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ORIGINAL RESEARCH

# Referrals to dietitians/nutritionists: A cross-sectional analysis of Australian GP registrars' clinical practice

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## Abstract

**Aim:** The present study aimed to describe referral patterns of general practitioner (GP) registrars to dietitians/nutritionists. There is a paucity of research regarding GP referral patterns to dietitians/nutritionists. Limited data show increasing referrals from established GPs to dietitians/nutritionists. There are no data on GP registrar (trainee) referrals.

**Methods:** This was a cross-sectional analysis of data from the Registrar Clinical Encounters in Training (ReCEnT) study. ReCEnT is an ongoing, multicentre, prospective cohort study of registrars, which documents 60 consecutive consultations of each registrar in each of the three six-month GP training terms. The outcome factor in this analysis was a problem/diagnosis resulting in dietitian/nutritionist referral (2010–2015). Independent variables were related to registrar, patient, practice and consultation.

**Results:** A total of 1124 registrars contributed data from 145 708 consultations. Of 227 190 problems/diagnoses, 587 (0.26% (confidence interval: 0.23–0.29)) resulted in dietitian/nutritionist referral. The most common problems/diagnoses referred related to overweight/obesity (27.1%) and type 2 diabetes (21.1%). Of referrals to a dietitian/nutritionist, 60.8% were for a chronic disease, and 38.8% were related to a Chronic Disease Management plan. Dietitian/nutritionist referral was significantly associated with a number of independent variables reflecting continuity of care, patient complexity, chronic disease, health equity and registrar engagement.

**Conclusions:** Established patients with chronic disease and complex care needs are more likely than other patients to be referred by registrars to dietitians/nutritionists. Nutrition behaviours are a major risk factor in chronic disease, and we have found evidence for dietitian/nutritionist referrals representing one facet of engagement by registrars with patients' complex care needs.

**Key words:** chronic disease, education, general practice, medical graduate, nutritionist, referral.

## Introduction

Medical nutrition therapy is an important management tool for a number of acute and chronic conditions, and dietitians are trained specifically in the field of applying nutrition therapy to medical conditions. Much dietetic input into acute disease management is undertaken in secondary care, mainly hospitals, but dietetic involvement in chronic disease, especially lifestyle-related chronic disease, is dealt with predominantly in the primary care sector.[1]

Nutrition and diet are widely acknowledged to be major factors in the prevention and treatment of chronic disease.[2] The increasing prevalence of chronic diseases has been recognised by the World Health Organization (WHO) as a global health burden.[2] Chronic diseases are common in

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Australia and are the leading cause of illness, disability and death, accounting for 90% of deaths in 2011.[3]

A study of established general practitioners (GPs) in Australia found that approximately 40% of consultations included chronic disease management (CDM).[4] These GPs often encounter presentations of chronic disease where nutrition is a significant factor, with hypertension (8 per 100 consultations), diabetes (4 per 100 consultations) and lipid disorders (3 per 100 consultations) being among the most frequently managed conditions.[4] In addition to this, more than half of adult general practice patients are classed as overweight or obese.[5] As Australia's ageing population continues to grow, so too will the prevalence of chronic disease and the burden this places on health service provision.[6]

The GP consultation offers an opportunity to provide lifestyle modification advice and/or refer patients to allied health practitioners, such as dietitians, podiatrists, physiotherapists and exercise physiologists. Data from established GPs in Australia found that almost 10% of all non-pharmacological clinical treatments were related to counselling or advice for nutrition/weight and that this occurred in 3.8 per 100 consultations.[4] A review looking at the role of GPs and dietitians in patient nutrition management has identified a number of barriers to GPs providing nutrition education, including limited nutrition training, a lack of knowledge and skills, a lack of time, inadequate reimbursement and difficulty translating knowledge into practice.[7] A multidisciplinary approach to health care has been shown to be an effective approach to improving patient health outcomes[8] and is routinely recommended internationally.[9–13] Furthermore, advice from dietitians has been found to be more effective than advice from GPs in reducing blood cholesterol levels,[14] and the combined care of a GP and dietitian has been demonstrated to be more effective in addressing weight management and hypertension compared to individual GP or dietitian management.[15] Thus, patterns of GP referral to dietitians to provide specialist nutrition counselling and education is of considerable clinical significance.

