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Exploring the Impact of a Nutrition Support Workshop for Ghanaian Nutrition Professionals

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Exploring the Impact of a Nutrition Support Workshop for Ghanaian Nutrition

Professionals

by

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Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctorate of Clinical Nutrition

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Dedication

I dedicate this work to the Ghanaian dietitians, nutritionists, dietetic interns and students at the University of Ghana, The Princess Marie Louise Children's Hospital, Korle-Bu Teaching Hospital and the 37 Military Hospital. Without their commitment to their patients, the profession and collaboration, this work would not have been possible.

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Thanks be to God! May this work help many and bear much fruit. "So, whether you eat or drink, or whatever you do, do everything for the glory of God" (1 Cor. 10: 31, New Revised Standard Version Catholic Interconfessional)

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Abstract

Ghana, a middle-income country in West Africa, has long experienced high rates of malnutrition and is increasingly struggling with nutritional challenges from non-communicable diseases including overweight, obesity, hypertension and stroke. There is an inadequate number of trained Ghanaian nutrition professionals to meet the demands of providing nutrition care for the citizens of Ghana and those professionals providing nutrition care have limited opportunities for continuing education. This quasi-experimental prospective, single cohort pre-test/post-test research was conducted in Accra, Ghana in September 2019 to determine if providing a nutrition support workshop to Ghanaian nutrition professionals (dietitians, dietetic interns, dietetic students and nutritionists) would impact their confidence in nutrition support practice, satisfaction with their nutrition support knowledge and ability to apply nutrition support knowledge utilizing the Nutrition Care Process (NCP). Demographic and nutrition support questionnaires were self-administered by participants with data collected prior to the workshop and at the conclusion of the workshop. The nutrition support questionnaire was adapted from a questionnaire used by Persenius et al. Participants ($n=76$) reported they had a great extent of responsibility for providing nutrition support care ($n=60$, 85.7%). Participants' confidence in their nutrition support skills ($p=.000$), satisfaction with their nutrition support knowledge ($p=.000$), nutrition support knowledge accuracy ($p=.000$) and ability to apply knowledge gains using the Nutrition Care Process (NCP, $n=39$, $p=.000$) improved significantly following the workshop. One-day intensive

workshops are effective in meeting the educational needs of Ghanaian nutrition professionals and providing a platform from which to scale up nutrition in West Africa.

Chapter I: Introduction and Literature Review

“Dietetics practice in Ghana is in a continuous state of evolution towards excellence.”¹

Introduction

Ghana, a middle-income country in West Africa, is experiencing an epidemic of diet-related diseases.¹ In 2017, Ghana had a population of 26 million people with 60% of Ghanaians living in urban communities and an annual growth rate slightly above 2% (see Appendix A for a Map of Africa and Maps of Ghana with cities and regions).^{1,2} Rural agrarian living used to be the norm for most Ghanaians, though this has shifted in recent decades.¹ Despite advancements and development, access to health and dietetic services remains a challenge in most regions of Ghana.¹

Research on nutrition support practice in Ghana is extremely limited.³ Ghanaian dietitians and nutritionists have a high level of knowledge, though the practice of dietetics in Ghana remains a challenge due to limited nutrition capacity in sub-Saharan Africa (SSA).^{4,5} The World Health Organization (WHO) has identified a significant gap between health care knowledge and practice throughout the world, particularly in low- and middle-income countries such as Ghana.⁶ Laar et al⁵ proposed short-term trainings as a way to build nutrition capacity in the African region. Ghanaian dietitians have knowledge of medical nutrition therapy from their education, work and internship experiences. Over the past few years nutrition professionals in Ghana have had an opportunity to attend continuing education sessions provided by dietitians from the University of North Florida (UNF) to build and enhance their knowledge and skills in

provision of medical nutrition therapy. Previous workshops have focused on the Nutrition Care Process and Nutrition-Focused Physical Examinations. Using an adult learning theory approach, this research project aimed to build on the knowledge and skills the Ghanaian dietitians and nutritionists possessed to enable them to construct new knowledge and skills in enteral nutrition support practice.

Significance of the Problem

Dietetics Practice and Practice Guidelines

Little is known about the practice of dietetics in Africa.⁷ There is no standardized credentialing or registration system for educational institutions and nutrition professionals, respectively, in Africa.^{4,8,9} Ghanaian nutrition professionals are interested in continuing professional education to hone their skills, provide evidence-based care, and leverage policy change to improve patient's lives, though opportunities for ongoing skill development are limited. This project could lead to changes in policy and protocols for inpatient dietetic services, nutrition support provision, and nutrition and dietetic education standards in Ghana. Utilization of enteral nutrition protocols improves the delivery of energy and protein to nutrition support patients and decreases malnutrition and hospital length of stay. Building the nutrition support knowledge and skills of Ghanaian nutrition professionals will empower these nutrition leaders to develop culturally relevant and resource appropriate nutrition support protocols to standardize and improve enteral nutrition practice throughout Ghana. With Ghana being a leader in nutrition in Africa, this project will likely impact not only the nutrition professionals in Ghana, but dietitians and nutritionists throughout Africa.

