

Is undergraduate nursing education sufficient for patient's nutrition care in today's pandemics? Assessing the nutrition knowledge of nursing students: An integrative review

Bobbi B. Laing^{a,*}, Jennifer Crowley^b

^a School of Nursing, Faculty of Medical & Health Sciences, University of Auckland, 85 Park Rd Grafton, Auckland, New Zealand

^b Discipline of Nutrition and Dietetics Faculty of Medical & Health Sciences, University of Auckland, 85 Park Rd, Grafton, Auckland, New Zealand

ARTICLE INFO

Keywords:

Nursing students
Education
Nutritional care
Nutrition
Nursing

ABSTRACT

Aim: To establish whether nurses are well prepared to provide nutrition care by identifying studies that evaluated undergraduate (baccalaureate) student nurses' nutrition knowledge, practices and selfcare and to identify areas for improvement.

Background: The importance of nutrition care in health is well recognised, with poor nutrition behaviour contributing to many million deaths annually and to less resilience to COVID 19. Nurses as the largest health professional group are ideally positioned to provide basic nutrition care.

Design: Integrative Review

Methods: Whittemore & Knaf'l's integrative review methodology guided this review. Appropriate search terms were used in seven databases (PubMed, Medline, Embase, ProQuest Nursing and Allied Health, the Royal College of Nursing Journals, Scopus) for Undergraduate nurses' nutrition knowledge during the period 2010–2020. The quality of the studies was assessed using the Mixed Methods Appraisal Tool.

Results: Of the 250 studies identified, ten studies met the inclusion criteria: seven studies also investigated nurses' eating patterns and health habits. Two themes emerged from data synthesis and analysis. Nursing students lack sufficient nutrition knowledge to develop the professional capacity to provide effective nutrition care to patients; nursing students' eating patterns and health habits suggest insufficient nutrition knowledge for appropriate selfcare.

Conclusion: Improvements in undergraduate nutrition care are required. Consideration should be given to the inclusion of nutrition experts to guide nurse educators to develop and implement innovative nutrition care programmes.

1. Introduction

The importance of nutrition in health and well-being is well recognised (Haddad et al., 2016). Globally, poor nutrition behaviour contributes to 11 million deaths annually which is apparent with the increased prevalence of non-communicable diseases (NCD's) and a high burden on health care and population health systems (Murray, 2019). Nutrition is central to treating many common conditions including heart disease and type-2 diabetes and increasingly plays a key role in building the immune response to viruses, such as COVID-19 (Calder, 2020; Bold et al., 2020). The impact of poor nutrition behaviour is also exacerbated among aging populations, where malnutrition is common (Griffin et al.,

2020).

In response to poor nutrition behaviour there have been efforts among nurse professional groups to improve nurses' nutrition knowledge and develop educational resources to provide nutrition care (Nursing and Midwifery Board of Ireland NMBI, 2015; Ministry of Health, 2017; Nursing and Midwifery Council (UK), 2018). Nutrition care is defined as any practice that aims to improve the dietary intake of patients to improve their health outcomes (Cardenas et al., 2019). Despite endeavours to provide basic effective nutrition care in health-care settings, delivery remains challenging. This is related to pressures in health systems, (Gillis et al., 2019), nurses' beliefs about their responsibilities and other health professionals' views (Mitchell et al.,

* Corresponding author.

E-mail addresses: b.laing@auckland.ac.nz (B.B. Laing), j.crowley@auckland.ac.nz (J. Crowley).

<https://doi.org/10.1016/j.nepr.2021.103137>

Received 26 April 2021; Received in revised form 13 June 2021; Accepted 27 June 2021

Available online 29 June 2021

1471-5953/© 2021 Elsevier Ltd. All rights reserved.

2018). However, recognising the pivotal role of nutrition care in health and disease is essential for all health professionals to ensure nutrition is integrated in clinical practice (Calder, 2020).

1.1. Nurses' role in nutrition care

As the largest group among health professionals, (Polat et al., 2016), nurses are ideally positioned to manage and support patients' basic nutrition care needs in their different work settings and cultures. In hospitals, this may include feeding difficulties, dehydration and/or malnutrition (Volkert et al., 2019) which if left uncorrected contributes to lengthened hospital stays and increased risk of mortality (Theilla et al., 2015). Currently, nutrition status among COVID-19 patients is assessed to measure resilience towards destabilisation (Aman and Masood, 2020). Destabilisation is related to the contributing role of vitamins and minerals to the body's immune defence against pathogens (such as vitamins A, B₆, B₁₂, folate, C, D, E,) and trace minerals zinc, copper, selenium, iron (Birgisdottir, 2020; Calder, 2020). In community settings, nurses are expected to provide nutrition counselling to people with non-communicable diseases (Vasiloglou et al., 2019). However, Chao et al. (2020) report that undergraduate nurses are often not taught this. Post registration education programs are needed to increase their confidence and willingness to provide nutrition care (Vasiloglou et al., 2019; Chao et al., 2020). Currently, nursing registration scopes of practice assume that nutrition care is already embedded in nurses' knowledge and clinical skillset before entering professional practice (Nursing and Midwifery Council (UK), 2010); Ministry of Health (New Zealand), 2017). This suggests a disconnect between nursing students' undergraduate nutrition education and the nutrition care they are

expected to apply as graduates to their clinical practice (Scammell, 2017; Chao et al., 2020).

2. Aims and methods

2.1. Aims

To establish whether nursing students' nutrition knowledge and practices, including selfcare, prepare them for the role of providing nutrition care and to identify areas for improvement in nutrition education.

2.2. Design

The integrative review method was selected as it allows qualitative, quantitative and mixed methods studies to be included. To ensure a systematic approach, Whittemore and Knafli's (2005) five stages (problem identification, the literature search, data evaluation, data analysis and presentation of the findings) were followed, along with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (Moher et al., 2009) (Fig. 1). The two investigators (BL and JC) screened the titles and abstracts independently using the inclusion and exclusion criteria written below.

