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RESEARCH ARTICLE

A two-day professional development workshop on advanced nutrition support increased Ghanaian nutrition and dietetic professionals' self-efficacy and practical knowledge of enteral and parenteral nutrition support

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Aims: Enteral and parenteral nutrition support (NS) improves clinical outcomes in critically ill patients, yet evidence from a needs assessment indicates that Ghanaian clinical nutrition practitioners (CNPs) have low self-efficacy in administering NS, especially parenteral nutrition. This study aimed to assess changes in knowledge and self-efficacy of Ghanaian CNPs on enteral and parenteral NS following a continuous professional development (CPD) workshop.
Methods: A one-group pre-test/post-test study was used. Remote workshops curated in July 2022 and designed to meet predetermined needs were delivered over two days by registered dietitians and certified nutrition support clinicians. CNPs' self-efficacy was assessed using a 5-point Likert scale. Practical knowledge was assessed using 7 short case scenarios for indications of enteral and parenteral NS, and open-ended questions were used to request additional qualitative information concerning self-efficacy scores. Paired-sample *t*-tests were used to compare pre- and post-survey scores, and qualitative data were thematized.
Results: Fifty-two participants completed both surveys. There were statistically significant increases in self-efficacy for enteral and parenteral NS delivery, including: assessing indications for enteral nutrition (EN) ($d = 0.62$ CI 0.30, 0.94); writing EN prescriptions ($d = 0.71$ CI 0.38, 1.04) and determining micronutrient additives for parenteral nutrition (PN) ($d = 1.07$ CI 0.70, 1.44) as well as increases in knowledge based on the practical case studies ($d = 0.29$ CI 0.01, 0.57). In-depth understanding of EN and PN guidelines and feelings of empowerment were identified as reasons for increased self-efficacy and practical knowledge.
Conclusion: CPD workshops are a good first step to bridge gaps in the delivery of NS by Ghanaian CNPs; however, additional practical training modules are needed to improve practitioners' competencies in the delivery of NS.

Keywords enteral nutrition, Ghana, nutrition support workshop, parenteral nutrition

Introduction

While the practice of modern-day dietetics is still emerging in Ghana, its origins date back to the early 1960s when foreign-trained dietitians gradually began to replace catering officers as the main professionals recognised to provide dietary services to patients in the hospital setting.[1] In 1998, efforts to improve the low dietitian-to-patient ratios had begun, and by 2012 dietetics as a profession had become more formalised in Ghana, with three of the major public universities in the country offering dietetics training at the undergraduate and/or graduate level.[1] Currently, five universities across the country provide nutrition and dietetics training; however, as with other schools outside of Ghana, none of these institutions offer a focus on or specialisation in nutrition support (verbal communication with Vice-President of the Ghana Academy of Nutrition and Dietetics, and a Senior Lecturer at the University of Ghana).

Around the world, training in enteral (EN) and parenteral nutrition (PN) is usually achieved on the job.[2] Ghanaian dietitians are therefore expected to receive some exposure to nutrition support (NS) through clinical rotations and in-service training. However, a needs assessment study conducted as part of this project found that most of the student participants reported limited exposure to enteral and parenteral nutrition support on clinical rotations.[3] In this needs assessment survey, less than 50% of respondents who indicated that their facilities practiced routine nutrition risk screening ranked dietitians first as the main professionals performing nutrition screening in their facility.[3]

Further, nutrition and dietetic professionals who participated in the needs assessment survey had low self-efficacy scores related to the administration of EN and PN, with the lowest scores observed for the calculation of goal volume and goal rate of feeds, and in the writing of EN and PN nutrition prescriptions.[3] The area where practitioners had the highest self-efficacy score was in the formulation of alternative preparations in lieu of commercial formula. Current evidence however indicates an absence of standardised recipes for kitchen-prepared enteral formula in Ghana.[4]

Limited opportunities for in-service training and insufficiency of nasogastric (NG) tube feeding protocols have also been identified as barriers to adherence to standard protocols on NG tube feeding among nursing staff.[5] For some other health providers, including dietitians, limited availability of standard

protocols in and of themselves are at the heart of the problem.[6] Efforts to establish feeding protocols and continuous education for nutrition professionals, aspiring nutrition professionals and other health staff are necessary to ensure appropriate standards of care across facilities in Ghana.