Policy Implications

Africa has reached a pivotal point in the development of nutrition policies. Current policies have seen significant impact in improving malnutrition rates and increasing nutrition capacity throughout Africa. Building nutrition capacity creates an urgent need for policies on nutrition and dietetics education and practice to ensure Africans are provided safe, effective and evidence-based care by qualified professionals.

The African Nutrition Society (ANS) is a professional society promoting skills in research and research communication.⁵ ANS is developing a technical capacity development platform and professional practice frameworks “that will lead to professional registration and accreditation.”⁵ Laar et al⁵ note the long-term aim of this framework is consistency of nutrition training across Africa, especially in higher education institutions. The ANS has identified the Association for Nutrition (AfN) as the partner to work with in developing a professional practice framework in Africa.⁵ AfN is the independent, not-for-profit, regulator for Registered Nutritionists in the United Kingdom.¹⁰ The ANS has begun discussions with AfN on options for African nutritionists to register with AfN, higher education nutrition courses applying for AfN accreditation, development of an ANS/African system of professional registration and course accreditation based on UK standards, and development of a process for local or pan-African nutrition registration and course accreditation based on UK principles.⁵

Ethical Implications

As dietetics practitioners we utilize ethical principles to guide our clinical practice, research, education activities, and policy development. *The Code of Ethics for*

the Nutrition and Dietetics Profession addresses dietetic professionals' "social responsibility for local, regional, national, [and] global nutrition and well-being."¹¹

Nutrition professionals should "contribute time and expertise to activities that promote respect, integrity, and competence of the profession."¹¹

The ethical implications of this study are centered around beneficence and justice as they apply to professional development, capacity building and knowledge sharing. Beneficence is an ethical principle that "encompasses taking positive steps to benefit others."¹² This project aimed to improve the knowledge, skills and self-efficacy in providing nutrition support care among Ghanaian nutrition professionals in an attempt to benefit not only the nutrition professionals participating in the workshop, but also the patients whom they care for, the hospitals in which they work and their larger health care systems.

The principle of "justice supports fair, equitable and appropriate treatment."¹² Knowledge sharing between developed and developing nations supports the ethical principle of justice. In 1993, Alan Berg of the World Bank accused nutritionists and pediatricians of sliding toward malpractice "for failing to improve nutrition in the developing world despite considerable research advances in nutritional science."^{13,14}

Education is a resource that must be shared. In 1972, the International Commission on the Development of Education published a report by UNESCO and found that "the world of the future will require that education...be concerned primarily...with engaging human beings in a process of inquiry throughout their lives."¹⁵ The Commission proposed

lifelong learning as a key component of educational policies for both developed and developing countries.¹⁵

The UNESCO Institute for Education identified concept characteristics of lifelong education including, “institutions of education like schools, universities, and training centers, are of course, important, but only as one of the agencies for lifelong education. They no longer enjoy the monopoly for educating people and can no longer exist in isolation from other educative agencies in society.”¹⁵

Berg touched on an incredibly important topic that has been re-introduced in recent years, notably by Pope Francis, as the “redistribution of wealth”. Wealth, as Berg noted, is not solely monetary. Wealth of information and research requires the dissemination of knowledge that can lead to elevation of quality of life in developing nations and offers both beneficence and justice. This study will lead to the sharing of knowledge in a way that will allow nutritionists and dietitians in Ghana to provide better nutrition support care to patients in Ghana and will lead to improved nutrition capacity in Ghana and its neighboring countries.

Introduction to Analysis of Relevant Literature

Africa is a continent faced with many nutritional issues. Africans continue to battle malnutrition and increased nutrient needs due to communicable diseases while problems of overweight and obesity, hypertension and stroke are becoming more prevalent.^{1,4,13,16,17} Nutrition professionals in Africa are striving to meet the demands for nutrition care, though due to a lack of capacity, skilled staff, infrastructure and continuing education opportunities, many gaps in nutrition care remain.^{1,4} Africa lacks a multi-

disciplinary clinical nutrition organization that addresses the current status of nutrition support care in Africa and develops protocols to improve nutrition care throughout the continent. Despite these challenges, nutrition professionals in West Africa are striving to improve nutrition care.