There is very little research regarding the referral patterns to dietitians/nutritionists from GPs. Limited data show that the rate of referral from established GPs to dietitians/nutritionists has been increasing steadily over time,[16] coinciding with an increase in the private practice dietetics workforce.[17]

GP registrars (vocational trainees in general practice) are a group of particular interest with regard to dietetic referrals. They are entering practice and establishing future clinical behaviour at a time when the multidisciplinary team approach in general practice is becoming well-accepted. A study of Australian GP registrars found that, compared to their established GP colleagues, a considerably smaller proportion (30%) of consultations included a chronic disease.[18] However, there are no data on registrar dietetic referrals. The present study aimed to fill this evidence gap and describe the referral patterns of GP registrars to dietitians/nutritionists. The Registrar Clinical Encounters in Training (ReCEnT) study of GP registrars' clinical practice provides a means of addressing this issue.

## Methods

This was a cross-sectional analysis of data from the ReCEnT study. ReCEnT is an ongoing, multicentre, prospective cohort study of GP registrars in 5 of the 17 regional training providers (RTPs) that encompass the whole of Australia. Participating RTPs were located in five of the six Australian states. Registrars in general practice training posts operate within an apprenticeship-like model (with access to advice and assistance when needed from a senior GP supervisor) but with considerable autonomy, including the capacity to make referrals equivalent to their more experienced GP peers.

In ReCEnT, registrars document the nature and associations of their in-practice consultation-based clinical and educational experiences. The study protocol is described in detail elsewhere.[19] Briefly, registrar demographics and practice data are documented at the start of each data collection period (6-monthly for full-time registrars, 12-monthly for part-time registrars). At approximately the mid-point of each of a registrar's three six-month (full-time equivalent) general practice training terms, registrars complete paper-based forms recording details of 60 consecutive consultations. These details include the patient demographics and clinical aspects of each consultation.

The outcome factor in the present study was whether a problem/diagnosis resulted in referral to a dietitian/nutritionist. We defined referral to a dietitian or nutritionist as those referrals coded as International Classification of Primary Care, second edition classification system (ICPC-2 plus) codes D66 001 (Referral; dietitian/nutrition) and A66 016 (Referral; dietitian/nutritionist).

Independent variables related to registrar, practice, patient and consultation. Registrar variables were: age, gender, training term, whether in full-time or part-time (less than 32 hours per week) training, place of primary medical qualification (Australia or international) and whether the registrar had worked at the practice in a previous term. The RTP with which the registrar trained was also an independent variable.

Practice variables recorded were: size (small practice considered less than six doctors) and whether the practice routinely bulk bills (i.e. government subsidy is accepted as full payment, and there is no cost to the patient). Practice postcode was used to determine the Australian Standard Geographical Classification-Remoteness Area classification to define the practice locations' degree of rurality (very remote, remote, outer regional, inner regional or major city location)[20] and Socioeconomic Index for Area Index of Disadvantage.[21]

Patient variables recorded were: age, gender, Aboriginal or Torres Strait Islander status, non-English-speaking background status, the patient being new to the practice and the patient being new to the registrar.

Consultation variables recorded were: duration, the nature and number of problems/diagnoses managed and whether pathology or imaging tests were ordered or follow up arranged. Educational factors included whether the trainee sought advice or information during the consultation (from their supervisor or other resources, such as specialists, books or electronic resources) or generated learning goals.

Two further consultation variables recorded (but not included as independent variables in multivariable analyses) were billing and the problems/diagnoses managed in the consultation. The means of billing (bulk billing, private billing, etc.) and individual billing items (using Medicare Benefits Schedule (MBS) item numbers) were recorded. Problems/diagnoses were coded according to the International Classification of Primary Care, second edition classification system (ICPC-2 plus). Problems/diagnoses were also classified as being new or pre-existing and as being a chronic disease (classified according to the methodology of O'Halloran *et al.*)[22] or not. For descriptive purposes, individual ICPC-2 codes were grouped with clinically congruent codes to create clinically meaningful categories of problems/diagnoses. The grouping was performed collaboratively by two members of the research team, a dietitian and a GP.