While it is not expected that every registered dietitian (RD) in the country will be fully engaged in all aspects of patient care during hospitalisation, it is within the dietitian's scope of practice to make recommendations for EN and PN in patients for whom this is indicated.[7,8] Context-specific programmes and training modules in nutrition support are therefore necessary to help bridge gaps in knowledge and practice. These will provide opportunities for continuous professional development (CPD) for Ghanaian clinical nutrition professionals (CNP) already exposed to EN and PN and those who hope to begin careers in the field.

Our study aimed to (1) provide a 2-day online advanced nutrition support workshop to Ghanaian dietitians to improve their competencies in enteral and parenteral nutrition support, and to bridge identified knowledge and practice gaps, and (2) assess effects of the workshop on the knowledge of enteral and parenteral nutrition support using an online pre-/post-workshop survey.

Methods

Study design and participants

This was an online, one-group pre-test/post-test study among Ghanaian dietitians, nutritionists and students/interns participating in a remote CPD training to provide education on enteral and parenteral nutrition care support in the acute care setting. We employed a triangulation mixed-methods model in our approach. We administered a knowledge, attitude and practices (KAP) survey and incorporated open-ended questions into the survey. Of note, our emphasis was on the quantitative data; however, the open-ended questions were included to help generate qualitative responses to validate the quantitative data.[9] A more detailed description of our approach can be found in our previously published KAP results.[3] There were no restrictions on the recency of completion of nutrition and dietetic education, neither were there exclusions based on years of experience. All members of the Ghana Academy of Nutrition and Dietetics (GAND) who were at least 18 years old and willing to participate in the surveys were eligible to participate (information concerning membership of GAND and participation rates for workshops are published elsewhere[3]). In our previously published KAP results, we had 76 participants completing the baseline survey leading up to the workshop.[3] For the analysis presented here, we included data from participants who completed both the pre-test and post-test surveys. The ethics committee of the University of Massachusetts Amherst reviewed the protocol and deemed it exempt. Written consent was obtained from the participants through an online consent form.

Details of workshops

The remotely delivered workshop comprised three sessions: Enteral Nutrition with case studies (3 hours); Parenteral Nutrition with case studies (3 hours); Nutrition Support in the era of COVID, with case studies (2 hours), for a total of 8 hours over the two days. The modules covered included topics related to the evaluation of the nutritional status of hospitalised and critically ill patients and recommendations for appropriate nutrition support through EN and PN. Specifically, the workshop speakers, who all practise in North America, reviewed (1) the ASPEN NS guidelines; (2) current literature on EN, and formulation of blenderised tube feeds (BTF) using a variety of strategies, including food-based dietary guidelines and standardised recipes adapted to local context; (3) indications for and calculations of both EN and PN regimen; and (4) current NS guidelines for COVID-19 patients. Competencies were met through lectures and case studies. Throughout the workshops, Zoom polls were used to assess participation and understanding of the materials covered.

Three of the authors served as technical experts who developed the didactic presentations on enteral and parenteral nutrition support for the workshops. They are registered dietitians at the Yale-New Haven Hospital, all of whom had at least five years of experience working in the acute care setting. The first author developed the case study presentations for the practical aspects of the workshops. A total of seven case studies were presented, with one case study adapted to the blenderised tube feeding module. The workshops were delivered in partnership with the GAND as part of a credited CPD for their membership.