Nutrition professionals in West Africa have developed relationships with dietetic professionals in the United States and the United Kingdom to collaborate and improve nutrition capacity in their region. Dietitians in Ghana have worked closely with faculty and dietitians at the University of North Florida to provide concentrated nutrition education experiences targeting the areas of greatest need for nutrition knowledge and skills development among Ghanaian nutrition professionals. Workshops have been shown to be an effective modality to improve knowledge and skills among healthcare professionals and have been successful with nutrition professionals in Ghana.^{1,18–20}

Literature Review

This literature review began with extensive searches within the PubMed, PsycINFO, ERIC, EbscoHost databases with combinations of relevant terms such as: enteral nutrition, nutritional issues, nutrition capacity, nutrition regulations, nutrition education, dietitian, nutritionist, professional development, workshops, World Food Programme, developing countries, Africa, Sub-Saharan Africa and Ghana.

Nutritional Issues in Sub-Saharan Africa

The primary nutritional issues in Sub-Saharan Africa (SSA) include malnutrition from starvation or inadequate dietary intake, increased nutrient needs from chronic infections, malabsorption from persistent diarrhea which is often due to lack of adequate

sanitation.⁴ Africa has been described as the youngest continent as the life expectancy in SSA continues to be low at approximately 57 years due to the HIV epidemic, communicable diseases, injuries and conflict in addition to malnutrition.¹⁶ Malnutrition is a primary cause of childhood mortality and child stunting, giving West Africa one of the highest rates of stunting in the world.^{4,13} In many regions of Africa use of traditional healers remains common which often causes delay in seeking care in modern medical facilities.¹³ Micronutrient deficiencies, including vitamin A, zinc, iodine and iron deficiencies, are prevalent in West Africa and increase risk of infection and death.^{4,5}

Lack of capacity, including tools, skills staff and infrastructure, is one of the most significant barriers to scaling up nutrition in West Africa.⁴ Many West African countries are seeking improvement in nutrition capacity through policy and coordination of nutrition activities.⁴ Sporadic lapses in nutrition supplies are commonplace in West African countries due to weak logistic and supply chain systems.⁴ Nigeria and Ghana have emerged as the West African countries with the greatest capacity to support the expansion of the nutrition workforce.⁴ The UN Development Programme defines capacity as “the ability of individuals, organizations and systems to perform functions effectively, efficiently and sustainably.”⁵

Most countries in West Africa have committed to participate in the Scaling Up Nutrition (SUN) movement to increase nutrition capacity in countries with the greatest burden of undernutrition.⁴ In 2008 the World Health Organization (WHO) estimated that 60% of deaths worldwide were from non-communicable diseases (NCDs) with more than 80% of NCD deaths occurring in developing nations.¹ Sub-Saharan Africa (SSA) is one

of the top three regions for highest risk of mortality from NCDs for adults between the age of 30 and 70 years.¹

Pediatric Malnutrition. In 1933 the *Archives of Disease in Childhood* published the landmark article by Cicely D. Williams²¹ of the Princess Marie Louise Children's Hospital in Accra, Ghana in which she described a nutritional syndrome associated with a maize diet. Williams²¹ provided the original description of kwashiorkor in what has been described as “perhaps the most important [paper] ever published in the *Archives*”. Williams²¹ described the nutritional syndrome kwashiorkor, which is now commonly referred to as protein-energy malnutrition or PEM, as occurring in children between the ages of one and four years of age with symptoms including edema, “chiefly of the hands and feet, followed by wasting; diarrhea; irritability; sores, chiefly of the mucous membranes; and desquamation of areas of the skin.” This syndrome was noted by Williams²¹ to occur in patients with a history of an abnormal diet, specifically those who had inadequate breastfeeding or were provided with supplementary foods consisting only of maize which did not meet the child's energy or protein needs.

Severe PEM is common in Sub-Saharan Africa with prevalence rates varying widely by region.^{13,22} Wasting, or low weight-for-age, is one of the risk factors associated with increased mortality from child malnutrition.²³ Poverty and ignorance have historically been identified as the two major factors leading to malnutrition in developing countries, though commitment to cultural food practices, traditional child feeding practices, female literacy level and inadequate complementary feeding practices are significant barriers to adequate pediatric nutrition.²² Increased income has not

consistently correlated with improvement in nutritional status among children in developing countries.²² The prevalence of pediatric malnutrition in children under five has historically been higher in the African countries of Ivory Coast, Nigeria, Egypt and Sudan with a per capita gross national product (GNP) above 400 dollars compared with lower rates of malnutrition in Sierra Leone, India, Uganda and Kenya where the GNP is below 400 dollars.²²

