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How does self-perceived nutrition competence change over time during medical training? A prospective longitudinal observational study of New Zealand medical students

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ABSTRACT

Objectives Medical nutrition education aims to equip doctors with nutrition knowledge, skills, attitudes and confidence to counsel patients to improve their diet. This study aimed to describe changes in medical students' self-perceived nutrition competence at three time points during medical training.

Design Prospective longitudinal observational study.

Setting The University of Auckland, School of Medicine.

Participants Year 2 medical students (phase 1, preclinical) were surveyed in May 2016. Participants repeated the survey in February 2018 as Year 4 students and July 2019 (phase 2, clinical) as Year 5 students.

Primary outcome measure Primary outcome measure was self-perceived nutrition competence measured using the validated NUTrition Competence (NUTCOMP) survey.

Results In 2016, 102 of 279 eligible Year 2 medical students completed the survey (response rate (RR 36.7%)). In 2018, 89 Year 4 students repeated the survey (RR 87.3%) and 30 students as Year 5 students in 2019 (RR 29.41%). There was a significant increase in total NUTCOMP scores (knowledge, skills, confidence to counsel and attitude towards nutrition) between Year 2 and Year 4 (p=0.012). There was a significant increase in the confidence to counsel construct (mean difference 7.615, 95% CI 2.291 to 12.939, p=0.003) between Year 2 and Year 4. Constructs with lowest scores at all time points were nutrition knowledge and nutrition skills. There was clear desire for more nutrition education from all students: Year 2 (mean=3.8 out of 5 (1.1)), Year 4 (mean=3.9 out of 5 (0.9)), Year 5 (mean=3.8 out of 5 (0.8)).

Conclusion Medical students' self-perceived nutrition competence in providing nutrition care increased modestly at three points throughout medical training. There remains opportunity for further supporting medical students to increase their competence in nutrition care, which could be achieved through mandatory and greater medical nutrition education.

What this paper adds

- Students' self-perceived nutrition confidence at three points during medical training was investigated.
- NUTCOMP, a valid and reliable tool, was used to measure self-perceived competence in nutrition care.
- The impact on the research when having 2 years between the Year 2 and Year 4 survey and 1 year between the Year 4 and Year 5 survey is unknown.

INTRODUCTION

The importance of adequate nutrition for healthy living is well recognised.[1] Poor dietary intake contributes to the global burden of disease, leading to increased demands on healthcare services and population health systems.[2] Diet is now recognised as a leading risk factor for death across the world, contributing to 11 million deaths annually[3] and is underpinned by racial and socioeconomic inequities in determinants of health.[4] Strategies are clearly required to support healthy eating for people and populations.

A key strategy to support healthy eating is to incorporate nutrition into healthcare services. Doctors are recommended to apply nutrition knowledge in practice to support patients to improve their diet[5] for conditions where diet is a major risk factor.[6] This support is termed 'nutrition care', previously defined as any practice conducted by a health professional to improve the nutrition behaviour and subsequent health of patients.[7] Nutrition care is fundamental in supporting improved dietary behaviours because of its direct relevance to healthcare and population health systems.[7] To provide nutrition care, doctors require adequate nutrition knowledge, skills and attitudes to support the integration of nutrition care into routine practice with patients and recognise when to refer to other health professionals, such as dietitians, for in-depth support.

Internationally, extensive literature on nutrition in medical education exists, yet no

studies have described how medical students' nutrition knowledge, skills, confidence to counsel and attitudes change throughout medical training. It is well recognised that graduating medical students lack nutrition knowledge and skills to effectively support dietary behaviour change in patients[8 9] and report dissatisfaction with the nutrition education received feeling unprepared to counsel patients in nutrition.[10] Nutrition education impacts on medical students' confidence in nutrition,[11] and modest improvements have been reported when nutrition education initiatives are introduced into training programmes.[12] It is also known that when nutrition education is not continually reinforced throughout medical training the perceived relevance of nutrition counselling declines.[13]

