

Original Article

Clinical nutrition knowledge, attitude and practice of medical interns in Shanghai: Contributory factors

Min Zong MD¹, Yan-Qiu Chen MD¹, Xia Liu MM², Hua Xie PhD¹, Mei-Fang Zhang MD³, Jian-Qin Sun Prof¹

¹Department of Clinical nutrition center, Huadong Hospital Affiliated to Fudan University, Shanghai, China

²Food hygiene and nutrition department of Shanghai University of Traditional Chinese Medicine, China

³Nutrition department, Shanghai 9th Peoples Hospital Affiliated to Shanghai Jiaotong University School of Medicine, Shanghai, China

Background and Objectives: To provide a questionnaire, with Shanghai medical interns as respondents, analyzing knowledge (K), attitude (A), and practice (P) in relation to clinical nutrition, and to explore factors that could affect KAP scores. **Methods and Study Design:** The cross-sectional study used 330 interns from Shanghai medical universities responding to general material data questionnaires and KAP questionnaires on clinical nutrition. **Results:** The mean KAP score was 210.26±25.9 (X±SD), and the score for each part of the KAP questionnaire was just within the threshold for qualified. Multivariate analysis showed that the factors influencing the proportion of excellent scores for K were preventive medicine major (OR=3.45, $p<0.001$), senior intern (OR=2.52, $p=0.002$), and tertiary intern hospital (OR=2.31, $p=0.006$). The only factor influencing the proportion of excellent scores for P was accessing nutritional information one to three times per week (OR=3.95, $p=0.011$). Nutrition course had no relation to any scores of K, A, P. **Conclusions:** The mean scores of overall KAP and the individual K, A, P were all categorized as qualified. The P score was the lowest and only influenced by how frequently information was accessed. In summary, nutrition knowledge and regular practical training gained from intern hospital could be a better way to enable senior interns to quickly and competently address patient nutrition problems at the commencement of their careers.

Key Words: knowledge score, attitude score, practice score, frequency of accessing nutrition information, method of accessing nutrition information

INTRODUCTION

In the 21st century, a new bio-psychological-social model has emerged in China. The prevalence of malnutrition and nutrition-related chronic diseases that affect disease prognosis make clinical nutrition increasingly crucial.¹ Not only dietitians but also various other medical staff communicate nutrition and health knowledge to patients. Currently, however, medical students and young clinicians are underperforming in their application of nutritional knowledge to benefit patients. Wahlqvist et al²⁻⁵ demonstrated that most clinical frontline doctors consider current nutrition-related knowledge insufficient for their professional needs. Clinical nutrition education for medical students is also inadequate. The Chinese school network survey found undergraduates majoring in clinical medicine from more than 90 medicine colleges had almost no compulsory courses in clinical nutrition.⁶

A number of foreign studies have suggested that medical interns could improve clinical nutrition knowledge and practical abilities through long-term interdisciplinary integration teaching like problem-based-learning (PBL) or short-term nutritional skills training.^{7,8} However, such research remains limited in China. This study designed a clinical nutrition questionnaire (KAP questionnaire) to assess and subsequently better understand Shanghai med-

ical interns' clinical nutritional knowledge, attitude, and practice and analyze primary factors affecting K, A, P. Furthermore, we also try to establish new internship training methods so as to better adapt to new medical treatment modes.

METHODS

Pre-survey questionnaires

Based on the KAP theoretical model and clinical nutrition, an initial questionnaire was designed by a panel of nutritionists. Each question and its matched answer was modified and confirmed item by item during several discussions before being included in the preliminary survey.

Then 30 interns from Shanghai Traditional Chinese Medicine University were selected as volunteers for the

Corresponding Author: Prof Jian-Qin Sun, Department of Clinical nutrition center, Huadong Hospital Affiliated to Fudan University, 221 West Yan'an Road, Jing'an District, Shanghai, China, 200040.