Traditional breastfeeding practices in SSA included unlimited breastfeeding beyond the first year of life.²² These practices have changed due to the need for the nursing mothers to work to augment the family income which has led to shorter durations of breastfeeding and earlier introduction of low-energy, low-protein weaning diets.²² In Nigeria the traditional weaning food among the three ethnic groups (Hausa, Igbo and Yoruba) is thin porridge made from corn, sorghum or millet.²² Milk, groundnut paste and sugar are not traditionally added to the weaning porridge.²²

Kwashiorkor is characterized by “edema, irritability, anorexia, fatty infiltration of the liver, skin dyspigmentation, hair changes and reduced hepatic export proteins.”¹³ In some regions of SSA kwashiorkor is the predominant form of child malnutrition with etiologies ranging from food insecurity, lack of dietary variation with reliance on limited staple foods, chronic infections from tuberculosis or human immunodeficiency virus.¹³ Malnutrition rates shift during the wet season and dry season due to shifts in availability of food commodities.

The dry season runs from July through December with January through June being the rainy or wet season.^{13,24} In many developing nations in Africa legumes and oil

seeds are readily available despite the season and weak economy.²² Foods such as beans, soy beans, groundnuts, and melon seeds have been less commonly consumed in developing nations due to traditional cultural food practices.²²

Pediatric malnutrition is managed with standardized treatment protocols including nutrition assessment visits, clinical evaluation and data collection as well as fortified milk with micronutrient supplementation.¹³ Nutriset is a micronutrient supplement containing potassium, calcium, magnesium, zinc, manganese, selenium, iodine, copper and multivitamins.¹³ The milk-based repletion diet is made from a prepared mixture of dried skim milk powder, vegetable oil and sugar supplied to Nutrition Rehabilitation Centres by the World Food Programme.¹³ The standardized treatment protocol begins with a phase 1 milk that contains 66 kilocalories and 1.0 gram (g) of protein per 100 milliliters (mLs).¹³ This provides an intake of 79 kilocalories and 1.2 grams of protein per kilogram of body weight during phase 1.¹³ Patients remain on phase 1 until their edema, appetite and mental status improve at which time they advance to phase 2, typically during the second week of treatment.¹³ The phase 2 diet consists of high energy milk with 114 kilocalories (kcal) and 4.1 grams of protein per 100 mLs provided four times per day plus two feedings daily of porridge.¹³ Phase 2 porridge contains maize, soy, sugar and oil providing 112 kcal and 3.3 g protein per 100 mL.¹³ The recommended intake is 150 mL/kg per day (d) which, if achieved during phase 2, provides 170 kcal/d and 5.8 g protein per kg/d.¹³ Patients that are unable to take the milk-based diet orally are provided with intermittent tube feedings.¹³

Deaths from malnutrition while under treatment are categorized as early, within five days of treatment initiation, and late, after five days of treatment at a Nutrition Rehabilitation Centre.¹³ Late deaths are considered an indicator of the quality of nutritional case management.¹³ Patients receiving nutrition treatment at a central hospital have been shown to have a lower rate of late death, earlier resolution of edema, better weight gain and shorter length of stay than their malnourished counterparts receiving care at district and rural treatment facilities.¹³ Some facilities use routine nasogastric feeding protocols with kwashiorkor admissions, though this is not standardized elsewhere due to mother refusal as this treatment modality is culturally associated with death due to it being utilized in severe cases.¹³ Those receiving tube feedings for kwashiorkor have shown a significantly greater weight gain during admission (8.24 vs 4.51 g/kg/d, $P = .000001$), though there was no statistically significant difference in mortality rates.¹³

Adult Malnutrition. The Global Leadership Initiative on Malnutrition (GLIM) is “focused on building a global consensus around core diagnostic criteria for malnutrition in adults in clinical settings.”²⁵ The initiative was convened in January 2016 by several global clinical nutrition societies and agreed upon a two-step approach for diagnosis of adult malnutrition.²⁵ First, screening should be utilized to identify “at risk” status using a validated screening tool followed by an assessment for diagnosis and grading for severity of malnutrition.²⁵ Undernutrition remains common in SSA due to supply chain problems and seasonal variations in food security.^{13,24,26,27}

Nutrition Transition. Many areas of Sub-Saharan Africa (SSA) are experiencing the nutrition transition with high prevalence of both malnutrition from undernutrition and

rising rates of overweight and obesity and its related diseases. Over the past three decades many low- and middle-income countries have undergone a shift in health burden towards an increase in non-communicable diseases (NCDs) due to economic development and rapid urbanization that have caused significant shifts in diet and lifestyle.¹⁷ This change in disease burden towards an increase in overnutrition-related chronic diseases while the burden of undernutrition and micronutrient deficiencies remain is known as the nutrition transition.¹⁷ The nutrition transition is especially troublesome for low- and middle-income countries that continue to have a burden of child malnutrition and stunting and are increasingly being faced with managing malnutrition at both ends of the weight spectrum. The worldwide prevalence of obesity has increased by more than 200% since 1980, though there has been no significant change in the prevalence of undernutrition.¹⁷