2.3. Search strategy

The search strategy used the SPIDER design (Table 1). From this, key word searches were developed. These included: "student nurse", "undergraduate nurse", "baccalaureate education", "nutrition knowledge",

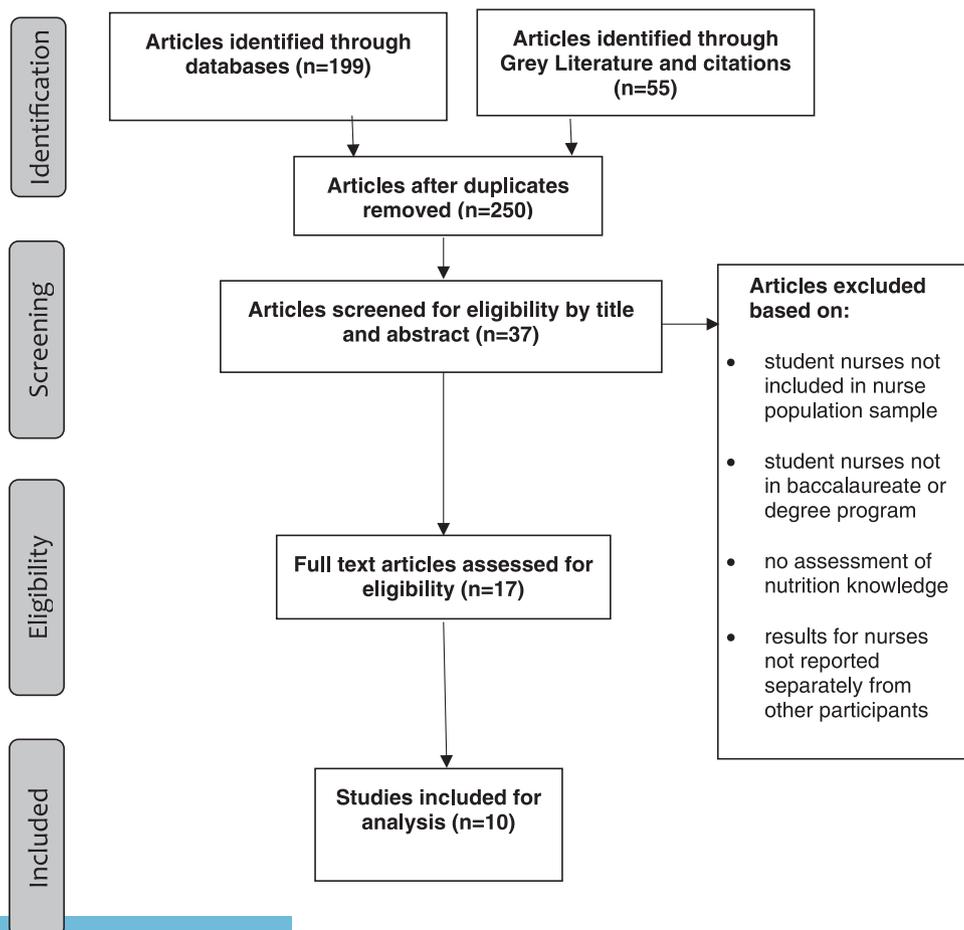


Fig. 1. Flow chart of search strategy and results.

Table 1
Spider design.

Spider	
S-Sample	Nursing students in an undergraduate / baccalaureate nursing programme.
PI-Phenomenon of Interest	Student Nurses nutrition knowledge and Selfcare
D-Design	All designs
E-Evaluation	Synthesis of studies evaluating on student nurses nutrition knowledge
R-Research Type	Qualitative, quantitative and mixed methods.

“healthy eating”, “alternative nutrition evaluation” and “pre-test”, “post-test” and “before-and-after effect”. With health librarian assistance, identical search terms were used in seven databases (PubMed, Medline, Embase, ProQuest Nursing and Allied Health, the Royal College of Nursing Journals, Scopus) along with the Boolean operators “AND” and “OR” and the asterisk (*) for alternative headings. Medical subject headings were used for PubMed and MEDLINE.

2.4. Inclusion and exclusion criteria

Inclusion criteria: all empirical, full-text studies in English from 2010 to 2020 that examined any aspect of recently graduated or current nursing students’ nutrition knowledge, attitudes, clinical skills and selfcare; data on nursing students was distinguishable from other health disciplines. Exclusion criteria: nursing students not included in the nurse population sample; nursing students not in a baccalaureate or degree programme; no assessment of nutrition knowledge.

2.5. Search results

Following removal of duplicate studies, 250 articles were identified. Titles and abstracts were reviewed using the above inclusion and exclusion criteria, which left 37 eligible studies. Full texts of these studies were scrutinised, and ten studies remained (Fig. 1).

3. Qualitative assessment and synthesis

3.1. Quality assessment

The Mixed Methods Appraisal tool (MMAT) was used to assess the quality of the studies. The MMAT allows for simultaneous evaluation of all empirical literature qualitative, quantitative and mixed methods studies, making it appropriate for an integrative review. The tool involves four questions which are answered as Yes, No or Unclear. A 0 was given for meeting none of the five criteria and (*****) given for meeting all criteria (Table 2). It is user friendly and has high intra-class correlation (Hong et al., 2018). Agreement was reached for 90% of the appraised items. Discussion resolved any differences in scoring. Studies determined as lower were not excluded but methodological issues were identified in the results.

3.2. Data extraction

To provide a synopsis of the studies, data were extracted by one author and placed in a table using the following headings: author, year, country, aim, participants and design, outcome measures, findings. Study limitations and quality ratings were added later. To ensure accuracy, the second author cross-checked the extracted data with the full text of each study.

3.3. Data analysis/synthesis

To discern differences in content, the studies were read several times. The methods data on nursing students’ nutrition knowledge and

practices, including selfcare and results of any educational interventions aimed at improving nutrition care were highlighted, colour coded, then tabulated. Differences in methodologies and interventions were then reassessed and categorised. This enabled relationships and themes of the studies to emerge and allowed the researchers to move from an overview of individual studies to identification of themes relevant to the research objectives. (Whittemore and Knafli’s, 2005). Synthesis of the studies provided an integrated summary of nursing students’ nutrition knowledge and practices from which areas for improvement in nursing students’ nutrition education were identified.