The analyses in the present study used data from 11 collection periods during 2010–2015. Individual RTPs participated in 3–11 rounds of data collection, depending on each RTP's date of commencement in the study.

The unit of analysis was the individual problem/diagnosis rather than the registrar consultation.

The proportion of problems/diagnoses resulting in a referral to a dietitian/nutritionist was calculated with 95% confidence intervals (CI).

Initial univariate analyses of relationships between independent variables and the outcome were performed using Chi-squared and Wilcoxon rank-sum tests for categorical and continuous variables, respectively.

To test associations of a problem/diagnosis being referred to a dietitian/nutritionist, simple and multiple logistic regression were used within a generalised estimating equation (GEE) framework to account for the repeated measures within registrars. All variables with a p-value <0.2 and relevant effect size in the univariate analysis were included in the multiple regression models. Variables that had a small effect size and were no longer significant in the multivariate model were removed from the final model as long as removal of the variable did not change the resultant model.

In an ad hoc analysis, the odds ratio for consultations resulting in referrals to dietitians/nutritionists being bulk-billed was calculated using simple logistic regression within a GEE framework.

Statistical analyses were completed using Stata 13.1 (StataCorp. 2013. College Station, Texas). Variables were considered significant if the *P*-value was <0.05.

The ReCEnT project has approval from the University of Newcastle Human Research Ethics Committee, Reference H-2009-0323. Compliance with STROBE has been addressed separately.

## Results

A total of 1124 registrars (response rate 95.7%) contributed data from 145 708 consultations to the analysis. The demographics of registrars and practices and consultation variables are presented in Appendix I. Of 227 190 problems/diagnoses, 587 (0.26% (95% CI: 0.23–0.29)) resulted in the referral to a dietitian/nutritionist.

The most common problems/diagnoses referred to a dietitian/nutritionist were related to overweight/obesity, type 2 diabetes/pre-diabetes, elevated lipids and gastro-intestinal symptoms. The 12 most common problems/diagnoses referred to a dietitian/nutritionist are presented in Table 1. Of all referrals to a dietitian/nutritionist, 60.8% were for a chronic disease.

Of the referrals to a dietitian/nutritionist, 38.8% were related to a CDM plan (MBS items 721, 723, 732). Furthermore, 70.2% of consultations that resulted in referral to a dietitian/nutritionist were bulk-billed by the registrar, and there was a significant association of referral to a dietitian/nutritionist with bulk-billing of the consultation.

Characteristics associated with referral to a dietitian/nutritionist are presented in Table 2. The multiple logistic regression models for referral to a dietitian/nutritionist are presented in Table 3. In the adjusted model, patient age (15–64 years) and being an existing patient of the registrar and of the practice were significantly associated with referral to a dietitian/nutritionist. There were no significant registrar variables associated with referral.

Practice variables associated with referral to a dietitian/nutritionist were smaller practice size and being a wholly bulk-billing practice.

Consultation variables associated with referral to a dietitian/nutritionist included longer consultation duration, more problems per consultation, ordering less imaging, ordering more pathology and the problem/diagnosis being a chronic disease. Additionally, referral to a dietitian/nutritionist was significantly associated with the registrar

**Table 1** The most common problems/diagnoses referred to a dietitian/nutritionist

| *Problems/diagnoses* | *Percentage of total problems referred* |
|---|---|
| Overweight and obesity | 27.1 |
| Type II diabetes and pre-diabetes | 21.1 |
| Elevated lipids | 7.0 |
| Gastro-intestinal symptoms | 6.9 |
| Cardiovascular disease | 3.4 |
| Allergy/intolerance including coeliac disease | 3.1 |
| Primary prevention | 2.8 |
| Musculoskeletal disease/injury | 2.4 |
| Nutrient deficiency and anaemia | 1.6 |
| Fatty liver | 1.5 |
| Polycystic ovary syndrome | 1.5 |
| Eating disorders | 1.3 |