Measurement of workshop outcomes

Two weeks before and within one week after the workshop, participants were asked to complete an online survey to assess their self-efficacy in using EN and PN and their practical knowledge of the indications for EN and PN. Details of the pre-workshop survey, including methods for assessments of self-efficacy and practical knowledge, are described elsewhere.[3] Briefly, we used a 5-point Likert scale (1: Never to 5: Almost always) to assess self-efficacy regarding indications for EN/PN, selection of EN formula, calculation of goal volume and goal rate of EN/PN, preparing of EN formula in lieu of commercial formula, writing of EN/PN prescriptions, calculation of macronutrient provision of PN, and determining TPN micronutrient additions, for a total possible score of 25. We used a 10-point self-rating scale (1: Not comfortable up to 10: Very comfortable) to assess general confidence in prescribing and using EN and PN. Practical knowledge was assessed using seven short case scenarios for a maximum score of 7 points (1 point for each correct answer).[3] The post-workshop survey comprised the same questions for the knowledge, practice and self-efficacy domains from the pre-workshop survey, but included additional questions on workshop satisfaction. To assess factors related to changes in self-efficacy scores, we included two open-ended questions each for EN and PN, on both the pre- and post-workshop surveys, asking participants to explain the rationale for their scores.

Statistical analysis

Statistical analyses were conducted using IBM SPSS Stats Version 28.0 for Windows (IBM Corp, Armonk, NY, USA). Paired sample t-tests were used to evaluate the differences in means between the pre-test and post-test scores. A standardised mean difference was used to determine the effect size (Cohen's d and 95% confidence intervals [CIs]). A p-value $\leq$ 0.05 was considered statistically significant for all analysis. Open-ended questions were analysed qualitatively by first coding and then thematizing responses to identify emergent themes.

Results

As shown in Figure 1, a total of 52 participants completed both the pre-test and post-test surveys. Over two-thirds (68%) of

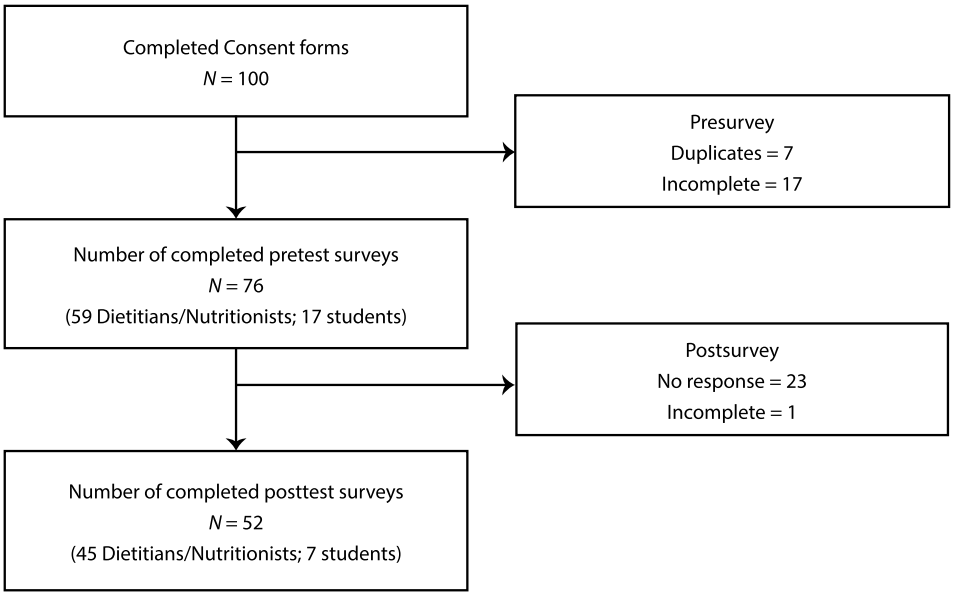

Figure 1: Flow diagram of project showing number of participants from recruitment through post-workshop surveys.

participants who initially completed the needs assessment survey prior to the workshops also completed the post-test. Most participants identified as registered dietitians (71.2%). Among dietitians and nutritionists, more than half (64.5%) reported four or more years of work experience (Table 1).

Self-efficacy in the use of enteral nutrition

There was a significant increase in mean self-efficacy scores for all combined aspects of enteral nutrition tested ($d = 0.67$ CI 0.34, 0.99), and for indications for EN ($d = 0.62$ CI 0.30, 0.94), selection of the EN formula ($d = 0.65$ CI 0.32, 0.92), and writing EN prescriptions ($d = 0.71$ CI 0.38, 1.04) (Table 2).