Stunting. Undernutrition, especially stunting, is clustered in high-burden countries including Ghana.²⁸ Stunting is a low height-for-age identified by a length or height measurement below two standard deviations for age on World Health Organization (WHO) growth charts.^{13,29} Failure to reach linear growth potential occurs due to nutritional deficiencies which may be caused by suboptimal health or inadequate intake to meet nutrient needs.²⁹ The determinants of stunting in preschool children varies between and within nations with political instability, slow economic growth, infectious disease rates and lack of education being common factors.²⁹ In developing countries poor nutritional status during pregnancy is common and leads to stunting.²⁹ Jonah, Sambu and May³⁰ found stunting rates are decreasing in middle-income African countries, though

40% of children under the age of 5 in Zambia “are stunted, compared with 26% in Kenya and 19% in Ghana”.³⁰

Hypertension and Stroke. The WHO reported that the proportion of adults with hypertension is higher in Africa than any other region of the world at 46% of the adult population.¹ Stroke admissions account for approximately one quarter of medical admissions for elderly adults and over three quarters of neurologic admissions in sub-Saharan Africa.³¹ Many sub-Saharan African countries lack the resources to care for stroke patients with an average of 0.4 neurologists per 100,000 Africans.³¹

Infant and Childhood Mortality. Rates of infant and child mortality before the age of five are high in SSA. Prematurity and malnutrition are leading factors impacting infant mortality rates.³² Uganda has one of the highest rates of preterm birth in East Africa, though minimal resources to care for these infants.³²

Infectious and Communicable Diseases. Communicable and infectious diseases are problematic in Sub-Saharan Africa with tuberculosis, diarrheal diseases, malaria and HIV and AIDS being of highest nutritional significance.

HIV and AIDS. The human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS) remain dominant health problems in Sub-Saharan Africa (SSA).³³ Prevalence rates are highest in the central, east and southern regions of SSA.³³ Diarrhea-wasting syndrome is a common complication of HIV in Africans.³³ Micronutrient deficiencies are prevalent among patients with HIV and have been linked with hastened disease progression and mortality.³³

Kelly and colleagues³³ evaluated the impact of micronutrient supplementation in patients with AIDS diarrhea-wasting syndrome (n=106) in Zambia, Sub-Saharan Africa, and found serum vitamin A and E concentrations predicted early mortality (p=.001 and p=.038, respectively), though supplementation did not decrease diarrhea symptoms (p=.40) or mortality (p=.87) in the first month of supplementation. The authors found no significant difference in serum concentrations between those receiving micronutrient supplementation and those receiving placebo (p=.21).³³

Nutritional Issues in the Ghanaian Population

Despite economic gains and increases in dietetic vocations, nutritional issues are prevalent in Ghana. Vitamin A deficiency, anemia, iodine deficiency, inadequate infant and child feeding practices leading to malnutrition and stunting are leading nutritional issues in Ghana.^{1,5} With a growing economy and access to international food ways chronic disease and obesity prevalence are rising in Ghana.¹

Dietitians in Ghana, in general, have the needed equipment and supplies to perform nutrition-related tasks, including weighing scales, measuring boards, mid-upper arm circumference tapes and patient education materials, though they are not available in all areas or in each work site.⁴ Equipment and supplies, such as ready-to-use therapeutic foods (RUTF) are largely provided by development partners which can cause lapses in supplies.⁴ Intermittent lack of supplies occurs in Ghana due to lack of a strong logistic and supply chain system, inadequate forecasting of needed materials and supplies and lack of transportation.⁴

Ghana participates in the Renewed Efforts Against Child Hunger and undernutrition (REACH) initiative to improve nutrition security within its regions.⁴ The prevalence of food insecurity among older persons in Accra is 60.9%.¹⁶

Staple Diet and Foodways. Ghanaians typically consume three meals per day with normal cooking procedures including boiling, frying, baking, roasting and steaming.³⁴ Work and school schedules often interfere with family meals on weekdays leading many Ghanaians to seek take-out and fast food convenience foods.²⁰ Ghanaians' staple foods include tropical starches such as yams, cassava, plantains, corn and rice in addition to beans, groundnuts, fish, primarily tilapia, and poultry.^{20,34} Palm oil is the primary cooking oil used in Ghanaian cuisine.^{20,34}