4. Results

4.1. Descriptive characteristics of included papers

The included studies published between the years 2010–2017 were from: Europe (n = 4), Africa (n = 3), Asia-Pacific (n = 3). All studies assessed nursing students’ nutrition knowledge and seven studies used descriptive cross-sectional quantitative surveys (Table 2). Dietary and lifestyle habits were investigated using the Health Promotion Lifestyle Profile Scales survey in two studies, or structured interviews in another study and two studies used 3-day food records or 24-hour food recalls. One study also assessed confidence in counselling lifestyle modification. Three studies used education interventions with two using quantitative pre-and-post-test designs. One intervention study included anthropometric measures and the other two intervention studies measured changes in lifestyle factors (Table 2).

4.2. Identified themes

Two themes emerged from the analysis and synthesis of the data: nursing students lack sufficient nutrition knowledge to develop the professional capacity to provide effective nutrition care to patients; nursing students’ eating patterns and health habits indicate insufficient nutrition knowledge for appropriate selfcare.

4.2.1. Nurse students have insufficient nutrition knowledge

In assessing nursing students’ nutrition knowledge (Table 2), three studies identified limitations in nursing students’ knowledge, such as fragmented nutrition knowledge and lack of food composition knowledge (Lee et al., 2017; Yfanti et al., 2011; Van den Berg et al., 2012). These findings were based on the results of structured nutrition knowledge questionnaires designed specifically for each study and included a closed type format in two studies (e.g. Yes/No/Don’t know) and an open-ended answer format in the third study. In one of the two intervention studies, nutrition knowledge was measured by using open-ended questions. In the other intervention study, the nutrition component (from the Health-Promoting Lifestyle Profile-I questionnaire) was measured by responses to questions on nutrition for which the answers were given on a 4-point Likert scale ranging from 1 (never) to 4 (routinely). From these intervention studies gaps in nursing students’ nutrition knowledge base were identified regardless of the nutrition education received (Chepulis and Mearns, 2015; Kara, 2015). In one study, nutrition knowledge was measured by a validated questionnaire where only 36% of final year nursing students achieved good scores (60–79%). The remainder had mediocre (49–59%) or poor scores (<40%). In this study, nursing students’ overall nutrition knowledge scores and comparative mean knowledge scores were lower than that of other health groups (Parker et al., 2011). In only one study, where nursing students were educated about healthy weight, were increases in nutrition knowledge reported (Lee et al., 2017).

4.2.2. Nursing students’ eating patterns and health habits indicate insufficient nutrition knowledge for appropriate selfcare

Seven studies investigated nursing students’ eating patterns and health habits (Table 2). Lee et al. (2017), explored nursing students’

Table 2
Description of included studies (n = 10) in date order.

	First Author, Year & Country	Aim	Participants and Design	Outcome Measures	Findings	Limitations	Quality Rating
1.	Lee, 2017, China	To identify current NK, body-related perspectives, and weight control behaviours.	Participants: Korean NS mostly in 2nd-3rd years Age: 20.5 years (mean) Sample: n = 40 Gender: female= 95% Design: Education intervention. Data collected: anthropometric & demographic measures, weight control attempts & methods, current body size & satisfaction, sources of weight control and NK.	Difference in scores in pre and post-tests in questionnaires; anthropometric measures	Weight: 78.9%-normal; 7.9%-under; 7.95%-over; 5.3%-obese. 2/3rds dissatisfied with body size; Unhealthy wt. control methods-60%: laxatives/ diuretics-91.75%, saunas/ spas-87.5%, one food diet-79.2%; NK increased by 24 points after education programme. Nutrition programs needed to target healthy weight control & body related perspectives.	No control group, Survey instrument not validated, study size < 100.	****
2.	Polat, 2016, Turkey	To determine health promotion behaviours.	Participants: NS 1st-4th year Age: 20.9 years (mean) Gender: female = 90.2% Sample: n = 245 Design: descriptive cross-sectional quantitative survey-questionnaire with 15 demographic questions and HPLP-II	Scores in HPLP-II	Mean NK scores for 3rd year sig. higher than other years (p < 0.5). Subscale scores were sig. higher in those with regular health checks p < 0.5. Higher scores in students with diagnosed long term health problems (p < 0.5). Interventions needed to enhance health promoting behaviours in all years of the programme.	60% response rate.	***
3.	Kara (2015), Turkey	To examine the long-term effects of an education intervention on improving health behaviour.	Participants: NS 1st-4th year Age: 18.2 years. Sample: n = 108 Gender: Female Design: Educational Intervention using HPLP-1 questionnaire.	Changes in Health behaviours at pre-test, post-test and after 3 years using the HPLP-1	NK score increased at post-test (p = 0.001) but three years later was lower than post-test (< 0.05). The intervention was partially effective over the long term. Integration of health behaviours within the nursing curriculum is needed.	Convenience sampling	****
4.	Park, 2015 Korea	To study the dietary intakes patterns, and health behaviours in relation to obesity and osteoporosis.	Participants: NS 1st-4th years Age: 20.6 years (mean) Sample: n = 160 Gender: Female Design: Cross sectional study. NK questionnaire, 3-day food diary, demographic questions (based on Pender's Health promotion model), BMD, anthropometric measures.	Scores in knowledge & lifestyle questionnaires, 3- day food diary, 24- hour diet recall, BMI, BMD	NS deficient in vitamin D (65%) and calcium (52.5%). Excessive intakes: cholesterol (53.8%); sodium (85.6%). Alcohol consumed (73.8%) current smokers (1.3%). Overweight (21.3%); no regular exercise (63.1%). BMD-20% below normal. Tailored strategies and education needed to narrow the gap between NK and practice.	Survey instrument not validated.	****
5.	Chepulis, 2015, New Zealand	To assess NK after nutrition education & identify NK gaps.	Participants: NS 1st-2nd year. Age: N/A Sample: Intervention n = 140 Control group= 57 Gender: N/A Design: Education Intervention. Convenience sample. Demographic data & NK survey with 30 Q multi-choice plus questions.	Scores from multi-choice nutrition survey between different groups.	Low mean- 52.5%-NK scores. Intervention-60.5%. Sig. gaps in knowledge exist even in those in intervention. More NK is needed in NS education programs tailored to ethnicity.	Survey instrument not validated, convenience sampling.	**
6.	Evagelou, 2014, Greece	To explore dietary habits.	Participants: NS Age: N/A Sample: n = 435-convenience Gender: female= 83.4% Design: descriptive cross-sectional quantitative survey, self-report, NK questionnaire with 18 open questions and demographic questions	Questionnaire scores	NS move away from a traditional Mediterranean diet during their undergraduate years. Health promotion programs should be encouraged in nursing curriculum to establish healthier lifestyles in undergraduate NS.	Survey instrument not validated, convenience sample.	**
7.	Buxton, 2013, Ghana	Assess NK and identify differences between those with diplomas/ those without/ those	Participants: NS 3rd-4th years Age: 25–34 years: 84.3%; > 44years:3.6% Sample: n = 166 Gender: female= 68.7%	Scores in nutrition tests between different groups.	Participants nutrition was reported as good (3.6%), adequate (62.7%) and	Survey instrument not validated, 64% response rate.	**