Self-efficacy in the use of enteral and parenteral nutrition

There was a significant increase in mean self-efficacy scores for all combined aspects of parenteral nutrition evaluated ($d = 1.01$ CI 0.65, 1.36). The aspects of PN with the highest effect sizes were for determination of macronutrient composition of PN ($d = 0.85$ CI 0.50, 1.19), calculation of goal volume and goal rate of TPN ($d = 0.92$ CI 0.57, 1.27), and determining of micronutrient additives for parenteral nutrition ($d = 1.07$ CI 0.70, 1.44) (Table 3).

Table 1: Occupational characteristics of participants

Professional background		
	n (%) Pre-test	*n* (%) Post-test
Nutritionist	12 (16)	8 (15)
Registered dietitian	47 (62)	37 (71)
Student/intern	17 (22)	7 (14)
Total	76 (100)	52 (100)
Years of experience for nutrition professionals		
Years	*n* (%) Pre-test	*n* (%) Post-test
3 or less	20 (34)	16 (36)
4 or more	39 (66)	29 (64)
Total	59 (100)	45 (100)

Practical knowledge and overall confidence in prescribing and using EN and PN

When asked to rate overall confidence in prescribing and using EN and PN following the workshops, participants scored themselves higher for both (6.82 ± 22.82 for EN and 5.53 ± 2.48 for PN respectively) (Table 4). Overall confidence in PN, as has been consistent with results so far, were lower than EN scores; however, the effect size of the change was greater for PN ($d = 0.85$ CI 0.51, 1.19) compared with EN ($d = 0.52$ CI 0.21, 0.83) (Table 4).

Workshop appraisal

Majority of participants (82.7%) agreed or strongly agreed that the topics covered were context-specific and useful to a Ghanaian dietitian, and that they received sufficient resources to allow them to prescribe EN and PN (72.6% for EN, 68.6% for PN). (Figure 2). Additionally, most participants (88.5%) agreed or strongly agreed that they would advocate for standard protocols in their workplaces (Figure 2).

Discussion and triangulation with qualitative responses

This project is the second attempt to bridge knowledge and practice gaps in delivering nutrition support therapy in Ghana. A previous study, conducted as part of a doctoral dissertation in 2020, focused mainly on EN support,[10] while our study is the first to focus on both EN and PN support. Our findings are consistent with the results of this previous study, in which a nutrition support workshop was provided to Ghanaian dietitians leading to an increase in confidence in their nutrition support skills, satisfaction with their nutrition support knowledge, the precision of nutrition support knowledge and ability to apply their knowledge gains using the Nutrition Care Process. This suggests that continued availability of workshops in EN might be useful in improving nutrition professionals' confidence in the use of EN.[10] Unfortunately, besides this work, we did not encounter any additional studies conducted in Ghana on the topic. Due to the paucity of literature, we also made comparisons with a similar workshop that was aimed at improving Ghanaian dietitians' knowledge and self-efficacy regarding malnutrition, by providing information including the AND/ASPEN

Table 2: Paired sample t-test for pre-post workshop scores for EN knowledge with effect sizes

Self-efficacy domain (EN)	Pre-test Mean (SD)	Post-test Mean (SD)	Two-sided *p*-value	Effect size Cohen's *d* (95% CI)
Indications for EN	3.44 (1.18)	4.04 (1.00)	< 0.001	0.62 (0.30, 0.94)
Selection of EN formula	3.27 (1.23)	4.00 (0.93)	<0.001	0.65 (0.32, 0.92)
Calculation of GV and GR of EN	3.16 (1.26)	3.82 (0.94)	0.001	0.51 (0.20, 0.82)
Writing EN prescriptions	3.07 (1.29)	3.96 (0.95)	<0.001	0.71 (0.38, 1.04)
Preparation of home blends	3.64 (1.37)	4.04 (1.04)	0.03	0.34 (0.03, 0.62)
All EN self-efficacy questions[1]	16.58 (5.78)	19.87 (4.25)	<0.001	0.67 (0.34, 0.99)

[1]Total possible score is 25. EN: enteral nutrition; GV: goal volume; GR: goal rate.