Tel: +86-021-62483180; Fax: +86-021-62483182

Email: jianqins@163.com

Manuscript received 13 August 2019. Initial review completed 22 August 2019. Revision accepted 27 October 2019.

doi: 10.6133/apjcn.202003_29(1).0011

preliminary survey, which purpose was to improve the validity and reliability of the formal questionnaire. The Cronbach's alpha values was 0.825, and the Kaiser-Meyer-Olkin (KMO) value was 0.707 on pre-survey questionnaires.

Criteria for inclusion

- (1) Participants must be fifth- to eighth-year medical students at Shanghai medical colleges.
- (2) Participants require more than 6 months' clinical internship experience at intern hospital.
- (3) Informed consent and voluntary participation in the survey are required.

Research participants

We created an online survey platform named the "WeChat Questionnaire Star Survey System" for use in the KAP investigation. Using the cross-sectional method, the investigations were conducted at 12 specialist hospitals and integrated teaching hospitals in Shanghai, and each hospital recruited 25 to 30 eligible medical interns. Informed consent was obtained for the questionnaire. Regular reminders were provided (by email and in person) until the quota (25-30/unit) was full (open from October

2017 to December 2017). And finally collected 330 questionnaires of which 314 were valid. The study was approved by the Ethics Committee of Huadong Hospital Affiliated to Fudan University.

Final questionnaire contents

The questionnaires that had been revised after pre-survey were used for the final, formal version, including:

- (1) General questionnaire: medical interns' gender, height, weight, grade, major, name of intern hospital, length of internship, name of nutrition course, methods of accessing nutrition information, and frequency of accessing nutrition information.
- (2) KAP questionnaire and score assignment (Table 1).
 - a. Clinical nutrition knowledge: Comprised 13 items and scored out of 100 points, 7.69 points were allocated for each correct answer and 0 points for each wrong answer.
 - b. Nutrition attitude: Comprised 7 items and scored out of 100 points, for each item, agree≈14.28 point, somewhat agree≈10.71 points, somewhat disagree≈7.14 points, disagree≈3.57 points.
 - c. Nutrition practice: Comprised 6 items and scored out of 100 points, for each item, execute inde-

Table 1. KAP contents and consensus rate

Item	Question and correct answer	Number (rate %)
K		Correct rate
K1	The inpatients' quick and effective way of nutritional screen is NRS2002 score	89 (28.3)
K2	The calculation formula of BMI is weight/height ² (kg/m ²)	288 (91.7)
K3	In order to lower the generation of CO ₂ , the nutrient that respiratory failure patients should decrease the proportion of intake is carbohydrate.	204 (64.9)
K4	Kidney failure on patients should be given the low protein diet.	283 (90.1)
K5	The nutrient which could be primary restricted in pancreatitis is fat.	231 (73.6)
K6	Animal liver or blood could prevent hypoferric anemia.	273 (86.9)
K7	The diet which constipation patients should eat more is high fiber diet.	308 (98)
K8	The food type that gout patients should eat more is wax gourd.	198 (63)
K9	The food that osteoporosis patients should eat more is milk.	285 (90.7)
K10	Compared with parenteral nutrition, the enteral nutrition' advantage is less complications.	193 (61.4)
K11	Venous support is not the enteral nutrition' support method.	253 (80.6)
K12	The vital role of serum albumin by iv is maintain colloid osmotic pressure.	229 (72.9)
K13	The status of under-nutrition could be easily happened in malignant tumor's patient.	276 (87.8)
A [†]		Consensus rate
A1	Do you think your diet healthy?	268 (85.3)
A2	Do you know nutrition-related associations or academic groups?	37 (11.6)
A3	Do you know the dietary guidelines for Chinese residents?	95 (30.2)
A4	Do you feel it's necessary to understand clinical nutrition knowledge?	308 (98)
A5	Do you treat patients with nutritional treatments related to their disease?	303 (96.5)
A6	Do you think it is necessary to set up a nutrition clinic in the hospital?	299 (95.2)
A7	Do you know the role of nutritional support in clinical outcomes?	175 (55.6)
P [‡]		Consensus rate
P1	How do you assess patient' nutrition status by method of nutritional screening?	172 (54.8)
P2	How do you implement nutritional plan for patients whose nutritional status are under-nutrition?	122 (38.9)
P3	How do you do the nutritional propaganda to chronic disease' patients like diabetes, hypertension or heart disease?	233 (74.2)
P4	How do you implement nutritional plan for special diet request on patients like diabetes, hypertension or heart disease?	183 (58.2)
P5	How do you estimate energy request and implement enteral nutrition' support for patients like severe burn, trauma or major surgery?	191 (60.8)
P6	How do you guide diet of chronic diseases to patients from outpatient during internship' clinic period?	226 (72)