(continued on next page)

Table 2 (continued)

First Author, Year & Country	Aim	Participants and Design	Outcome Measures	Findings	Limitations	Quality Rating
8. Van den Berg, 2012 South Africa	who completed nutrition courses. Assess NK, weight status and eating practices.	Design: Descriptive cross-sectional study with modified version of an existing NK questionnaire. Participants: NS 1st-4th year Age: 18–42 years Sample: n = 161 Gender: female: 68.3% Design: Descriptive cross-sectional study. Measures: BMI, waist and hip circumference; A structured NK questionnaire, 24-hour diet recall	NK, eating practices, association of NK and eating practices with body weight of NS	inadequate (33.7%). NS need more training in NK. A high occurrence of overweight, obesity, poor eating habits and insufficient NK among the nursing students. This limits their efficacy as future role models of health to the public.	Survey instrument not validated.	***
9. Yfanti, 2011 Greece	To assess NK.	Participants: 1st-4th year NS Age: 20 ± 0.3 years (mean) Sample: n = 506 Gender: female= 78.3% Design: descriptive cross-sectional quantitative survey. A NK questionnaire and dietary habits with closed type questions.	Questionnaire scores	Limitations in NK, which is fragmented. Perception of diet values distorted. Improved NK would contribute to adoption of healthy dietary habits by both medical professionals and the general public.	Survey instrument not validated, response rates: 12.9–17.0%/same semester	****
10. Parker 2011 South Africa	To evaluate NK and health promotion practices of public sector primary care health professionals and final year HP students.	Participants: Public sector primary care health professionals and final year students from four tertiary institutions. Age: NA Sample: Health professionals: n = 223, (Stratified random sampling in 30 Primary care facilities) Subsample interviewed: n = 14, convenience sampling for students in four tertiary institutions with medical/nursing programs. NS: n = 179 MS: n = 294 Patients: n = 580 Gender: NA Design: Comparative, multi-centred cross-sectional, descriptive quantitative study. Questionnaires: NK & confidence in counselling.	Questionnaire scores and confidence in counselling.	Knowledge: <10% of students and health professionals achieved 80% or higher; 60% NS had poor or mediocre scores (56% & 55%). HP and students were confident or very confident (24% & 20%) to counsel patients. Suitable training modules in lifestyle management are needed during undergraduate training for HPs, HP students and NS.		*****

Legend: BMI = Body Mass Index, BMD = Bone Mineral Density, NS = Nursing Students, HP = Health Professionals, HPLP-I = Health Professional Lifestyle Practices-I, HPLP-II = Health professional lifestyle practices-II. MS=Medical students, NA = not available, NK = nutrition knowledge Sig.=significant/significantly.

body related perspectives and weight control behaviours using closed questions. Over 60% of nursing students were dissatisfied with their current body size despite 75% being classified within the normal body weight range. Weight control methods used included laxatives, diuretics (91.7%) saunas or spas (87.5%) and a one-food diet (79.2%). Two studies examined healthy lifestyle behaviours of nursing students in different stages of their undergraduate training using either the Health Promotion Lifestyle Profile Scales (HPLPS)-I or HPLPS-II, which included Body Mass Index, smoking, alcohol intake, exercise habits, health responsibility, nutrition knowledge, spiritual growth, interpersonal relations and stress management. In the study by Polat et al. (2016), nursing students' scores for these criteria improved with increasing age and higher socio-economic status. In this same study, higher scores for health responsibility were also identified among students experiencing non-communicable diseases (26.1%). In the study by Kara (2015), following pre-and-post-testing of an educational intervention and a three year follow up, significant improvements in total healthy lifestyle behaviours were reported (p < 0.001). Significant improvements were also reported in subscales scores at three time points: (health responsibility (p < 0.01); self-actualisation (p < 0.043); nutrition (p < 0.001); exercise (p < 0.007) and stress management p < 0.001). Two studies investigated nursing students' health habits and eating patterns. In the study by Evagelou et al. (2014), which included open and closed questions it was identified that taste rather than healthiness was the major determinant for food choice. The study by Park et al. (2015), examined nursing students' health behaviours in

relation to obesity and bone mineral density. Students completed food diaries detailing all ingredients included in dishes consumed on two weekdays and one week-end day, using serving sizes based on plastic food models and pictures. Anthropometric and bone density measures were taken, and information was recorded about students alcohol intake, cigarette smoking and exercise patterns. Many students had vitamin D and calcium deficiencies (65% and 52.5% respectively) and displayed excessive cholesterol and sodium intakes (53.8% and 85.6% respectively). Nursing students unhealthy dietary and health habits included night-time snacking, excessive use of caffeinated drinks especially coffee, low milk intake and lack of exercise. In the study by Van den Berg, et al. (2012), from the measures of BMI, waist and hip circumference and a 24 h food recall, it was found that 92% of nursing students consumed less than two daily servings of dairy products or milk, 65% had waist measurements that exposed them to risk of insulin resistance and 35% were at high risk for non-communicable diseases.