In New Zealand (NZ), limited literature exists on nutrition in medical education. The assumption that confidence and competence in nutrition increases after training was questioned when the impact of nutrition education on medical students' confidence in nutrition was investigated at Auckland School of Medicine (SM).[14] It was suggested that medical students lack self-efficacy as medical graduands believed incorporating nutrition care into practice was important, yet were less confident patients improved nutrition behaviours after receiving this training.[15] Evidence to support medical students' lack of confidence to provide nutrition care was identified in Year 3 medical students, where although students believed doctors have a role to play in providing nutrition care, perceived limitations to their nutrition education included poor translation of nutrition science to clinical contexts and lack of confidence in skills related to application of nutrition care.[16] Gaps in medical students' nutrition knowledge and its application continue beyond medical training and have similarly been reported by general practice registrars and general practitioners (GP) being constrained by limited nutrition knowledge to provide evidence-based nutrition care.[17] This supports that a nutrition knowledge–practice gap exists in NZ medical students. Describing how NZ medical students' self-perceived nutrition knowledge, skills, confidence to counsel and attitudes change throughout medical training will elucidate the impact of medical nutrition education initiatives and inform future educational needs of these medical students. Therefore, the aim of this study was to describe changes in medical students' self-perceived nutrition competence at three time points during medical training.

METHODS

Study design and context

This study was an investigation of one cohort of undergraduate medical students at three time points (Year 2, Year 4 and Year 5) during medical training at The University of Auckland, SM. In an endeavour to maintain participant numbers and to decrease participant burden, it was determined not to survey participants in Year 3. Auckland SM is one of two medical schools in NZ, and produces more than 50% of medical graduates. Some nutrition education has slowly been integrated into medical curriculum since 2000 and in 2008, a NZ registered dietitian assumed responsibility for the delivery of nutrition education in the medical programme (CW). At present, Auckland SM medical degree uses a curriculum with a case-based framework and nutrition education does not have a dedicated domain. Nutrition is taught predominantly within the preclinical curriculum (Years 2 and 3) and a small component is included during the clinical years (Years 4, 5 and 6). 'The Digestive System' module is taught in Year 2. This course covers the structure and function of the gastrointestinal system in health and disease, as well as the digestion and absorption of food components, their metabolic roles and action. Approximately one-third of the course is devoted to nutrition content, including 13 hours of contact time and one assessed nutrition practical activity. In the practical activity, students performed dietary recalls on peers and complete a nutritional assessment of their own dietary intake using dietary analysis computer software (FoodWorks, Xyris Software, Queensland, Australia). Students concurrently take a course in professional skills which covers behaviour change. In 2020, a pilot intervention for nutrition in weight management cases is being conducted to foster nutrition-related skills development in Year 4 students' (clinical) 1-week general practice observed simulation (GPOPs) education programme. In total, medical students receive approximately 19 hours of nutrition education, 13 hours in preclinical studies (Years 2 and 3) and 6 hours of nutrition education in clinical studies (Years 4, 5 and 6) on an ad hoc basis. This is a similar number of hours to the average hours of nutrition education reported in the USA.[18]

Instrument

The NUTCOMP survey is a valid and reliable tool to measure health professionals' self-perceived competence to provide nutrition care to patients with chronic disease.[19] Self-perceived competence in one's ability to complete a task has been shown to be an indicator of actual competence when the domains of investigation are specified.[20] NUTCOMP contains six sections. Sections 1–4 contain 35 questions to assess self-perceived confidence about nutrition and chronic disease (n=7), confidence in nutrition skills (n=11), confidence in communication and counselling about nutrition (n=9) and attitude towards providing nutrition care (n=8) using a 5-point Likert scale, to rate confidence in all items relevant for each construct. Section 5 consists of one question on perceptions of the need for more nutrition education. Section 6 contains questions on demographic data.