KAP: knowledge, attitude, practice; K: knowledge; A: attitude; P: practice; iv: intravenous injection

[†]Consensus rule was applied to combined (Likert Scale responses 1=Agree and 2=Somewhat agree).

[‡]Consensus rule was applied to combined (Likert Scale responses 1=Execute in dependently and 2=Executed according to tutor guidance).

pendently≈16.66 point, executed according to tutor guidance≈12.5 points, ask a dietitian≈8.3points, no supportive treatment≈4.16 points.

Each part of the KAP was scored out of 100 points, less than 60 points was categorized as poor, 60 to 79.9 points as qualified, and 80 points or more as excellent. Overall, the KAP was scored out of 300 points, which less than 180 points representing poor, 180 to 239.9 points representing qualified, and 240 points or more representing excellent. The reliability and validity coefficients for the final questionnaires were 0.735 (Cronbach's alpha) and 0.744 (KMO), respectively.^{9,10}

Statistical analysis

The valid questionnaire was double entered using Epidata3.1. After all data were entered into an Excel spreadsheet for logical error correction, they were analyzed with SPSS16.0, KAP and K, A, P were described using $\bar{X}\pm SD$ and IQR. Multivariate ordinal regression analysis was performed to explore the factors influencing the K, A, and P scores and the overall KAP score. *P* value<0.05 was considered statistically significant. Reliability and validity of the questionnaire were evaluated using Cronbach's α coefficient and the Kaiser-Meyer-Olkin (KMO) coefficient in SPSS16.0, respectively.

RESULTS

General material and KAP scores

A total of 330 interns responded to this survey, and 314 completed questionnaires were obtained after those missing data or logical errors were deleted. The response rate was 95%. Most respondents were women (68%, n=212 of 314) and majored in clinical medicine (77%, n=243 of 314). Approximately two-thirds had not yet reached the fifth year of training (62%, n=195 of 314), had not attend a nutrition course (62%, n=195 of 314), and had practiced in tertiary hospitals (61%, n=190 of 314). 16% of them were overweight or obese ($BMI\geq 24$ kg/m²) and 41% had undergone training for 1 year or more. The two main sources of nutrition knowledge were the internet (73%, n=230 of 314) and training hospital tutors (51%, n=160 of 314). Most respondents obtained nutrition knowledge between one and three times per month (45.5%, n=143 of 314).

The mean overall KAP score was 210.26 ± 25.9 ($\bar{X}\pm SD$), the mean K score was 76.92 (range, 69.23- 84.61), the mean A score was 71.42 (range, 64.28-75), and the mean P score was 66.66 (range, 58.33-75). And no correlation existed between K and P ($r=0.078$, $p=1.42$). However, a strong correlation was observed between K and A ($r=0.345$, $p<0.001$), and all of the individual scores had strong correlations with the overall KAP score.

Detail situation of clinical nutrition knowledge, attitude, and practice (Table1)

According to "K" part, low correct rate appeared respectively in K1, K3, K8 and K10 which represented NRS2002 scores as quick nutritional screening method, low proportions of carbohydrates given for respiratory failure patients, healthful food for the gout patients, and the advantage of enteral nutrition. For "A" part, low con-

sensus rate (agree or somewhat agree) just appeared respectively in A2, A3 which items were on recognition of nutrition-related associations and the dietary guidelines for residents.