5. Discussion

This integrative review identified deficiencies in nursing students' nutrition knowledge and health practice. This was illustrated in the results that varied in the assessment method used and demonstrated that there are gaps in nurses' nutrition knowledge. Despite the centrality of nutrition to a healthy lifestyle, nursing students are not developing sufficient professional capacity to provide nutrition care to patients or for themselves. This is of concern because nursing students' future roles

include: assessing patients' nutrition needs such as identifying malnutrition associated with frailty in older people; supporting patients' healthy dietary behaviours to achieve public health targets for reduced incidence of non-communicable diseases; providing strategies to patients to improve their immune response to viruses like COVID-19 and identifying patients requiring referral for specialised nutrition care. It is also important that nurses, as role models, practice healthy eating behaviours to improve their own resilience and immunity and reduce their risk of non-communicable diseases.

In the USA, patient surveys indicate inadequate nutrition care in hospital and community settings with few patients receiving nutrition counselling (Hargrove et al., 2017; Sacks, 2017; Chao et al., 2020), even though it is recommended that nutrition is an essential component of the baccalaureate programme (American Association of Colleges of Nursing, 2016). Similarly, in acute hospitals in the UK inadequate nutrition care still occurs with insufficient nutrition knowledge identified as a cause (Morison et al., 2010; Scammell, 2017). This suggests that in the USA and the UK, undergraduate nutrition education may not adequately prepare nursing students to apply appropriate nutrition care in clinical practice (Chao et al., 2020) or meet pre-registration standards for the essential skill cluster 'nutrition and fluid intake management (NMC, 2010). This is of concern, given the significance of nurse's role in dealing with global pandemics such as COVID-19 where resilience to infection is affected by nutritional status (Aman and Masood, 2020; Birgisdotir, 2020; Calder, 2020). Additionally, given the increasing number of older people worldwide for whom under-nutrition is often under diagnosed, improving their nutrition and decreasing weight loss will reduce the incidence of frailty in this group (Roberts et al., 2019). Recent reports and this integrative review highlight the need to reappraise nutrition education in undergraduate nursing programs and find creative ways to incorporate nutrition education more effectively into the curriculum.

Improvements in nutrition education can be achieved by innovative approaches to scaffold current undergraduate education, with evidence-based nutrition education to reinforce the impact of positive health behaviours for long-term good health (Burch et al., 2017). One innovative approach to increase medical students' knowledge and confidence to provide nutrition care was accomplished by increasing students' awareness and appreciation of diet in their own personal health to better prepare them to overcome barriers patients experience consuming a healthy diet (Frank et al., 2007; Aspry et al., 2018). This approach could equally apply to nursing students. Another education programme trialled in low socioeconomic areas integrated learning with culinary skills. This benefited patients through improved quality of care and social equity and provided evidence for reduced health system costs (Monlezun et al., 2018). Nutrition electives and brief nutrition courses have also been shown to improve medical students' nutrition knowledge and confidence in nutrition counselling (Crowley et al., 2019).

Nursing students can learn how to apply their nutrition knowledge in pathophysiology lectures and small group learning modules, which are known to assist student learning (Burgess et al., 2020). Discussions could include nutritional causes, biochemical interactions and potential treatments of chronic lifestyle diseases (Schoendorfer and Schafer, 2015). Role plays of case studies can be included in small group activities using assessment tool such as REAP (Rapid Eating and Activity Assessment for Patients) and WAVE (Weight, Activity, Variety and Excess) (Johnston et al., 2018). Interactive components to lectures are known to enhance learning (Tuma, 2021) and the use of digital technology such as clickers, to answer multichoice questions posed in lectures is effective use of technology (Schoendorfer and Schafer, 2015). Blended learning tools using evidence based online resources like webinars, wikis and/or podcasting and the use of virtual strategic partnerships are helpful. Information technology-empowered learning needs to be developed and trialled for innovative nutrition education to be incorporated in the health care curriculum (Kris-Etherton et al., 2015).

Nursing students' nutrition education also needs other components

to develop nurses' skills in: conducting nutrition-related conversations with patients in different cultural settings, (Alpers, 2019); promoting nutrition strategies to improve immune response to viruses such as COVID-19; accessing evidence based nutrition care information; and referring patients to nutrition experts (Aspry et al., 2018). Other recent recommendations to enhance nutrition care education also emphasise the need for competency-based curricula and a shift toward early integration of clinical applications (Frenk et al., 2010; Aspry et al., 2018). Additionally there is a need for inter-professional and team-based education, for nurse students to become effective team members in providing nutrition care (Nursing and Midwifery Board of Ireland NMBI, 2015; Ministry of Health, 2017; Nursing and Midwifery Council, 2018). These teams could be led by nutrition experts to guide the development and implementation of undergraduate nutrition care education, (Crowley et al., 2020) and supervise clinical practice in nutrition care. This would provide opportunities for nurse students to discuss nutrition and diet with patients, (O'Connell et al., 2018); increase their ability to implement nutrition strategies that would improve patients and nurses' own immune response to viruses like the COVID-19 virus and teach patients the skills needed to prevent and/or manage non-communicable diseases. It is essential to evaluate nursing students' communication and counselling skills throughout undergraduate education to reinforce the importance of nutrition care and increase their ability and willingness to provide nutrition care in the context of patients and family cultures (DiMaria-Ghalili et al., 2016; Monlezun et al., 2018).

Finally, there is a need for international consensus on standards for nutrition education and its integration into clinical practice to provide nutrition care appropriately in a range of multi-sectoral and multi-cultural settings (Aspry et al., 2018; Alpers, 2019). Currently there are no international standards and the scope of practice for nurses varies among countries (Nursing Council of New Zealand, 2020). This is especially relevant when graduate nurses choose to work in countries other than their country of undergraduate training. If there is an expectation from Nursing Councils and Nursing Registration Boards (Nursing and Midwifery Council, 2010; Ministry of Health, 2017; Balmer et al., 2020) that nutrition care is embedded in nurses' knowledge and clinical skillset before entering professional practice, there also needs to be more institutional commitment from Nursing Councils.