Data collection

Time point 1: In week 7 of semester 1 (2016), following completion of the introductory lecture to 'The Digestive System' module, all phase 1, Year 2 students (preclinical) at Auckland SM were invited by a person not involved

in the study to complete a survey to provide baseline assessment of self-perceived nutrition knowledge, skills, attitudes and competence to provide nutrition care. Potential participants were provided with a consent form to sign, before completing an anonymous NUTCOMP survey. Participants used student identification numbers on their survey to protect their anonymity and allow linking of surveys over time. Completed surveys were placed in a sealed box, outside the lecture theatre over a 2-week period. Three reminders were given to students at the end of lectures.

Time point 2: In week 1 of semester 1 (2018), all Year 4 students (phase 2, clinical) who had completed the first survey were given prior notice of the follow-up survey via the university online messaging system. An administrator matched participants' identification numbers to students' email which provided a link to the NUTCOMP survey in Qualtrics, a university online survey system. Participants were given 1 month to complete the survey and three reminders were emailed to them via the online messaging system.

Time point 3: In week 8 of semester 2 (2019), participants were emailed the link to the final follow-up NUTCOMP survey as previously outlined. Participants were given 1 month to complete the survey during which time three reminders were emailed to them via the online student messaging system.

Data analysis

Analysis of the NUTCOMP survey was conducted using SPSS V.23. Descriptive statistics were calculated for each survey item. Representativeness of the sample for gender and age was investigated using a χ^2 goodness of fit test. Participants' self-perceived nutrition knowledge, skills and confidence to counsel in nutrition was determined by summing their responses for each nutrition competence construct using the Likert scale: 1='Not confident at all'; 2='Not very confident'; 3='Somewhat confident'; 4='Very confident'; and 5='Extremely confident'. Responses for attitude towards nutrition were determined by summing responses to this construct using the Likert scale: 1='Completely disagree'; 2='Somewhat disagree'; 3='Neither agree nor disagree'; 4='Somewhat agree'; and 5='Completely agree'. Totals for the four constructs were summed and a group average was calculated. Responses for further nutrition education included 'Strongly disagree', 'Disagree', 'Neither agree nor disagree', 'Agree' and 'Strongly agree'. Responses were summed and a group average was calculated. Differences between Year 2 (baseline survey), Year 4 and Year 5 students' (follow-up surveys) knowledge in nutrition, skills, attitudes and confidence in counselling were investigated using analysis of variance. Because of a marked decrease in participant numbers between Year 4 and Year 5, a paired t-test was conducted between the 75 pairs of Year 2 (baseline survey) and Year 4 (follow-up survey) participants who completed both surveys, to determine if there were any significant changes to their responses to the four nutrition constructs. Pearson's Chi square tests were used to determine if there were associations between the four construct scores. The statistical significance level was set at $p<0.05$.

Table 1 Age and gender characteristics of participants

Gender	Year 2 (n=102)	Year 4 (n=89)	Year 5 (n=30)
Female	62 (60.8%)	53 (59.6%)	19 (63.3%)
Male	40 (39.2%)	36 (40.4%)	11 (36.7%)
Total	102	89	30
Average age in years	20.8		

RESULTS

NUTCOMP

One hundred and two out of 279 eligible medical students completed the Year 2 survey, resulting in a response rate of 36.7%. The majority of participants (n=65, 60.8%) were female and the average age was 20.8 years. There was no significant difference between the participating and non-participating students with regard to gender (p=0.836), but there was a small difference in age (20.5 years compared with 20.8 years, p<0.001). Of the 102 students who completed the baseline survey in Year 2, nearly all (n=89, 87.3%) completed the follow-up survey as a Year 4 student, but only some (n=30, 29.41%) completed the final follow-up survey as a Year 5 student. Twenty-six students completed all three surveys. Age and gender characteristics of participants are presented in table 1.

Changes at three time points among 26 participants who completed all surveys

Participants' mean scores for each NUTCOMP construct are presented in table 2.