Lots of items in "P" part, such as nutrition screening; nutrition therapy for patients under- nutrition or patients who had chronic disease; and implementation of Parenteral and Enteral Nutrition (PEN), had low consensus rate (execute independently + executed according to tutor guidance).

Multivariate analysis (Table2)

To prevent interaction between independent variables, the factors related to the proportion of excellent K, A, P scores were analyzed using multivariate analysis. The proportions of excellent knowledge scores, attitude scores, practice scores, and overall KAP scores were used as dependent variables. After fitting optimization, multivariate ordered logistic regression modeling revealed statistically significant influencing factors to be as follows:

Preventive medicine major (OR=3.45; 95% CI: 1.78-6.71), senior intern (OR=2.52; 95% CI: 1.41-4.49) and tertiary intern hospital (OR=2.31; 95% CI: 1.78-6.71) were found to be statistically associated with the proportion of excellent K scores. Nutrition knowledge obtained from tutor (OR=7.03; 95% CI: 2.61-18.9), nutrition knowledge from sources other than tutors (OR=3.55; 95% CI: 1.36-9.23), accessing nutrition information once a week (OR=6.19; 95% CI: 1.9-20.0) were associated with the proportion of excellent A scores, while only accessing nutrition information once a week (OR=3.95; $p=0.011$) were correlated to the proportion of excellent P scores.

DISCUSSION

Two contexts were used in relation to clinical nutrition awareness among medical staff and patients. In Asian countries,^{11,12} patients with diabetes and medical staff in cancer-related fields had positive awareness, but both knowledge level and executive ability were low, and the two were significantly related. In another European and American countries,^{13,14} the cognition of nutrition knowledge was high, but the executive ability was still low.

None of these problems could be solved with the early nutrition course in campus according to the literature.¹⁵ The reason could be the hospital's lack of tools for nutrition evaluation (body composition machine and metabolic vehicle), and the limitations of the staff in terms of time and skill.¹³ In our study, the K's contributory factors could be explained by preventive medicine interns' prevalence on nutrition courses, the scope of senior interns' insight and experience, and the prevalence of complicated nutrition-related diseases in tertiary hospitals. And interns who obtained high scores for practice (OR=2.35) and attitude (OR=7.03) were also those who had received frequent bedside teaching from a hospital tutor. Course had no relation to any scores of K, A, P (Table2).

Due to the reasons above, the patients' prognoses could be improved by enhancing medical staff members and interns' nutritional intervention skills through training.^{16,17} Jerusalem community nurses had been trained for 18 months, through a series of seminars and interactive-

Table 2. Multivariate ordinal regression analysis on excellent rate of K, A, P

Category	KAP score (%)		Knowledge score (%)		Attitude score (%)		Practice score (%)	
	OR _{adj} (95% CI)	<i>p</i> value	OR _{adj} (95% CI)	<i>p</i> value	OR _{adj} (95% CI)	<i>p</i> value	OR _{adj} (95% CI)	<i>p</i> value
Major								
Preventive medicine	2.73 (1.34-5.6)	0.006	3.45 (1.78-6.71)	0.000				
Clinical medicine	1.0		1.0					
Course								
Nutrition	1.34 (0.72-2.51)	0.349	1.11 (0.71-1.75)	0.647	1.46 (0.79-2.67)	0.22	0.94 (0.56-1.56)	0.804
No nutrition	1.0		1.0		1.0		1.0	
Intern grade								
Senior interns			2.52 (1.41-4.49)	0.002				
Junior interns			1.0					
Type of hospital								
Tertiary hospital			2.31 (1.78-6.71)	0.006				
Special hospital			2.06 (0.91-4.63)	0.081				
Secondary hospital			1.0					
Frequency of accessing nutrition information								
1-3 times per week	5.51 (1.68-18.13)	0.005			6.19 (1.9-20.0)	0.002	3.95 (1.36-11.43)	0.011
1-3 times per month	2.25 (0.96-5.27)	0.063			4.57 (1.87-11.16)	0.001	1.96 (0.99-3.88)	0.051
1-3 times per year	1.14 (0.51-2.54)	0.743			1.52 (0.67-3.42)	0.311	1.65 (0.85-3.21)	0.137
None	1.0				1.0		1.0	
Major method of accessing nutrition information								
Tutor in training hospitals	3.21 (1.17-8.81)	0.023			7.03 (2.61-18.9)	0.000	2.35 (0.99-5.63)	0.054
Without tutor	1.3 (0.49-3.47)	0.589			3.55 (1.36-9.23)	0.009	1.69 (0.7-4.06)	0.239
None	1.0				1.0		1.0	