6. Limitations

This integrated review has some limitations. Studies relevant to this review may be excluded because they did not match keywords used or meet the inclusion criteria. The methodological quality in the reviewed studies varied between ** (n = 3), *** (n = 1), **** (n = 5) and ***** (n = 1) (Table 2). In seven studies, survey instruments were not validated, possibly because of expense (Hooson et al., 2020).

A strength of this integrative review was that the included studies assessed nutrition knowledge and several assessed nursing students' selfcare. Eighty percent of the sample sizes contained more than 100 nursing students.

7. Conclusion

This integrative review has implications for education, nursing practice and research. Current nutrition education in undergraduate nursing education is insufficient to meet the needs of nurses as future health professionals to provide nutrition care appropriate to the needs of patients or themselves. To increase nurses' professional capacity to support patients, their own long-term health and address current nutrition challenges, such as the COVID-19 virus, consideration should be given to the use of nutrition experts to guide nurse educators to develop and implement innovative nutrition care programs. Future research could include the views of nursing students, nurses and nurse educators and with greater emphasis on nutrition curriculum initiatives.

Ethics approval and consent to participate

Not applicable.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not for profit sectors.

CRedit authorship contribution statement

Both authors contributed to: Conceptualization; Data curation; Formal analysis; Methodology; Visualization; Roles/Writing - original draft; Writing - review & editing.

Declaration of Competing Interest

Conflicts of interest: none.

Acknowledgements

We would like to acknowledge Dr Lauren Ball, Griffith University, and Deborah L Raphael, University of Auckland for their advice regarding the structure of the review.

Funding sources

No external Funding.