There was a significant increase in total self-perceived NUTCOMP scores (knowledge, skills, confidence to counsel and attitude towards nutrition) between Year 2 and Year 4 (p=0.012). There was also a significant increase in self-perceived confidence to counsel in nutrition construct (mean difference 7.615, 95% CI 2.291 to 12.939, p=0.003) between Year 2 (baseline survey) and Year 4 participants (follow-up survey). The average self-perceived nutrition knowledge score (19.5/35, 55.7%) was the lowest relative to the other nutrition competence constructs, followed by nutrition skills (32.7/55, 59.5%).

Changes at two time points between matched pairs of Year 2 and Year 4 students (n=75)

Changes in self-perceived nutrition competence between matched pairs (n=75) of Year 2 and Year 4 students are presented in table 3. There were significant increases in self-perceived confidence in nutrition knowledge (p=0.045), confidence in nutrition skills (p=0.010) and confidence to counsel patients (p<0.0001) between Year

Table 2 Participants' average nutrition competence scores (n=26) at three time points

	Year 2 mean (SD)	Year 4 mean (SD)	Year 5 mean (SD)	P value
Nutrition (maximum 35)	18.96 (5.0)	20.00 (4.8)	19.69 (4.6)	
Skills (maximum 55)	31.46 (8.1)	33.61 (6.4)	33.03 (6.5)	
Counsel (maximum 45)	28.23 (6.2)	31.50 (5.8)*	30.11 (6.2)	0.003*
Attitude (maximum 40)	34.57 (3.1)	35.73 (3.0)	35.15 (4.3)	
Total average for four constructs (maximum 175)	113.23 (17.9)†	120.85 (17.0)†	118.00 (17.3)†	0.012†

Nutrition=confidence in nutrition knowledge. Skills=confidence in nutrition skills. Counsel=confidence to counsel in nutrition.
Attitude=attitudes towards nutrition
*Significant increase between Year 2 and Year 4 confidence to counsel in nutrition.
†Significant increase between Year 2 and Year 4 in the four nutrition competence constructs.

2 (baseline survey) and Year 4 participants (follow-up survey). Pearson's Chi square tests demonstrated associations between self-perceived nutrition knowledge, nutrition skills, x^2=41.84 (p<0.0001) and confidence to counsel, x^2=25.17, (p<0.0001). Self-perceived nutrition skills were associated with attitude towards nutrition, x^2=4.58 (p=0.011).

Among the three surveys, there was clear agreement of a self-perceived need for more nutrition education Year 2 (baseline survey) (mean=3.8 (1.1)), Year 4 (follow-up survey) (mean=3.9 (0.9)) and Year 5 (follow-up survey) (mean=3.8 (0.8)).

DISCUSSION

This is the first study to describe how medical students' self-perceived nutrition competence changes over time during medical training. The results of this study demonstrate that medical students perceive that they have a positive attitude towards nutrition (average mean score 35/40 (87.5%)). The students significantly increased their average total NUTCOMP scores (knowledge, skills, confidence to counsel and attitude towards nutrition) between Year 2 (baseline survey) and Year 4 (follow-up survey) (p=0.012) and their self-perceived confidence to counsel in nutrition between Year 2 and Year 4 (p=0.003). However, the small increases in self-perceived nutrition knowledge (average mean score 19.5/35 (55.7%)) and skills (average mean score 32.7/55 (59.5 %)) at the three time points suggest that medical school students do not feel confident in these two essential components of nutrition competence. Similar results were also found among the matched pairs (n=75) of Year 2 (baseline survey) and Year 4 students (follow-up survey) for nutrition knowledge and skills. This means that the limited nutrition education received at specific time points in the medical curriculum is insufficient to change self-perceived competence in nutrition knowledge and skills throughout medical training.