**Table 2** Characteristics associated with referral to dietitian/nutritionist (n = 227 190)

| | | *Referral to dietitian/nutritionist* | | |
|---|---|---|---|---|
| *Variable* | *Class* | *No (n = 226 603)* | *Yes (n = 587)* | P |
| Patient age | 0–14 | 30 989 (99.9) | 23 (0.1) | <0.001 |
| | 15–34 | 58 037 (99.7) | 152 (0.3) | |
| | 35–64 | 90 417 (99.7) | 312 (0.3) | |
| | 65+ | 43 698 (99.8) | 92 (0.2) | |
| Patient gender | Male | 81 858 (99.8) | 199 (0.2) | 0.23 |
| | Female | 138 751 (99.7) | 379 (0.3) | |
| Aboriginal or Torres Strait Islander | No | 211 044 (99.7) | 3103 (99.7) | 0.65 |
| | Yes | 547 (0.3) | 10 (0.3) | |
| NESB | No | 200 616 (99.7) | 518 (0.3) | 0.74 |
| | Yes | 15 197 (99.7) | 41 (0.3) | |
| Patient/practice status | Existing patient | 99 336 (99.6) | 437 (0.4) | <0.001 |
| | New to registrar | 109 789 (99.9) | 119 (0.1) | |
| | New to practice | 15 003 (99.9) | 19 (0.1) | |
| Registrar gender | Male | 75 507 (99.8) | 180 (0.2) | 0.35 |
| | Female | 151 096 (99.7) | 407 (0.3) | |
| Registrar FT or PT | Part time | 50 502 (99.7) | 130 (0.3) | 0.90 |
| | Full time | 170 928 (99.7) | 435 (0.3) | |
| Training term/post | Term 1 | 97 289 (99.8) | 234 (0.2) | 0.22 |
| | Term 2 | 69 573 (99.7) | 193 (0.3) | |
| | Term 3 | 59 741 (99.7) | 160 (0.3) | |
| Qualified as doctor in Australia | No | 45 064 (99.7) | 122 (0.3) | 0.69 |
| | Yes | 179 464 (99.7) | 463 (0.3) | |
| Worked at the practice before | No | 166 418 (99.7) | 435 (0.3) | 0.92 |
| | Yes | 57 029 (99.7) | 145 (0.3) | |
| Practice size[1] | Small | 77 809 (99.7) | 237 (0.3) | 0.035 |
| | Large | 143 411 (99.8) | 331 (0.2) | |
| Practice routinely bulk bills | No | 185 208 (99.8) | 441 (0.2) | 0.003 |
| | Yes | 40 242 (99.6) | 142 (0.4) | |
| Rurality | Major city | 130 200 (99.7) | 344 (0.3) | 0.97 |
| | Inner regional | 59 017 (99.7) | 149 (0.3) | |
| | Outer regional/remote/very remote | 37 386 (99.7) | 94 (0.3) | |
| RTP | 1 | 61 373 (99.7) | 192 (0.3) | 0.67 |
| | 2 | 32 377 (99.8) | 66 (0.2) | |
| | 3 | 28 386 (99.9) | 41 (0.1) | |
| | 4 | 96 990 (99.7) | 256 (0.3) | |
| | 5 | 7478 (99.6) | 32 (0.4) | |
| Is the problem new? | No | 92 451 (99.6) | 336 (0.4) | <0.001 |
| | Yes | 114 969 (99.8) | 204 (0.2) | |
| Any sources used | No | 191 982 (99.7) | 487 (0.3) | 0.54 |
| | Yes | 34 621 (99.7) | 100 (0.3) | |
| Any imaging ordered | No | 209 375 (99.7) | 578 (0.3) | <0.001 |
| | Yes | 17 228 (99.9) | 9 (0.1) | |
| Any pathology ordered | No | 187 614 (99.7) | 473 (0.3) | 0.25 |
| | Yes | 38 989 (99.7) | 114 (0.3) | |
| Any learning goals generated | No | 181 379 (99.8) | 422 (0.2) | <0.001 |
| | Yes | 35 967 (99.6) | 139 (0.4) | |
| Any follow up organised | No | 126 443 (99.8) | 247 (0.2) | <0.001 |
| | Yes | 100 160 (99.7) | 340 (0.3) | |
| Chronic disease | No | 177 815 (99.9%) | 230 (0.1%) | <0.001 |
| | Yes | 48 385 (99.3%) | 357 (0.7%) | |
| Registrar age | Mean (SD) | 32.6 (6.3) | 32.5 (5.8) | 0.70 |
| SEIFA decile | Mean (SD) | 5.4 (2.9) | 5.1 (2.7) | 0.11 |
| Consultation duration | Mean (SD) | 18.9 (9.9) | 25.4 (12.2) | <0.001 |
| Number of problems | Mean (SD) | 2.0 (1.0) | 2.5 (1.0) | <0.001 |
| Number of pathology tests ordered | Mean (SD) | 0.5 (1.5) | 0.7 (1.9) | 0.001 |

