephrology. CKD – chronic kidney disease, AKI – acute kidney injury, CRRT – continuous renal replacement therapy.

Figure 2: Procedure practices across ANZ: (a) operators performing procedures at participants' current site of practice and (b) regional practice differences in nephrology as primary procedure providers. Vascath – non-tunnelled haemodialysis catheter, Permcath – tunnelled haemodialysis catheter, PD – peritoneal dialysis.

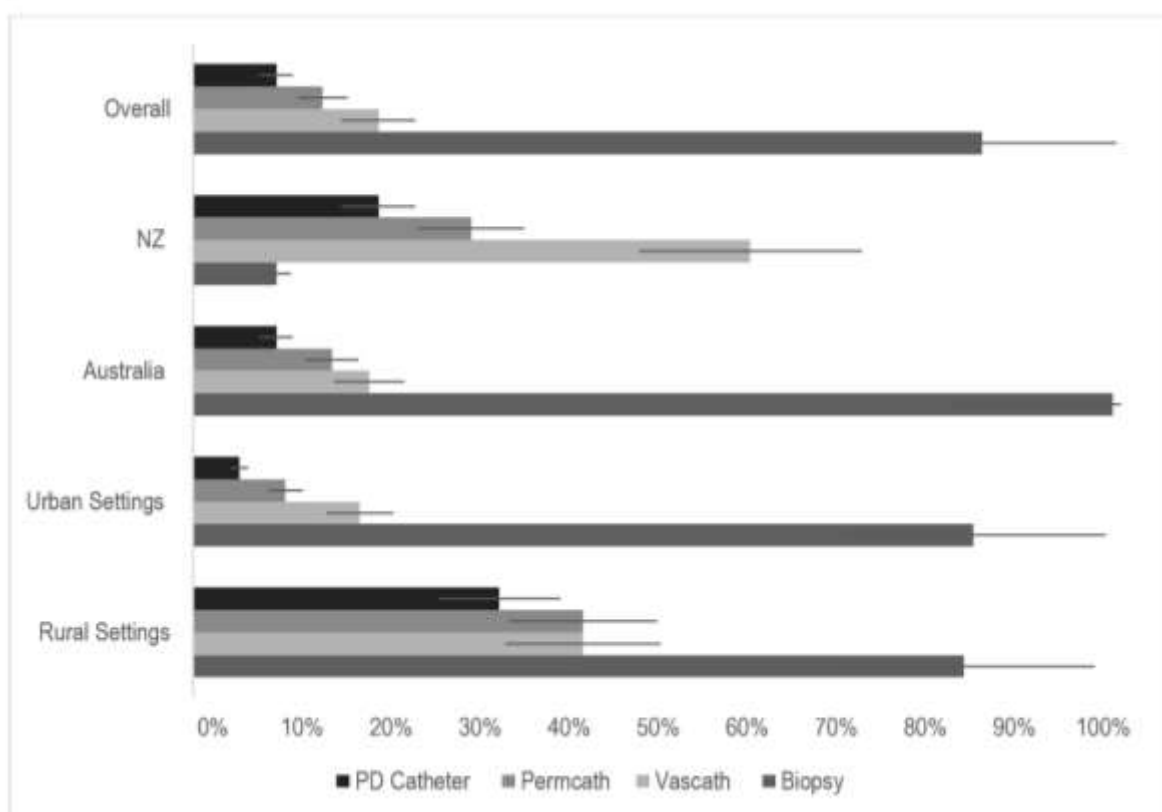
Figure 3: Reported essentialness to nephrologists of common skills and procedures in nephrology. Vascath – non-tunnelled haemodialysis catheter, Permcath – tunnelled haemodialysis catheter, PD – peritoneal dialysis.

Figure 4: Employment outcomes depicted through comparison of consultants' desired and actual clinical practice after advanced training. HDR – higher degree by research.