Malnutrition diagnosis criteria and the nutrition-focused physical exam.[11] In this study, the authors demonstrated a significant increase in knowledge, application and confidence with effect sizes ranging from 0.606 to 0.730 (partial eta squared).

Our study went further to provide additional training on PN, and is the first study to specifically assess self-efficacy in the use of PN among Ghanaian nutrition professionals after a continuous professional development workshop. We observed similar increases in confidence following our workshop. Although the mean individual self-efficacy scores for PN following the workshops were not as high as the mean scores for EN after the workshops, the effect sizes were greater for PN compared with EN. This is likely because participants had lower self-efficacy in delivering PN compared with EN at baseline.[3] A study from the UK similarly demonstrated that dietitians continue to have challenges delivering PN to patients due to limited in-service training.[12] PN support training is therefore likely a global need for dietitians practising in various socioeconomic contexts. While a single workshop cannot be as comprehensive as intensive multi-day courses in PN, our results suggest that continuous professional development workshops might be useful, at least in the short term, in bridging the gaps in knowledge of PN support for nutrition professionals in Ghana.

Reasons for increases in self-efficacy in EN and PN and possible challenges to implementation of knowledge gained

Recurring themes for why participants scored higher in the post-surveys were exposure to the knowledge provided, a deeper understanding of guidelines, including assessment and calculations, and feelings of empowerment. It is important to note that the participants in this study had varying backgrounds and years of experience. Hence, individual responses from our qualitative sample might not reflect the feelings of the entire group of professionals who participated in the workshops but did not complete the surveys. Some quotes from participants include:

The insights from the workshop … empowered me. (Registered dietitian, 4 years of work experience)

… because of the level of exposure I had during this workshop. (Registered dietitian, 4 years of work experience)

I now have a deeper understanding of the contraindications of EN. (Nutritionist, 4 years of work experience)

After this recent CPD, I have understood how to assess patient needs and calculate requirements for enteral (feeding). (Registered dietitian, 4 years of work experience)

… I believe I have gained adequate knowledge with regards to the determination, calculations involved in, and prescription of enteral feeds. (Registered dietitian, 4 years of work experience)

I now [learned] about ways of fortifying the [blenderised] feed to meet the caloric need of the patient. (Nutritionist, 3 years of work experience)

With my years of experience in nutrition support and the knowledge acquired during the training, I believe I am more confident. (Registered dietitian, 3 years of work experience)

I have gained some practical knowledge. (Registered dietitian, 2 years of work experience)

I have acquired in depth practical knowledge on PN after the workshop. (Registered dietitian, 1 year of work experience)

… Been a while since I did PN, but the training has boosted my confidence in wanting to undertake it

Table 3: Paired sample t-test for pre–post workshop scores for PN knowledge with effect sizes

Self-efficacy domain	Pre-test Mean (SD)	Post-test Mean (SD)	Two-sided *p*-value	Effect size Cohen's *d* (95% CI)
Indications for TPN	2.78 (1.26)	3.73 (1.18)	< 0.001	0.81 (0.47, 1.14)
Calculation of macros	2.66 (1.45)	3.82 (1.11)	< 0.001	0.85 (0.50, 1.19)
Calculation of GV and GR of TPN	2.40 (1.29)	3.67 (1.13)	< 0.001	0.92 (0.57, 1.27)
Writing TPN prescriptions	2.27 (1.18)	3.36 (1.25)	< 0.001	0.84 (0.50, 1.18)
Determining TPN micronutrient additives	2.16 (1.09)	3.36 (1.11)	< 0.001	1.07 (0.70, 1.44)
All PN self-efficacy questions[1]	12.20 (5.85)	17.96 (5.28)	< 0.001	1.01 (0.65, 1.36)

[1]Total possible score is 25. PN: parenteral nutrition; macros: macronutrients; GV: goal volume; GR: goal rate; TPN: total parenteral nutrition.