[1] 'Practice size' – 'Small' refers to practices with five or less GPs and 'Large' refers to practices with six or more GPs.
NESB, non-English-speaking background; RTP, regional training provider; SEIFA, Socioeconomic Index for Area.

**Table 3** Predictors of referring to a dietitian/nutritionist: Simple and multiple logistic regression[1]

| | | *Univariate* | | *Adjusted* | |
|---|---|---|---|---|---|
| *Variable* | *Class* | *OR (95% CI)* | *P* | *OR (95% CI)* | *P* |
| Patient age | 15–34 | 3.41 (2.19–5.32) | <0.001 | 1.77 (1.08–2.89) | 0.023 |
| Referent: 0–14 | 35–64 | 4.44 (2.89–6.83) | <0.001 | 1.81 (1.12–2.93) | 0.015 |
| | 65+ | 2.69 (1.69–4.27) | <0.001 | 0.79 (0.46–1.33) | 0.37 |
| Practice bulk bills | Yes | 1.43 (1.13–1.80) | 0.003 | 1.40 (1.11–1.75) | 0.004 |
| Patient/practice status | New to practice | 0.24 (0.19–0.30) | <0.001 | 0.31 (0.25–0.40) | <0.001 |
| | New to registrar | 0.26 (0.16–0.42) | <0.001 | 0.24 (0.14–0.41) | <0.001 |
| Practice size | Large | 0.80 (0.66–0.98) | 0.035 | 0.82 (0.69–1.00) | 0.048 |
| Consultation duration | | 1.04 (1.04–1.05) | <0.001 | 1.03 (1.02–1.04) | <0.001 |
| Number of problems | | 1.60 (1.48–1.74) | <0.001 | 1.27 (1.16–1.40) | <0.001 |
| Imaging ordered | Yes | 0.17 (0.09–0.35) | <0.001 | 0.17 (0.08–0.36) | <0.001 |
| Generated learning goal | Yes | 1.65 (1.34–2.02) | <0.001 | 1.49 (1.12–1.85) | <0.001 |
| Follow up organised | Yes | 1.76 (1.48–2.09) | <0.001 | 1.27 (1.05–1.54) | 0.015 |
| Chronic disease | Yes | 5.67 (4.74–6.78) | <0.001 | 4.36 (3.55–5.36) | <0.001 |
| Is the problem new? | Yes | 0.49 (0.41–0.59) | <0.001 | 0.97 (0.79–1.19) | 0.80 |
| Number of pathology tests ordered | | 1.08 (1.03–1.22) | 0.001 | 1.08 (1.03–1.14) | 0.002 |

[1] Once the initial multivariable model was constructed, one covariate had a small effect size and was no longer significant and so was tested for removal from the model. The removal of 'SEIFA Decile' did not substantively alter the model, so this covariate was not included in the final model.

organising in-practice follow up and generating more learning goals.

## Discussion

Registrar rates of referral to dietitians/nutritionists are comparable to those of established GPs, with registrars making 0.26 referrals per 100 problems (compared to 0.2 per 100 problems in established GPs) and 0.40 per 100 consultations (compared to 0.4 per 100 consultations in established GPs).[16]

A number of important considerations emerged from our results concerning continuity of care, patient complexity, registrar engagement, chronic disease and health equity.