Ghanaians living in more urban settings may have tea, Milo or milk with bread for breakfast while those living in more agrarian settings may have cassava and soup leftover from the evening meal³⁵. The morning meal may include porridge or koose.³⁴ Porridge consists of corn dough, sorghum, oats, wheat or millet with sugar, water and salt.³⁴ Koose are dumpling-like patties of milled beans mixed with water, salt and pepper, ground into a paste, then fried³⁵ in small portions in vegetable oil with onions.³⁴ Dried cereal, such as corn flakes, may be included for breakfast.³⁴

A traditional Ghanaian lunch and supper includes a starchy food with soup, stew, chicken or fish and pepper sauce.³⁴ Pepper sauce is made with hot peppers, tomato, fish, onion and vegetable oil.

Starches may be boiled yam, boiled rice, rice balls, Jollof rice, 'waakye', 'kenkey', 'banku' or 'fufu'.³⁴ Typical soups and stews are beans stew, palm nut soup,

okra stew, garden egg (eggplant) stew, ground nut (peanut) soup, tomato stew or 'kontomire stew' (cocoyam leaves).³⁴

'Kenkey' is made by boiling corn dough with water, stirring constantly with a wooden stick. The mixture is then cooled and small portions of the dough are wrapped in leaves and boiled for approximately one hour.³⁴ 'Waakye' is made of rice, beans and salt with the beans being boiled until soft and then mixed with rice, salt and water and boiled until rice is cooked and water is fully absorbed.³⁴ 'Banku' is made of corn dough, cassava dough, water and salt mixed into a soft paste and boiled for several minutes with constant stirring and periodic addition of water to achieve a soft solid texture.³⁴ 'Fufu' is similar to 'banku', though it is pounded and made from a mixture of cassava and plantain or cocoyam rather than cassava and corn dough.²⁰ 'Palaver sauce' is made from cocoyam leaves, tomato, pepper, onion, fish, salt, pepper, palm oil and milled melon seeds.³⁴ Common snacks are often fruits, such as orange or banana, or fruit juice or a carbonated drink with biscuits or peanuts.

With increasing exposure to the global market many Ghanaians are abandoning traditional Ghanaian foodways in favor of convenience foods. Grocery stores, supermarkets and convenience food stores selling a variety of foods including processed foods are becoming accessible to Ghanaians living in both rural and urban areas.¹

Malnutrition and Stunting. The Scaling Up Nutrition (SUN) movement, initiated in 2010, is focused on improving institutional and human capacity in nutrition in developing countries.²⁸ Undernutrition is prevalent among Ghanaian men (62.2%) and women (44.6%) leading to poor nutritional status and underweight, particularly in rural

areas.¹⁶ The prevalence of wasting in children under the age of 5 increased from 8% in 2003 to 9% in 2008 followed by a decline to 5% in 2015.²³ Underweight prevalence among children under the age of five has continued to decline from the rate of 23% in 1993 to the current rate of 11%.³⁶

The rate of stunting in Ghana has declined from 35% in 1988 to 23% in 2012, however undernutrition and stunting remain problematic.²⁸ Stunting with concurrent overweight has been linked with poor nutritional status during fetal development and the first thousand days of life followed by a diet high in simple carbohydrates and an inactive lifestyle.³⁷

Thirty-six of the fifty-four countries with the highest burden of child undernutrition participating in the SUN movement are in Africa.²⁸ Ghana is one of few countries in SSA that is on track to meet the Millennium Development Goal target of halving the prevalence of undernutrition among children under the age of five.²⁸ The SUN academic platform in Ghana is focused on contributing to capacity strengthening across all relevant sectors in Ghana.⁵

Micronutrient Deficiencies. Dependence on a monotonous staple diet poses risk for micronutrient deficiencies for Ghanaians. Iron-deficiency anemia and vitamin A deficiency are common among children and women of child-bearing age.²⁸ The recent International Lipid-based Nutrient Supplements project by the University of Ghana included development and testing of food-based interventions to combat malnutrition in the eastern region of Ghana.⁵

The dietary supply of the trace mineral selenium is being discussed globally due to its role in prevention of oxidative stress and cellular damage.³⁴ The essential enzymes glutathione peroxidase and thioredoxin reductase, responsible for protection against cellular damage, are selenium-dependent.³⁴ Selenium is an essential trace mineral found in animal tissues with muscle meat, organ meats, eggs, seafood and some nuts representing good dietary sources.³⁴ Grains and starches vary in selenium content depending on the selenium concentration of the soil in which they are grown.³⁴ Selenium is toxic in high concentrations with intakes of 350 micrograms per day producing signs of selenium toxicity.³⁴ Selenium deficiency may lead to cardiovascular disease, congestion cardiomyopathy, cancer and communicable diseases.³⁴