Table 4: Paired sample t-test of pre–post workshop scores of confidence level in prescribing and using EN and PN, and pre–post workshop scores from practical questions, with effect sizes

Overall confidence level	Pre-test Mean (SD)	Post-test Mean (SD)	Two-sided *p*-value	Effect size Cohen's *d* (95% CI)
Enteral Nutrition	5.29 (3.08)	6.82 (2.82)	0.001	0.52 (0.21, 0.83)
Parenteral Nutrition	3.11 (2.61)	5.53 (2.48)	< 0.001	0.85 (0.51, 1.19)
EN and PN case scenarios				
Knowledge and practice domain[1]	3.44 (1.94)	4.04 (1.56)	0.041	0.29 (0.01, 0.57)

[1]Total possible score is 7, based on 7 case scenarios.

> more often when the opportunity [arises]. (Registered dietitian, 4 years of work experience)

> I have gained some practical knowledge. (Registered dietitian, 2 years of work experience)

Some participants mentioned the case study presentations as being useful in providing them with practical knowledge on EN and PN. The use of case studies as a teaching method has been shown to facilitate and promote active learning, help clinical problem-solving and encourage the development of critical thinking skills in nursing education.[13,14] This, coupled with our observation of increased participant post-workshop scores on the practical knowledge aspect of our survey, suggests that continued incorporation of case studies into training modules for CNPs might be useful in the future. Despite appreciating the practical aspects of the case studies, some participants, especially when it came to their confidence in parenteral nutrition, stated that they still needed some exposure to more practical applications of nutrition support. Specifically, some participants stated that they needed more practice with the calculations for parenteral nutrition for them to feel comfortable using it.

> [Currently, I have] the knowledge. However, it would require more practice for me to be comfortable. (Registered dietitian, 3 years of work experience)

> Now, I have [learned] how to assess, calculate, and monitor patients. But I am yet to practise them. (Registered dietitian, 2 years of work experience)

> I would have to practise the calculations involved again to be conversant with them [parenteral nutrition. (Nutritionist, 4 years of work experience)

> The case studies during the workshop [were] very helpful, but a more hands on clinical practice would help. (Registered dietitian, 3 years of work experience)

> I'll need more hands-on experience to be comfortable. (Registered dietitian, 3 years of work experience)

> I am still keen on learning a bit more about combining different parenteral feed formulas and making needed adjustments based on other medication being administered. (Registered dietitian, 4 years of work experience)

> … I feel I will need more practice to be very comfortable using parenteral nutrition in general. (Registered dietitian, 4 years of work experience)

In our needs assessment survey preceding the workshops,[3] we found that some students reported limited exposure to EN and PN on their clinical rotations. We recommend that the GAND work towards developing standard protocols for use in nutrition support rotations for students. In doing this, considerations must be made for provision of access to clinical rotations focused on nutrition support therapy. The GAND could achieve this by working closely with academic institutions to provide accredited clinical programmes in EN and PN support for nutrition professionals interested in this field of nutrition care.

There was a generally favourable response from participants concerning the content and specificity of the workshop. For the few participants who disagreed or were neutral, we speculate that this could be due to the short turnaround time for completion of the post-workshop survey. As shown by the qualitative responses, several participants felt that they needed additional exposure and practical on-the-job experience to feel more confident about using EN and PN. It may be useful to build in additional strategies to assess the longer-term impacts of CPD workshops after participants have had a chance to implement the knowledge acquired in their practice setting, potentially following up with participants after a couple of months rather than the couple of weeks preceding the workshops.

In terms of potential medium-term impacts of the workshop, most participants agreed or strongly agreed that they would advocate for standard protocols in their workplaces This sentiment was reinforced by the following participant, who stated:

> The workshop has been a great eye opener. My team and I have decided to work closely with the pharmacy department so we can constitute formulas especially for patients who cannot afford the 3 in 1 bags. (Registered dietitian, 4 years of work experience)

This is a very encouraging statement, as there are currently no standardised protocols for advanced EN and PN support for registered dietitians in Ghana.[6] It is important to note that the lack of standardised protocols is not peculiar to Ghana. Indeed, several studies around the world have cited the limited availability of standard protocols as barriers to the delivery of nutrition support therapy.[12,15–17] Additionally, while a nutrition support team is known to improve the delivery of nutrition support therapy, a number of studies have shown a lack of nutrition support teams in critical care facilities.[18–20] If Ghanaian CNPs are not involved in delivering nutrition support, they miss the opportunity to gain much-needed professional training in the field. The following participant stated:

> At my facility, the doctors don't involve me the dietician or even the nutritionists in prescribing parenteral nutrition. Meaning whenever I get the opportunity [it] will

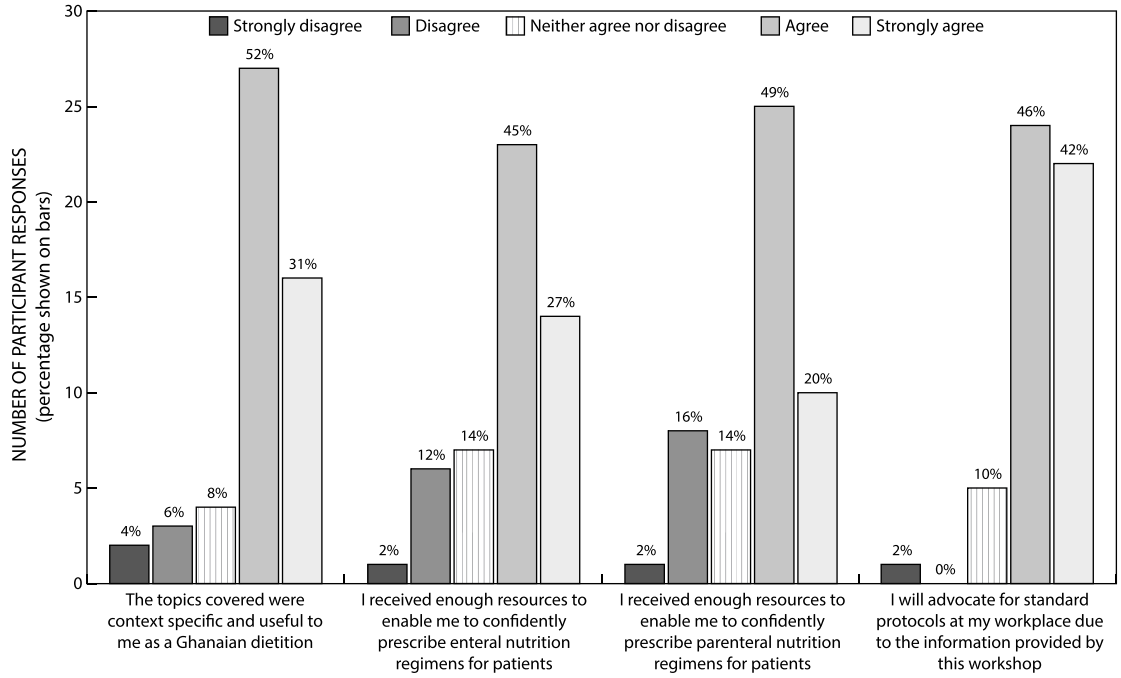

Figure 2: Participant responses to questions concerning workshop satisfaction.

be my first time. (Registered dietitian, 4 years of work experience)

While it is concerning that this dietitian is not involved in nutrition support in this facility, their comments gave us a moment to reflect on ensuring that nutrition support modules like the ones we developed are extended to other clinical professionals besides dietitians. A recent survey of doctors and nurses in an intensive care unit of a tertiary hospital in Ghana revealed a lack of standardisation in the execution of nutrition support practices.[21] Even though the survey participants in that study indicated that the single dietitian assigned to their unit conducted nutrition assessments, they were unfamiliar with institutional feeding protocols. Nutrition support should, however, be an interdisciplinary team effort.

Given the ongoing discussions around the world regarding the need for standardised nutrition support guidelines and the formation of nutrition support teams in ICUs,[18–20] it will be beneficial for Ghanaian dietitians to begin these conversations now to develop long-term action plans for improving nutrition support practices in Ghana.