There was no change in participants' self-perceived nutrition knowledge throughout the three time points surveyed. Although there is no benchmark for defining a nutrition knowledge curriculum it can be seen that an (average) self-perceived nutrition knowledge score of 19.6 is still a long way from a possible score of 35 and much lower than previous studies of dietitians (26.7),[19] GPs (25.8)[21] and personal trainers (22.7).[22] This confirms that there is a deficit of nutrition knowledge in this cohort of medical students. However, without a benchmark in

Table 3 Comparison of Year 2 and Year 4 participants' nutrition competence in the four constructs and associations between the nutrition constructs

	Mean score (n=75)			
	Year 2	Year 4	P value	Associations between scores
Nutrition mean (SD) out of 35	18.4 (4.6)	19.4 (4.1)	0.045	Skills: x^2=41.84, p=0.0001 Counsel: x^2=25.17, p=0.0001
Skills mean (SD) out of 55	30.9 (7.8)	32.9 (6.5)	0.010	Knowledge: x^2=41.84, p=0.0001 Counsel: x^2=45.44, p=0.0001 Attitude: x^2=4.58, p=0.01
Counsel mean (SD) out of 45	27.98 (5.9)	30.4 (5.0)	0.0001	
Attitude mean (SD) out of 40	35.0 (3.6)	35.2 (3.4)	ns	
Total average for four constructs out of 175	112.28 (17.3)	117.9 (14.5)		

Nutrition=confidence in nutrition knowledge. Skills=confidence in nutrition skills. Counsel=confidence to counsel in nutrition.
Attitude=attitudes towards nutrition
ns, not significant.

nutrition knowledge competence, it is challenging for medical educators to determine if nutrition education in medical training provides an adequate foundation on which to extend knowledge in postgraduate training.[23] The findings of this study align with previous international literature[24–26] and recent literature confirms that the situation remains unchanged.[27] Internationally and nationally, this is cause for concern as lack of knowledge about nutrition as it relates to evidence-based practice affects medical students' awareness of the relationship between diet and long-term health, clinical nutrition and nutrition in primary care.[10] At Auckland SM, the prescribed nature of 'The Digestive System' module permits only limited time to be devoted to the clinical application of the basic science underpinning nutrition in clinical contexts and the ad hoc nature of clinical nutrition education in clinical training (Years 4, 5 and 6) may account for medical students' lack of change in self-perceived nutrition knowledge. In recent literature from Auckland SM, medical students valued being taught by a dietitian[15 16] and identified that limited exposure to nutrition experts, interprofessional approaches to nutrition education and lack of role modelling of nutrition care act as barriers to providing nutrition care.[16] Internationally and nationally, continuation of nutrition knowledge deficits is seen throughout the medical profession[23 28] and doctors report that their personal health behaviours[29] and lack of detailed nutrition knowledge impact on their willingness and capacity to provide nutrition care.[30 31] This means that opportunities to enhance patients' nutrition behaviour and health outcomes are missed.[32] Clearly, there is a need to establish consensus on the required level of nutrition knowledge for medical students to establish a global benchmark for nutrition competence and further work to improve knowledge during medical training.

There was a small but significant increase in participants' self-perceived confidence to counsel in nutrition between Year 2 (baseline survey) and Year 4 (follow-up survey) (3.27%), which decreased slightly in Year 5 (follow-up survey). Self-perceived nutrition skills were associated with knowledge (x^2=41.84), confidence to counsel (x^2=45.44.) and attitude towards nutrition (x^2=41.58). This demonstrates the inter-relationship between the nutrition constructs and that for students to be competent in nutrition care medical nutrition education should encompass all four constructs. Medical students' average self-perceived confidence in nutrition knowledge (19.5/35, 55.7%) and skills (32.7/55, 59.5%) reflects their lack of self-perceived confidence in these two components on nutrition competence. The slight decline in students' self-perceived responses to the four nutrition constructs from Year 4 to Year 5 may be related to their transition from classroom-based learning education to an experiential learning environment.[27] It is difficult to determine the impact of the GPOPs course on participants' confidence and skills to counsel patients, as the small sample size of Year 5 students may have obscured the results obtained. The small sample size of Year 5 students also prevented investigating whether demographic variables were associated with changes over time and this could be investigated in future research. In recent literature from Auckland SM, medical students have reported positive self-perceived attitude towards nutrition,[15 16] and graduating students additionally reported moderate self-perceived confidence to provide nutrition care,[15] which aligns with the present study. Throughout medical training, it should be regarded as imperative that students witness application of nutrition science to clinical practice by their mentors and collaborate with nutrition professionals to acquire the skills and confidence to counsel patients[33] in a wide range of diseases,[34] to avoid the perceived relevance of nutrition counselling declining after training.[35] However, it is widely reported that students vary in their confidence and perceived competence to provide nutrition care.[10] As future medical practitioners, students will be required to address the increasing prevalence of chronic disease and public health issues.[36] To prepare for this role, medical students need to also be competent in the practice of behaviour change, and to be reflective practitioners.[37]