The average dietary intake of selenium (Se) ranges from 20-300 micrograms per day globally. Ghanaian diets are typically high in carbohydrates and low in protein which may put Ghanaians at risk for selenium deficiency. The Institute of Medicine recommends an intake of 55 micrograms per day or greater to avoid Se deficiency.³⁴ Adotey and colleagues³⁴ evaluated dietary selenium for adolescents in residential care orphanages in southern Ghana. The authors sampled adolescents' 24-hour duplicate diets, including water, for seven consecutive days using the "duplicate diet sampling technique."³⁴ Adolescents (age 12-15 years) residing at three residential care orphanages, Osu, Tutu-Akwapim and Teshie, were included in this study.³⁴ The authors found the mean daily dietary supply of selenium was 82.0 +/- 30.7 micrograms Se per day with a range of 44.6 to 133.0 micrograms per day at the Tutu-Akwapim orphanage.³⁴ At the Osu orphanage the mean daily dietary supply of selenium was 57.6 +/- 17.3 micrograms

Se per day with a range of 42.2 to 88.4 micrograms per day.³⁴ The Teshie orphanage had the highest mean daily dietary supply of selenium at 91.7 +/- 41.3 micrograms Se per day with a range of 42.6 to 153.4 micrograms per day.³⁴ At two of the three orphanages studied the low-end of the range of daily supply of Se fell below the recommended 55 micrograms of Se and the remaining orphanage had a supply of 57.6 micrograms on the low-end which was just above the recommended minimum intake level.³⁴ This suggests that selenium deficiency, especially in the presence of increased oxidative stress, is a concern for Ghanaians following a traditional diet.

Nutrition Transition. The Ghana Demographic and Health Survey (GDHS) reported an increase in obesity prevalence from 3.4% in 1993 to 15.3% in 2014 among Ghanaian women between the ages of 15 and 49 years.¹⁷ The prevalence of overweight among Ghanaian adults is estimated at 25.4% with reports ranging from 5.8% to 54.0%.¹⁷ Approximately 17% of Ghanaian children between the ages of 9-15 years old are overweight or obese.¹⁷

With a rise in urbanization there has been a change from an active agrarian lifestyle to a predominantly sedentary lifestyle.¹⁷ The economic and lifestyle drivers of the nutrition transition result in a shift from traditional high complex carbohydrate, high fiber diets to energy-dense diets that are high in fat and simple sugars.¹⁷

In 2008, approximately one third of all Ghanaian women were overweight or obese with a 35% obesity rate and 28% overweight in the capital of Accra.¹ Now nearly 43% of Ghanaian adults are overweight or obese.¹⁷ Overweight and obesity burden is higher among urban dwellers compared with rural dwellers (27.2% vs 16.7% overweight,

20.6% vs 8.0%, respectively).¹⁷ Ofori-Asenso and colleagues¹⁷ reported that the prevalence of overweight and obesity vary by region with an estimated rate of overweight and obesity of 32.4% in the Northern region compared with 55.2% in the Greater Accra region.

Hypertension, stroke, diabetes and cancers are now leading causes of mortality in Ghana.³⁸ Thirteen percent of Ghanaians are reported to have hypertension.³⁸ In 2014 the annual stroke admissions ranged from 49 admissions in regional hospitals to over 1500 in the tertiary teaching hospitals.³⁹ Baatiema and colleagues³⁹ have identified patient financial and sociocultural constraints, inadequate medical facilities, lack of stroke care protocol, limited staff and inadequate staff knowledge of stroke care interventions as barriers to stroke care in Ghana.

Nutrition Regulations in Africa

The World Health Organization conducted an analysis of the capacity to scale up nutrition actions in five high-burden West African countries including Burkina Faso, Cote d'Ivoire, Ghana, Mali, and Guinea.⁴ In 2009, the Assembly of Health Ministers of the Economic Community of West African States (ECOWAS) adopted a resolution for action in nutrition with an aim to improve nutrition capacity in West Africa.⁴ In 2013 the West Africa Nutrition Capacity Development Initiative (WANCDI) was launched to bridge the nutrition capacity gap in West Africa.⁴ As of 2014, no West African countries had a unified nutrition information system in place.⁴