The significant associations of a longer consultation time, chronic disease, more problems per consultation, ordering more pathology and the generation of registrar learning goals taken together are likely to reflect an increased medical complexity of the patients being referred to a dietitian/nutritionist. The significant association of registrars generating learning goals, as well as reflecting complexity, could also reflect the limited nutrition content of undergraduate and postgraduate medical education and training.[7] This finding supports the demonstrated barrier of a lack of nutrition knowledge preventing GPs from providing nutrition counselling.[7,23]

The significant associations of longer consultation time, organising in-practice follow up and the patient having been seen previously by the registrar suggest an element of continuity of care between the registrar and patients referred to dietitians/nutritionists. The implication is that referrals to a dietitian/nutritionist are part of an ongoing engagement with the patient rather than an expedient 'triage' to the dietitian. The increased likelihood of a registrar generating a learning goal when referring to a dietitian/nutritionist further demonstrates registrar engagement with the nutrition-related problem/diagnosis encountered during the consultation.

This level of registrar engagement has not always been evident in other ReCEnT analyses. Analyses of continuity of care in registrars' consultations, and of consultations with older patients and patients with chronic disease, have suggested limited therapeutic engagement in these areas.[18,24,25] This analysis' finding of a non-significant trend for older patient age being associated with less dietitian/nutritionist referral than middle-aged patients (despite increasing diet-related morbidity with age[2]) may reflect a general lack of engagement with the management of older patients,[18,24,25] being evident also in diet-related aspects of health.

The role of medical practitioners and dietitians/nutritionists in the management of the increasing burden of chronic disease is highlighted in multiple areas of the results. Over half (60.8%) of referrals were for a chronic disease; almost 40% of referrals related to a CDM plan; and the top three reasons for referral were associated with overweight/obesity, type 2 diabetes/pre-diabetes or elevated lipid levels. Clinical guidelines for the management of overweight/obesity, diabetes and coronary heart disease either encourage or recommend referral to a dietitian in the multidisciplinary management of these conditions both in Australia and internationally.[9–13,26–29] Our data do not allow us to assess what proportion of all patients with particular conditions receive referrals to dietitians/nutritionists at any point (i.e. at consultations not recorded in our limited data collection period, or referrals from non-GPs, or self-referrals). However, the total referrals for chronic disease (0.16%) may appear to be low given the high prevalence of type 2 diabetes (12%),[30] pre-diabetes (16%)[31] and overweight/obesity (63%)[32] in the Australian adult population. It is not

 

clear, despite the suggestive referral patterns found in our analysis, whether dietitians/nutritionists are being involved to an optimal extent in the general practice management of these patients. Previous research of Australian GPs has identified perceived barriers to GPs making a referral to a dietitian, including cost to the patient, accessibility of dietitian services, patient willingness to attend a dietetic consultation and whether the GP considers the patient capable of committing to dietary change.[23,33] These barriers may be contributing to what appear to be quite modest numbers of referrals found in the present study.

Aspects of health equity with regards to dietitian/nutritionist referral were evident in our results, with registrars in fully bulk-billing practices more likely to refer, along with a large proportion of referrals being related to a CDM plan. Consultations that resulted in referral to a dietitian/nutritionist were more likely to be bulk-billed compared to those that did not refer. These factors assist individuals by reducing the costs associated with both the GP consultation and/or the dietitian/nutritionist consultation. In Australia, chronic disease is more common and of greater severity in lower socioeconomic populations.[3] Bulk billing and CDM plans provide greater access to health services, which may not have been utilised by some patients due to the associated financial costs. A caveat to this interpretation, however, is that the socioeconomic status of the area in which the practice is located was not associated with dietitian/nutritionist referral.

We also found that referrals to a dietitian/nutritionist were more likely to come from registrars working in smaller practices. We hypothesise that our finding may be due to smaller practices lacking support staff, for example, practice nurses, diabetes educators/nurses, who are able to deliver general nutrition-related services such as weight loss groups, general nutrition education and diabetes-specific education. The absence of these additional support staff may result in these services being delivered by a dietitian.

The present study had a number of strengths, including the large sample size (145 708 individual consultations), high response rate (95.7%),[34] generalisability of results (data collected from five of Australia's six states from practices located across all urban/rural classifications) and the large number of independent variables collected. To our knowledge, this is the first study to look at the patterns and associations of referrals to dietitians/nutritionists from GP registrars.