KAP: knowledge, attitude, practice; K: knowledge; A: attitude; P: practice.

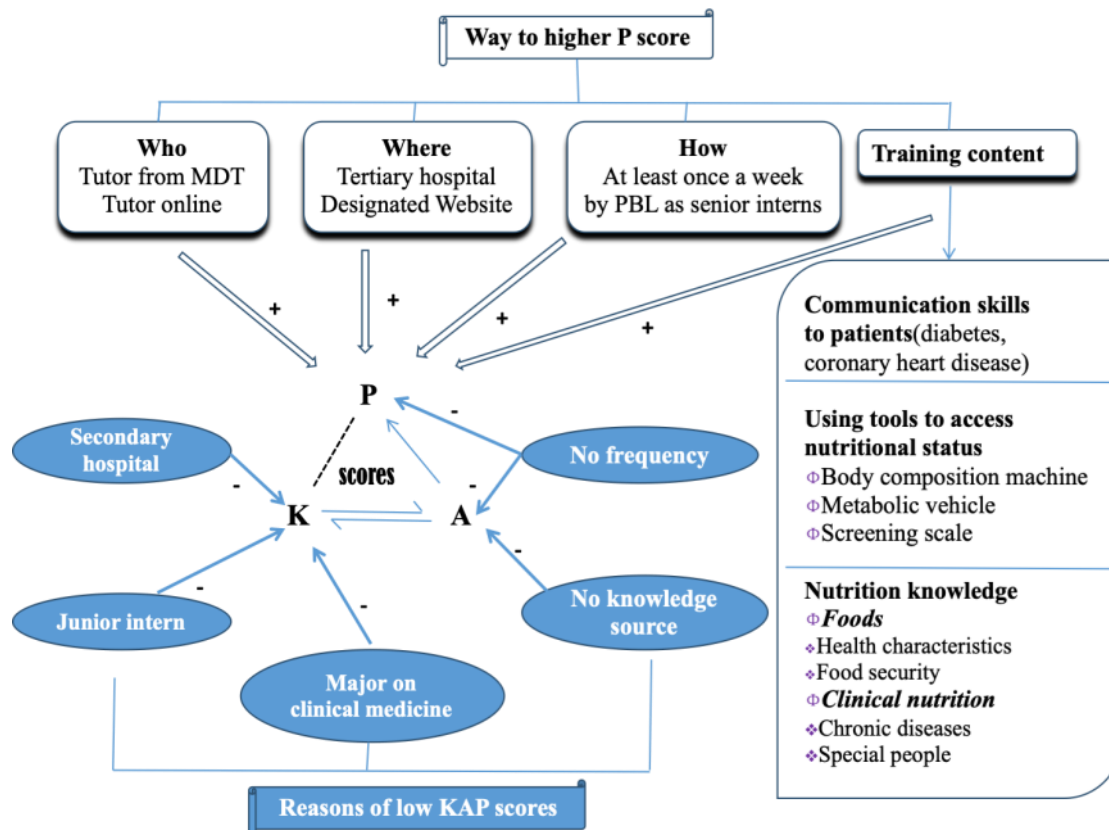


Figure 1. Reasons of low KAP scores and way to increase practice scores.