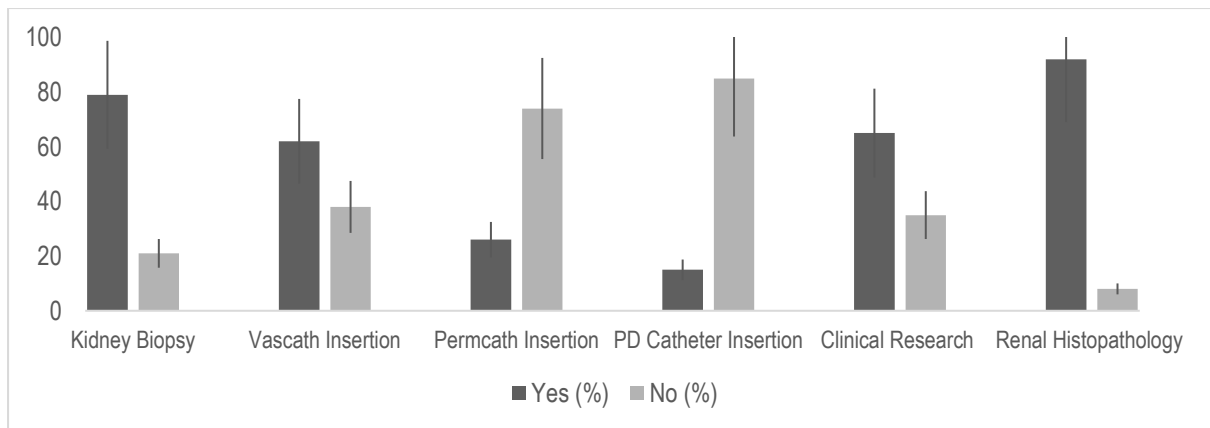


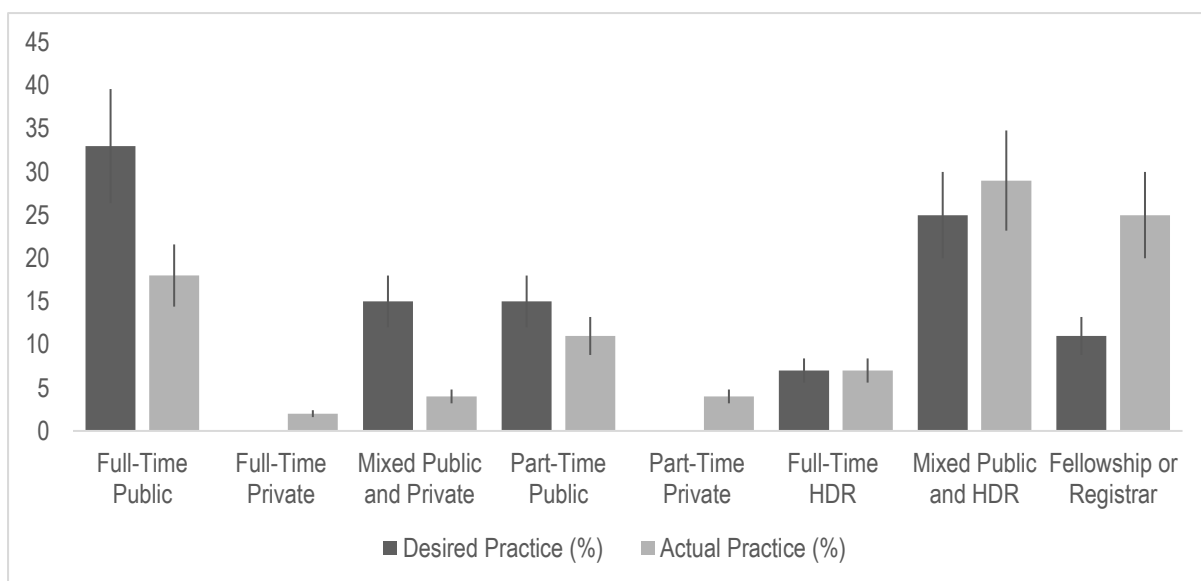


2a



2b





| Characteristic | Number (%) |
|--|------------|
| Australia | 71 (81%) |
| - Queensland | 23 (26%) |
| - New South Wales | 19 (23%) |
| - Victoria | 18 (20%) |
| - Western Australia | 4 (5%) |
| - South Australia | 3 (4%) |
| - Australian Capital Territory | 2 (3%) |
| - Northern Territory | 2 (3%) |
| New Zealand | 12 (14%) |
| Metropolitan setting | 71 (85%) |
| Regional or rural setting | 12 (15%) |
| Male gender | 36 (41%) |
| Female gender | 49 (56%) |
| Did not specify gender | 3 (3%) |
| Consultant | 57 (65%) |
| - Qualification year 2014-16 | 18 (32%) |
| - Qualification year 2017-19 | 39 (68%) |
| Advanced trainee | 31 (35%) |
| - Advanced training year 1 | 9 (29%) |
| - Advanced training year 2 | 11 (35%) |
| - Advanced training year 3 | 11 (35%) |
| Interstate relocation during advanced training | 11 (23%) |
| - For clinical experience | 8 (73%) |
| - To satisfy kidney transplant exposure requirements | 1 (9%) |
| - Personal lifestyle preference | 1 (9%) |
| International relocation during advanced training | 11 (18%) |
| - For clinical experience | 7 (60%) |
| - Personal lifestyle preference | 2 (20%) |
| - To satisfy kidney transplant exposure requirements | 1 (10%) |
| Undertaking HDR after advanced training | 21 (36%) |

| | |
|--|----------|
| - For career advancement | 13 (63%) |
| - Professional preference for research | 5 (26%) |
| - Personal lifestyle preference | 1 (5%) |
| Undertaking dual specialty training | 37 (42%) |
| - Professional or personal preference | 25 (68%) |
| - For career advancement | 11 (29%) |
| Desire nephrology subspecialty fellowships | 77 (89%) |
| - Kidney transplant | 43 (56%) |
| - Glomerulonephritis | 36 (47%) |
| - Interventional nephrology | 29 (38%) |
| - Home therapies | 20 (26%) |
| - Renal supportive and palliative care | 20 (26%) |
| - Obstetric medicine | 16 (21%) |
| - Critical care nephrology | 9 (12%) |
| - Genetics | 7 (9%) |
| - Uro-nephrology | 5 (6%) |
| - Immunology | 5 (6%) |