A limitation of the study is that, using the ICPC-2 coding system, we were unable to distinguish whether the referral was for a dietitian or nutritionist. However, we can infer from the high proportion of referrals associated with a CDM plan that a substantial number of referrals were in fact made to Accredited Practising Dietitians (APD) (as a dietitian must be a registered APD to obtain a Medicare Provider number, which is required for billing a CDM plan visit). Also, the data do not indicate whether the referral was requested by the patient or initiated by the registrar nor does it allow for us to know if the patient actually used the referral to attend a dietitian/nutritionist consultation. We also do not know if a referral was not made because the patient declined the registrar's offer.

Implications of our findings are in the context of registrars being the frontline medical practitioners as overweight/obesity and diabetes progress towards epidemic proportions. Further education for GPs and registrars regarding the wide range of clinical conditions, including chronic diseases, which dietetic input can assist with, is warranted, with the aim of increasing appropriate referrals and improving health outcomes. From a dietetics perspective, not only is it important to establish strong relationships with referring GPs[35] but to also recognise that, in the case of registrars, they are more likely to refer established patients with whom they have engaged with in practice. Effective multidisciplinary collaboration of GPs and dietitians/nutritionists is needed to facilitate appropriate referrals and further management.

There is scope for further research into the nature, rate and associations of referrals from GPs to dietitians/nutritionists that may inform this multidisciplinary collaboration. Additionally, qualitative enquiry could explore the issue of whether GP registrars experience similar barriers to collaboration with dietitians/nutritionists to those demonstrated in their established GP colleagues and associated educational implications.

In conclusion, the present study provides evidence for registrars especially referring established patients with complex care needs to dietitians/nutritionists. Nutrition behaviours are a major risk factor in chronic disease, and our evidence for dietitian/nutritionist referrals represents one facet of considerable engagement by registrars with these patients' complex care needs. Monitoring of referral patterns assists with assessing strategies to align practice with evidence-based guidelines and enhance multidisciplinary collaboration.

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## Conflict of interest

The authors have no conflicts of interest to declare.

## Authorship

The present study was conceived by KJM, PJM and AT. KJM, AT, MLvD, SM, ARD, KMH, NAS, RHK, NC and PJM contributed to data collection within the framework of the ReCEnT study. Statistical analyses were conducted by AT and KM. For the analysis presented in this paper, KJM, PJM, AT and JFW were involved in the interpretations of the findings. This paper was drafted by KM, PJM and AT. All authors made contributions to and approved the final version.

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## APPENDIX I

**Participating trainee, trainee term and practice characteristics**

| *Variable* | *Class* | *n % (95% CI) or Mean ± SD* |
|---|---|---|
| **Registrar variables (n = 1124)** | | |
| Registrar gender | Female | 74 666.4% (63.6–69.1) |
| Qualified as a doctor in Australia | Yes | 88 979.9% (77.4–82.1) |
| Registrar age (years) | Mean ± SD | 32.4 ± 6.3 |
| **Registrar-term[a] and practice-term variables (n = 2453)** | | |
| Registrar training term | Term 1 | 103 342.1% (40.2–44.1) |
| | Term 2 | 76 631.2% (29.4–33.1) |
| | Term 3 | 65 426.7% (24.9–28.4) |
| Registrar worked at the practice previously | Yes | 61 525.4% (23.7–27.2) |
| Registrar works full time | Yes | 186 077.6% (75.9–79.3) |
| Practice routinely bulk bills[b] | Yes | 43 417.8% (16.3–19.4) |
| Number of GPs working at the practice | 1–5 | 82 734.5% (32.7–36.5) |
| | 6+ | 156 765.5% (63.5–67.3) |
| Rurality of practice | Major city | 140 857.4% (55.4–59.3) |
| | Inner regional | 64 326.2% (24.5–28.0) |
| | Outer regional, remote or very remote | 40 216.4% (15.0–17.9) |
| SEIFA[c] Index (decile) of practice | Mean ± SD | 5.5 ± 2.9 |

[a]'Registrar-term' means the number of individual terms undertaken by all Registrars.[b]'Bulk bills' means no financial cost to the patient. [c]Socioeconomic Index for Area (SEIFA) Relative Index of Disadvantage.