incentives lectures. Canadian health care workers had been trained for 1 year, including on the Nutritional Screening Scale for admission, monitoring of patients' dietary intake and providing nutrition guidance at discharge. Interdisciplinary courses (JCIPE) were offered at the Jefferson Medical University in Pennsylvania which meant that during 2 years of internship, students selected for this course achieved all-around development through the hospital's tutors from various disciplines (including clinical nutrition) as well as through lectures, group discussions.¹⁸ Similar PBL studies have also been documented in the UK.⁸

The next step is to identify a method for framing the practice system according to this study and relevant literature.^{2,19} During the internship period, Multiple Disciplinary Team (MDT) members of the tertiary hospitals should provide PBL teaching on clinical nutrition once a week and transmit videos to other interns in Shanghai through the designated web. The training contents (Figure 1) should include (1) routine screening skills such as use of nutrition risk screening 2002 and body composition machine; (2) basic dietary knowledge, such as food structure, functional foods with antioxidants and high plant compound levels (3) food safety knowledge, such as food packaging containers, food labels with detailed ingredients, technique of food storage; and (4) communication skills for informing patients about clinical nutrition. At last, academic credit should be awarded for completion of all parts.²⁰

Today, nutritional training and incentive mechanisms of Shanghai medical interns still remain a blind spot. To facilitate rapid participation in the patient's clinical nutri-

tion treatment as young clinicians in the future, they must be combined bedside teaching practice on clinical nutrition during the internship with the early nutrition courses.

ACKNOWLEDGEMENTS

We wish to acknowledge the contribution of people managing the Medical Education Department, including Huadong Hospital Affiliated to Fudan University, Zhongshan Hospital Affiliated to Fudan University, Fifth People's Hospital of Shanghai Fudan University, Xinhua Hospital Affiliated to Shanghai Jiaotong University School of Medicine and Renji Hospital affiliated to Shanghai Jiaotong university. They include Jiewei Jiang, Yan Zhang, Jing Li, XiuHua Shen, and Yuyue Mao.

AUTHOR DISCLOSURES

The authors declare that there are no conflicts of interest exist in relation to the publication of this paper.

This study was funded by the Medical Education Project of Medical Education Branch of Chinese Medical Association (Series number: 2016B - RC027).

REFERENCES

1. Kris-Etherton PM, Akabas SR, Bales CW, Bistrian B, Braun L, Edwards MS et al. The need to advance nutrition education in the training of health care professionals and recommended research to evaluate implementation and effectiveness. *Am J Clin Nutr.* 2014;99:153S-66S. doi: 10.3945/ajcn.113.073502.
2. Wahlqvist ML, Lee M. Nutrition in health care practice. *Journal of Medical Sciences.* 2006;26:157-64.
3. Celia L, Renata V, Jack B, Heather K. Changing nutrition care practices in hospital: a thematic analysis of hospital staff perspectives. *BMC Health Serv Res.* 2017;17: 498-513. doi: 10.1186/s12913-017-2409-7.