References

- Alpers, L.M., 2019. Hospital food: When nurses' and ethnic minority patients' understanding of Islamic dietary needs differ. *Nurs. Open* 6 (4), 1455–1463. <https://doi.org/10.1002/nop.2.343>.
- Aman, F., Masood, S., 2020. How Nutrition can help to fight against COVID-19 Pandemic. *Pak. J. Med. Sci.* 36, 121. May;36(COVID19-S4).
- American Association of Colleges of Nursing., 2016. The essentials of baccalaureate education for professional nursing practice. (<https://www.aacnursing.org/portals/42/publications/bacessentials08.pdf>) (accessed 21 January 2021).
- Aspry, K.E., Van Horn, L., Carson, J.A.S., Wylie-Rosett, J., Kushner, R.F., Lichtenstein, A. H., Kris-Etherton, P., 2018. Medical nutrition education, training and competencies to advance guideline-based diet counseling by physicians: A science advisory from the American heart association. *In: Circulation*, 137, pp. e821–e841. <https://doi.org/10.1161/CIR.0000000000000563> (Article).
- Balmer, D., King, A., Moloney, W., Moselen, E., Dixon, R., 2020. Nursing students and health literacy: The effect of region and programme level. *Nurse Educ. Pract.* 42, 102688 <https://doi.org/10.1016/j.nepr.2019.102688>.
- Birgisdottir, B.E., 2020. Nutrition is key to global pandemic resilience. *BMJ Nutr. Prev. Health* 3 (2), 129–132. <https://doi.org/10.1136/bmjnph-2020-000160>.
- Bold, J., Harris, M., Fellows, L., Chouchane, M., 2020. Nutrition, the digestive system and immunity in COVID-19 infection (Fall). *Gastroenterol. Hepatol. Bed Bench* 13 (4), 331–340. <https://doi.org/10.22037/gghbb.v13i4.2094>.
- Burch, E., Crowley, J., Laur, C., Ray, S., Ball, L., 2017. Dietitians' perspectives on teaching nutrition to medical students. *J. Am. Coll. Nutr.* 36 (6), 415–421. <https://doi.org/10.1080/07315724.2017.1318316>.
- Burgess, A., van Diggele, C., Roberts, C., Mellis, C., 2020. Facilitating small group learning in the health professions. *BMC Med. Educ.* 20, 457. <https://doi.org/10.1186/s12909-020-02282-3>.
- Calder, P.C., 2020. Nutrition, immunity and COVID-19. *BMJ Nutr. Prev. Health* 3, 74–92 <https://doi.org/10.1136/bmjnph-2020-000085>.
- Cardenas, D., Bermudez, C., Echeverri, S., 2019. Is nutritional care a human right? *Clin. Nutr. Open Sci.* 26, 1–7 <https://doi.org/10.1016/j.cynex.2019.05.002>.
- Chao, A.M., Luong, V., Dowd, M., Compher, C., 2020. A national survey of faculty perceptions of Nutrition in Nursing Education *J Nurs Educ.*, 59(10):566–569 (<https://doi.org/10.3928/01484834-20200921-05>).
- Chepulis, L.M., Mearns, G.J., 2015. Evaluation of the nutritional knowledge of undergraduate nursing students. *J. Nurs. Educ.* 54 (9), S103–S106. <https://doi.org/10.3928/01484834-20150814-19>.
- Crowley, J., Ball, L., Wall, C., 2020. How does self-perceived nutrition competence change over time during medical training? A prospective longitudinal observational study of New Zealand medical students. *BMJ Nutr. Prev. Health* 3 (2), 270–276. <https://doi.org/10.1136/bmjnph-2020-000080>.
- Crowley, J., Ball, L., Hiddink, G.J., 2019. Nutrition in medical education: a systematic review. *Lancet Planet Health* 3 (9), e379–e389. [https://doi.org/10.1016/S2542-5196\(19\)30171-8](https://doi.org/10.1016/S2542-5196(19)30171-8). PMID: 31538623.
- DiMaria-Ghalili, R.A., Gilbert, K., Lord, L., Neal, T., Richardson, D., Tyler, R., Guenter, P., 2016. ASPEN Nurses Standards Revision Task Force, American Society for Parenteral and Enteral Nutrition. Standards of Nutrition Care Practice and Professional Performance for Nutrition Support and Generalist Nurses. *Nutr. Clin. Pract.* 31 (4), 527–547 <http://doi.org/10.1177/0884533616653835>.
- Evagelou, E., Vlachou, E., Polikandrioti, M., Koutelekos, I., Dousis, E., Kyritsi, E., 2014. Exploration of nursing students' dietary habits. *Health Sci. J.* 8 (4), 452 <http://hdl.handle.net/11400/4795> <https://www.hsj.gr/medicine/exploration-of-nursing-students-dietary-habits.pdf>.
- Frank, E., Elon, L., Hertzberg, V., 2007. A quantitative assessment of a 4-year intervention that improved patient counseling through improving medical student health. *Medgenmed: Medscape Gen. Med.* 9 (2), 58. (<https://pubmed.ncbi.nlm.nih.gov/17955112/>). PMID: PMC1994883.
- Frenk, J., Chen, L., Bhutta, Z.A., Cohen, J., Crisp, N., Evans, T., Finegrun, H., Garcia, P., Ke, Y., Kellay, P., Kistnasamy, B., Meleis, A., Naylor, D., Pablos-Mendez, A., Reddy, S., Scrimshaw, S., Sepulveda, J., Serwadda, D., Zurayk, H., 2010. Health professionals for a new century: Transforming education to strengthen health systems in an interdependent world. *Lancet* 376 (9756), 1923–1958 [https://doi.org/10.1016/S0140-6736\(10\)61854-5](https://doi.org/10.1016/S0140-6736(10)61854-5).
- Gillis, C., Martin, L., Gill, M., Gilmour, L., Nelson, G., Gramlich, L., 2019. Food Is Medicine: A Qualitative Analysis of Patient and Institutional Barriers to Successful Surgical Nutrition Practices in an Enhanced Recovery After Surgery Setting. *Nutr. Clin. Pract.* 34 (4), 606–615. <https://doi.org/10.1002/ncp.10215>.
- Griffin, A., O'Neill, A., O'Connor, M., Ryan, D., Tierney, A., Galvin, R., 2020. The prevalence of malnutrition and impact on patient outcomes among older adults presenting at an Irish emergency department: a secondary analysis of the OPTI-MEND trial. *BMC Geriatr.* 20, 455. <https://doi.org/10.1186/s12877-020-01852-w>.
- Haddad, L., Hawkes, C., Webb, P., Thomas, S., Beddington, J., Waage, J., Flynn, D., 2016. A new global research agenda for food. *Nature* 540 (7631), 30–32. <https://doi.org/10.1038/540030a>.
- Hargrove, E.J., Berryman, D.E., Yoder, J.M., Beverly, E.A., 2017. Assessment of nutrition knowledge and attitudes in preclinical osteopathic medical students, 2017 *J. Am. Osteopath Assoc.* 117 (10), 622–633. <https://doi.org/10.7556/jaoa.2017.119>.
- Hooson, J., Hutchinson, J., Warthon-Medina, M., Hancock, N., Greathhead, K., Knowles, B., & Cade, J.E., 2020. A systematic review of reviews identifying UK validated dietary assessment tools for inclusion on an interactive guided website for researchers: www.nutritools.org. *Critical reviews in food science and nutrition*, 60 (8), 1265–1289. <https://doi.org/10.1080/10408398.2019.1566207>.
- Hong, Q.N., Fabregues, S., Bartlett, G. et al. Boardman, F., Cargo, M., Dagenais, P., Gagnon, M-P., Griffiths, F., Nicolau, B., O' Cathain, A., Rousseau, M-C., Vedel, I., Pluye, P., 2018. The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. *Education for Information*, 34 (4). pp. 285–291. ISSN 0167–8329 (<https://doi.org/10.3233/EFI-180221>).
- Johnston, C.S., Bliss, C., Knurick, J.R., Scholtz, C., 2018. Rapid Eating Assessment for Participants [shortened version] scores are associated with Healthy Eating Index-2010 scores and other indices of diet quality in healthy adult omnivores and vegetarians. *Sep 28 Nutr. J.* 17 (1), 89. <https://doi.org/10.1186/s12937-018-0399-x>.
- Kara, B., 2015. The efficacy of an educational intervention on health behaviors in a sample of Turkish female nursing students: A longitudinal, quasi-experimental study. *Nurse Educ. Today* 35 (1), 146–151. <https://doi.org/10.1016/j.nedt.2014.08.015>.
- Kris-Etherton, P.M., Akabas, S.R., Douglas, P., Kohlmeier, M., Laur, C., Carine M Lenders, C.M., Levy, M.D., Nowson, C., Ray, S., Pratt, C.A., Seidner, D.L., Saltzman, E., 2015. Nutrition Competencies in Health Professionals' Education and Training: A New Paradigm. *Adv. Nutr.* 6 (1), 83–87. <https://doi.org/10.3945/an.114.006734>.
- Lee, J., Jin, M., Son, H., Cui, W., 2017. Body-related perspectives and weight control methods of Korean-Chinese nursing school students in Yanbian, China: A pilot study. *Osong Public Health Res Perspect.* 8 (4), 275–281. <https://doi.org/10.24171/j.phrp.2017.8.4.08>.
- Ministry of Health (New Zealand), 2017. Nursing scopes of practice. (<https://www.health.govt.nz/our-work/nursing/nurses-new-zealand/nursing-scopes-practice>).
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., 2009. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Ann. Intern. Med.* 151 (4), 264–269 <https://doi.org/10.1002/9781118118715598>.
- Monlezun, D.J., Dart, L., Vanbeber, A., Smith-Barbaro, P., Costilla, V., Samuel, C., Terregino, C.A., Abali, E.E., Dollinger, B., Baumgartner, N., Kramer, N., Seelochan, A., Taher, S., Deutchman, M., Evans, M., Ellis, R.B., Oyola, S., Maker-Clark, G., Dreibelis, T., Harlan, T.S., 2018. Machine learning-augmented propensity score-adjusted multilevel mixed effects panel analysis of hands-on cooking and nutrition education versus traditional curriculum for medical students as preventive cardiology: Multisite cohort study of 3,248 trainees over 5 years. *Biomed Res Int.* <https://doi.org/10.1155/2018/5051289>.
- Mitchell, H., Lucas, C., Charlton, K., McMahon, A., 2018. Models of nutrition-focused continuing education programs for nurses: a systematic review of the evidence. *Aust. J. Prim. Health* 24 (2), 101–108. <https://doi.org/10.1071/PY17088>.
- Morison, S., Machniewski, S., Purdy, J., Carlisle, K., Rea, M., Coleman, D., 2010. Exploring the Nutritional Needs of Older People in a Hospital Environment: The Educational Perspective. Report for the Belfast: Changing Ageing Partnership. (<http://pure.qub.ac.uk/en/publications/exploring-the-nutritional-needs-of-older-people-in-a-hospital-env>) (accessed 21 January 2021).
- Murray, C.J., 2019. Health effects of dietary risks in 195 countries, 1990–2017: A systematic analysis for the global burden of disease study. *Lancet* 393, 1958–1972. [https://doi.org/10.1016/S0140-6736\(19\)30041-8](https://doi.org/10.1016/S0140-6736(19)30041-8).
- Nursing Council of New Zealand 2020. Standards and guidelines for nurses (NCSZ) http://www.nursingcouncil.org.nz/Public/Nursing/Standards_and_guidelines/NCSZ/nursing-section/Standards_and_guidelines_for_nurses.aspx.