Strengths and limitations

Prior to our workshop, we conducted a needs assessment survey to identify gaps in knowledge and practice in the delivery of EN and PN support. This was useful in helping us adapt standardised recipes to the Ghanaian context during our educational session on blenderised tube feeds (BTFs). Given that this is probably going to be the main approach to EN in the clinical setting in Ghana due to the sociocultural and economic context, we emphasised the use of African food-based dietary guidelines and the use of additives to help fortify BTFs, and food safety. Additionally, we were able to identify the common types of PN solutions available on the Ghanaian market, which informed the approaches we used to teach the calculation of total parenteral nutrition (TPN) goal volume, goal rate and macro-nutrient compositions during the case studies presentations. This specificity allows Ghanaian CNPs to utilise the resources available to them.

Despite these strengths, our study was limited in its online pre-test/post-test design. We worked on an honour system that assumed that the health professionals who completed the surveys would not look up answers to our questions for the knowledge assessment. Given the rise of online education, especially post-COVID-19, online workshops and evaluations are not out of the ordinary. They can be quite useful for mitigating the cost-prohibitive barriers to in-person education. If participants looked up answers for both the pre- and post-surveys, then the effect of this would be non-differential. However, if participants looked up only answers for the post-surveys, it would imply that the positive differences observed are an overestimation of the true impact of our workshops. This notwithstanding, if the workshops compelled participants to conduct additional online research to correctly answer the case study questions, this should be viewed positively in the context of exposing them to these cases in the first place. Additionally, while randomised controlled trials (RCTs) are considered the gold standard for interventional studies, they are not always applicable to all research questions. Because the workshops were delivered as CPDs available to the entire GAND body, it would have been challenging to properly control for intervention contamination with an RCT.

Finally, our response rate for the post-workshop survey was 68%, as 23 participants were lost to follow-up and there was one incomplete post-survey. We sent daily reminders to participants through REDCap and WhatsApp and kept the turnaround time for completing the post-survey within a week following the workshops in our attempt to improve response rates. Attrition in research is, however, inevitable as participants may not always be motivated to complete post-workshop surveys once the CPDs have ended. That said, based on analysis to assess the rates of attrition and dropout in app-based interventions for chronic diseases, our attrition rate of 32% (or retention of 68%) seems comparable to the reported 49% for

observational studies and 40% for randomised controlled trials.[22] While our study was not an RCT, nor was it focused on chronic disease prevention or management, we likely had a comparably lower attrition in our study because our participants were healthcare providers.

Conclusions and implications for future research and practice

We found that the two-day professional development workshop increased Ghanaian nutrition professionals' knowledge and self-efficacy. This project is the second attempt to bridge knowledge and practice gaps in the delivery of nutrition support therapy, and our study is the first to include didactic components on parenteral nutrition. Our study and the few previous studies and grey literature available demonstrate that there is a need to continue professional development workshops to fill gaps in training on EN and PN support. That said, two days of didactic training is certainly not sufficient to cover all areas of EN and PN and is by no means sufficient to meet all the learning needs of Ghanaian dietitians who come from varying academic and professional backgrounds. As seen by the qualitative responses, some participants continue to desire more practical hands-on experience to attain higher confidence levels in using PN, especially.

It is important to make a concerted effort to develop curricula to train specialists in Ghana. This could be woven into the current postgraduate training framework or offered as additional top-up courses for dietitians already practising in the clinical context. This training, however, cannot be completed in a research-limited context. It is also important that we conduct clinical studies to help us develop country-specific guidelines so that local dietitians have access to culturally relevant evidence-based information.

We anticipate that the results of our study will add to ongoing efforts to set standards of practice for Ghanaian dietitians for nutrition support therapy and contribute to current discussions concerning approaches to conducting rigorous research and providing continued training to nutrition professionals.

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Data share statement – Data described in the manuscript, code book and analytic code will be made available upon request pending application and approval.

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Authorship contributions – 1. Conception/design, contribution to acquisition, and initial analysis: Dr Ruthfirst Ayande, Percival Agordoh, Dr Elena Carbone, Dr Matilda Asante. 2. Interpretation of data: all authors. 3. Initial manuscript drafting: Ruthfirst Ayande, Percival Agordoh. 4. Critical revision: all authors. 5. Final approval: all authors. 6. Agreeing to manuscript: all authors.

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