4. Zhang X, Li W, Chen G, Zhao G, Chen J, Luo S et al. Tumor nutrition knowledge-attitude-behavior analysis of Chinese medical staff. *Electronic Journal of Cancer Metabolism and Nutrition*. 2016;3:108-13. doi: 10.16689/j.cnki.cn11-9349/r.2016.02.011. (In Chinese)
5. Adeline EM, Beatrice WM, Onesmo AK, George O. Nutrition knowledge, attitudes and practices among health care workers in management of chronic kidney diseases in selected hospitals in Dar es Salaam, Tanzania; a cross-sectional study. *BMC Nutr*. 2016;2:1-7. doi: 10.1186/s40795-016-0045-y.
6. Yao Xueting, Lu Li, Guo Songchao. The current situation and development trend of the education of clinical nutrition in medical students in China. *Journal of Guangxi Medical University*. 2007;24:34-6. doi: 10.16190/j.cnki.45-1211/r.2007.s1.025. (In Chinese)
7. Taren DL, Thomson CA, Koff NA, Gordon PR, Marian MJ, Bassford TL et al. Effect of an integrated nutrition curriculum on medical education student clinical performance, and student perception of medical-nutrition training. *Am J Clin Nutr*. 2001;73:1107-12. doi: 10.1093/ajcn/73.6.1107.
8. Ray S, Udumyan R, Rajput-Ray M, Thompson B, Lodge KM, Douglas P et al. Evaluation of a novel nutrition education intervention for medical students from across England. *Evaluation of a novel nutrition education intervention for medical students from across England*. *BMJ Open*. 2012;2:e000417-425. doi: 10.1136/bmjopen-2011-000417.
9. Amiri P, Asghari G, Sadrosadat H, Karimi M, Amouzegar A, Mirmiran P et al. Psychometric properties of a developed questionnaire to assess knowledge, attitude and practice regarding vitamin D (D-KAP-38). *Nutrients*. 2017;9:471-84. doi: 10.3390/nu9050471.
10. Turconi G, Celsa M, Rezzani C, Biinol G. Reliability of a dietary questionnaire on food habits, eating behavior and nutritional knowledge of adolescents. *Eur J Clin Nutr*. 2003; 57:753-63. doi: 10.1038/sj.ejcn.1601607.
11. Al-Maskari F, El-Sadig M, Al-Kaabi JM, Afandi B, Nagelkerke N, Yeatts KB. Knowledge, attitude and practices of diabetic patients in the United Arab Emirates. *PLoS One*. 2013;8:e52857-65. doi: 10.1371/journal.pone.0052857.
12. Zhang X, Cheng X, Li W, Tian Y, Kang L, Shi H. The effect of oncology nutrition therapy training on nutrition knowledge-attitude-behavior of nursing staff. *Journal of Cancer Metabolism and Nutrition*. 2017;4:198-202. doi: 10.16689/j.cnki.cn11-9349/r.2017.02.014. (In Chinese)
13. Hall-McMahon EJ, Campbell KL. Have Renal dietitians successfully implemented evidence-based guidelines into practice? A survey of dietitians across Australia and New Zealand. *J Ren Nutr*. 2012;22:584-91. doi: 10.1053/j.jrn.2011.09.004.
14. Fluker SA, Whalen U, Schneider J, Cantey P, Bussey-Jones J, Brady D et al. Incorporating performance improvement methods into a needs assessment: experience with a nutrition and exercise curriculum. *J Gen Intern Med*. 2010;25:627-33. doi: 10.1007/s11606-010-1404-z.
15. O'Connell MT, Rivo ML, Mechaber AJ, Weiss BA. A curriculum in systems-based care: experiential learning changes in student knowledge and attitudes. *Fam Med*. 2004;36:S98-S104.
16. Hasson R, Stark AH, Constantini N, Polak R, Verbov G, Edelstein N et al. "Practice What You Teach" public health nurses promoting healthy lifestyles: program evaluation. *J Ambul Care Manage*. 2018;41:171-80. doi: 10.1097/JAC.0000000000000243.
17. Celia VL, Heather HK, Lori C, Pauline D, Joseph M, Sumantra R. Comparing hospital staff nutrition knowledge, attitudes, and practices before and one year after improving nutrition care: results from the more-2-eat implementation project. *JPEN*. 2018;42:786-96. doi: 10.1177/0148607117718493.
18. DiMaria-Ghalili RA, Mirtallo JM, Tobin BW, Hark L, Van Horn L, Palmer CA. Challenges and opportunities for nutrition education and training in the health care professions: intra professional and inter professional call to action. *Am J Clin Nutr*. 2014;99: 1184S-93S. doi: 10.3945/ajcn.113.073536.
19. Lawlis T, Torres SJ, Coates AM, Clark K, Charlton KE, Sinclair AJ, Wood LG, Devine A. Development of nutrition science competencies for undergraduate degrees in Australia. *Asia Pac J Clin Nutr*. 2019;28:166-76. doi: 10.6133/apjcn.201903_28(1).0022.
20. Wahlqvist ML. The clinical practice of food security. *Journal of the Australasian College of Nutritional and Environmental Medicine*. 2013;32:3.

Reproduced with permission of copyright owner. Further reproduction prohibited without permission.