- Nursing and Midwifery Board of Ireland (NMBI), 2015. Scope of nursing and midwifery practice framework. (<https://www.nmbi.ie/Standards-Guidance/Scope-of-Practice/Nursing-Practice-Scope-Definition>).
- Nursing and Midwifery Council, 2010. Essential Skills Clusters (2010) and Guidance for Their Use. (<https://www.nmc.org.uk/globalassets/sitedocuments/standards/nmc-standards-for-pre-registration-nursing-education.pdf>) (accessed 21 January 2021).
- Nursing and Midwifery Council, Standards of proficiency for registered nurses. 2018. (<https://www.nmc.org.uk/standards/standards-for-nurses/standards-of-proficiency-for-registered-nurses/>).
- O'Connell, M.B., Jensen, P. S. andersen, S.L., Fernbrant, C., Nørholm, V., Petersen, H.V., 2018. Stuck in tradition-a qualitative study on barriers for implementation of evidence-based nutritional care perceived by nursing staff. *J. Clin. Nurs.* 27 (3–4), 705–714. <https://doi.org/10.1111/jocn.14020>.
- Park, D., Choi-Kwon, S., Han, K., 2015. Health behaviors of Korean female nursing students in relation to obesity and osteoporosis. *Nurs. Outlook* 63 (4), 504–511. <https://doi.org/10.1016/j.outlook.2015.02.001>.
- Parker, W., Steyn, N.P., Levitt, N.S., Lombard, C.J., 2011. They think they know but do they? Misalignment of perceptions of lifestyle modification knowledge among health professionals. *Public Health Nutr.* 14 (8), 1429–1438. <https://doi.org/10.1017/S1368980009993272>.
- Polat, Ü., Özen, Ş., Kahraman, B.B., Bostanoğlu, H., 2016. Factors affecting health-promoting behaviors in nursing students at a university in turkey. *J. Transcult. Nurs.* 27 (4), 413–419. <https://doi.org/10.1177/1043659615569536>.
- Sacks, S.G., 2017. The Shrinking of formalised nutrition education in health professions curricula and postgraduate training JPEN J Parenter Enteral Nutr. 41(2):217–225. (<https://doi.org/10.1177/0148607116685049>). Epub 2017 Jan 5. PMID: 28058977.
- Roberts, H.C., Lim, S.E.R., Cox, N.J., Ibrahim, K., 2019. The challenge of managing undernutrition in older people with frailty. *Nutrients* 11 (4), 808 <https://doi.org/10.3390/nu11040808>.
- Scammell, J., 2017. Food for thought: do student nurses have the knowledge and skills to deliver effective nutritional care? *BJN Education Matters* (<http://eprints.bournemouth.ac.uk/29102/1/finalbjn240217%20.pdf>) (accessed 21 January 2021).
- Schoendorfer, N., Schafer, J., 2015. Enabling valuation of nutrition integration into MBBS program. Article ID 760104 *J. Biomed. Educ.* 1–6. <https://doi.org/10.1155/2015/760104>.
- Theilla, M., Grinev, M., Kosak, S., Hiesmayr, M., Singer, P., nutritionday Israel Working Group, 2015. Fight against malnutrition: the results of a 2006–2012 prospective national and global nutritionday survey (Article). *Clin. Nutr. ESPEN* 10 (2), e77–e82. <https://doi.org/10.1016/j.clnesp.2015.01.002>.
- Tuma, F., 2021. The use of educational technology for interactive teaching in lectures. *ISSN 2049-0801 Ann. Med Surg. (Lond.)* Volume 62, 31–235. <https://doi.org/10.1016/j.amsu.2021.01.051>.
- Van den Berg, V.L., Okeyo, A.P., Dannhauser, A., Nel, M., 2012. Body weight, eating practices and nutritional knowledge amongst university nursing students, 4 Afr. J. Prim. Health Care Fam. Med 2012, 1. <https://doi.org/10.4102/phcfm.v4i1.323>.
- Vasiloglou, M.F., Fletcher, J., Poulia, K.A., 2019. Challenges and Perspectives in Nutritional Counselling and Nursing: A Narrative Review. *J. Clin. Med.* 8 (9), 1489. <https://doi.org/10.3390/jcm8091489>.
- Volkert, D., Beck, A.M., Cederholm, T., Cruz-Jentoft, A., Goisser, S., Hooper, L., Bischoff, S.C., 2019. ESPEN guideline on clinical nutrition and hydration in geriatrics. *Clin. Nutr.* 38 (1), 10–47. <https://doi.org/10.1016/j.clnu.2018.05.024>.
- Whittemore, R., Knaf, K., 2005. The integrative review: Updated methodology. *J. Adv. Nurs.* 52 (5), 546–553 <https://doi.org/10.1111/j.1365-2648.2005.03621.x>.
- Yfanti, E., Tsigira, S., Yfantis, A., Tiniakou, I., Mastrapa, E., 2011. Nutrition knowledge in students of a nursing school. *Health Sci. J.* 5 (2), 118 <http://hdl.handle.net/11400/1285>.

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