At three time points during medical training, the majority of medical students in this study perceived need for further nutrition education. This result concurs with the international literature.[10] Recent recommendations to enhance medical education include emphasis on competency-based curricula, interprofessional and team-based education, information technology-empowered learning and a shift towards early integration of clinical applications in the basic sciences.[4 33] For nutrition education, these recommendations highlight recognising and developing competencies required for effective practice[33 38] and integrating nutrition into existing curriculum to scaffold nutrition education throughout curricula to maximise acquisition of nutrition knowledge and skills.[16] Medical nutrition education should also incorporate multidisciplinary teaching approaches to model the contribution of health professionals in addressing nutrition in patient care.[39] What is also now needed is institutional commitment for adequate nutrition education to be a required component of medical training[40] to produce graduates with nutrition competence. This would align calls to better standardise medical training and learning outcomes across the world.[33] Of note, a Nutrition Competency Framework has been developed for NZ and Australia and mapped to the Australian Medical Council Graduate Outcome Statements, although it is yet to be adopted by the regulatory body for both countries.[41 42]

Some medical students requested future nutrition education to address the global focus to improve health via better diet intake, as outlined in United Nations' Sustainable Development Goals,[43] the Paris Agreement,[44] the Lancet Commission on the global syndemic of obesity, malnutrition and climate change[2] and the EAT-Lancet Commission on healthy diets and sustainable food systems.[2] Other literature endorses the need to make appropriate nutrition education available in medical

training for future doctors to influence global concerns at personal and public health levels.[3 33 38] This supports consideration of global standards in medical education to fulfil patients' right to preventive healthcare in emerging public health issues.[45] Previously, the potential of a joint strategic approach to medical nutrition education among countries with comparable tertiary education systems, continuing medical education, language of delivery and health needs of the population that would promote uniform content has been suggested.[46] Alignment of global standards in medical nutrition education and the EAT-Lancet Commission would help address the minimal clear gains in nutrition education in recent years.

There are strengths and limitations to this study. This study reported medical students' self-perceived nutrition knowledge, skills, confidence to counsel and attitude towards nutrition at three time points at one medical school. Given the difference in medical curricula and lack of standardised nutrition education, the results may not reflect other institutions or countries. Although the survey has been validated, the sensitivity of the tool at detecting small improvements within one sample has not previously been investigated. Furthermore, an ideal NUTCOMP score has not yet been established that identifies the point at which a participant is viewed as being 'competent'.[19] Additionally, students may have provided socially desirable answers to the questions. It is also possible that Year 2 students with an interest in nutrition completed the survey and the results need to be interpreted with caution. The impact of 2 years between the Year 2 and Year 4 survey and 1 year between the Year 4 and Year 5 survey on the analysis is unknown. The low response rate in Year 5 may have been related to the voluntary nature of surveys, the importance placed on contributing to evaluations or the high workload of students.

CONCLUSION

Medical students' self-perceived nutrition competence in providing nutrition care to patients with lifestyle-related chronic disease increased modestly at three points throughout medical training. Despite self-perceived nutrition competence increasing throughout medical training, medical students perceived a need for further nutrition education to be competent to provide nutrition care to patients, including emerging global nutrition issues. There remains opportunity for further supporting medical students to increase their competence in nutrition care, which could be achieved through mandatory and greater medical nutrition education.

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