Nutrition Regulations in Ghana

Nutrition activities in Ghana are coordinated under the National Development Planning Commission with a National Nutrition Policy emphasizing key nutrition action areas of malnutrition, breastfeeding, anemia and vitamin A deficiency.⁴ Nutrition programs are coordinated through the Cross-Sector Planning Group for Nutrition (CSPG).⁴ Ghana, along with its West African neighbors, has limited financial resources for nutrition activities, though there has been a trend in recent years to increase budget allocations for nutrition activities.⁴ A sub-committee of the Cross-Sectoral Planning Group of the national SUN movement secretariat was established to focus on resource mobilization.⁴ In Ghana each unit of the government that provides nutrition activities has its own budget that is often embedded in higher-level budget categories.⁴

In 2005 the Ghanaian government launched the Ghana School Feeding Programme (GSFP) to address high malnutrition and low education rates.⁴⁰ The GSFP reaches 38% of the student population (1,642,271 students) and is available in all 216 districts in Ghana.⁴⁰ Participating schools must provide a cooked lunch 195 days per year with approximately 150 grams of cereal grains, 40 grams of legumes and 10 grams of vegetable oil, though the actual meal provided to students may deviate from the policy.⁴⁰ The World Food Programme's Homegrown School Feeding Project reported in 2007 that the GSFP monitoring and evaluation system is "very weak."⁴⁰ The policy guiding the GSFP does not document the meal or nutrient profile students receive, cost of the meal or options for adjusting the meal to increase nutrient density.⁴⁰

Ghana has a formal approach to placement of nutritionists through the civil service commission.⁴ Though there are some areas of nutrition regulation in Ghana, the practice of dietetics and nutrition remains largely unregulated.^{1,4} Qualified dietitians have expressed frustration about unqualified persons acting as dietitians due to the lack of regulation of practice.¹ In an effort to combat unregulated nutrition therapy practice the Ghanaian government passed the national public health law in 2012 requiring all allied health professionals, including dietitians, nutritionists and nutrition technical officers to register with the Allied Health Professions Council.^{1,41} To be in good standing with the Allied Health Professions Council dietitians must complete a twelve-month internship in an accredited institution and pass a certification examination.^{1,41}

Enteral Nutrition in Resource-Limited Settings

Enteral nutrition (EN) is the preferred route, rather than parenteral nutrition (PN), for nutrition delivery when patients are unable to eat safely or adequately.^{42,43} Enteral nutrition is a cost-effective, accessible and low-risk treatment modality.⁴² Patients receiving EN rather than PN have been shown to have significantly lower risk for infectious complications.⁴² Using the enteral route for provision of nutrition is “considered to be more physiologic, providing nutritional and various non-nutritional benefits including maintenance of structural and functional gut integrity as well as preserving intestinal microbial diversity.”⁴² Many routes of enteral nutrition administration are feasible, though the nasogastric route is most commonly used in low-resource settings.⁴⁴ While use of enteral feeding pumps is common in high-resource setting, this equipment is rarely, if ever, available in low-resource settings. When enteral

feeding pumps are unavailable the feeding is typically provided via bolus gravity feedings provided several times per day to meet the patients estimated macronutrient, micronutrient and fluid needs.

Advancement of nutrition support practice in Sub-Saharan Africa (SSA) is challenging due to limited personnel, lack of appropriate, functional diagnostic and treatment resources.⁴⁴ Balumuka and colleagues⁴⁴ reported on cases of esophageal perforation in SSA and concluded that conservative management with tube thoracostomy, nil per os, intravenous antibiotics, physical therapy and enteral feeding via gastrostomy is safe and effective treatment for esophageal perforations in resource limited areas. Surgical esophageal repair is the preferred treatment in countries with advanced medicine, though in SSA there is limited availability of thoracic surgeons eliminating the option for surgical repair in many areas.⁴⁴

The first case reported by Balumuka and colleagues⁴⁴ was a patient that had an esophageal perforation following a dilation procedure. The patient had a thoracostomy placed and was kept nil per os (NPO) with IV fluids and antibiotics to treat septicemia. The patient had a gastrostomy tube placed on day 7. The patient was unable to have a barium esophagram because the mother was unable to afford the procedure. The patient had an oral feeding trial on day ten with an increase in thoracostomy drainage and was kept NPO until four weeks after the initial esophageal injury when he was able to successfully tolerate oral feeding with no thoracostomy drainage or fever.⁴⁴ The second patient reported by Balumuka et al⁴⁴ had a cervical esophageal perforation after swallowing a coin. This patient was unable to have a barium esophagram due to the

machine being broken. The patient was noted to have fever, wasting and pallor on presentation eighteen days after the coin she had swallowed was removed. The patient was made NPO and was provided IV fluids until signs of septicemia subsided and she was initiated on enteral nutrition via gastrostomy. After two weeks the patient was able to have a barium esophagram which showed no leak and was started on oral feeding the following day. Within two days the patient was taking adequate oral nutrition and was discharged.⁴⁴

Nutrition Support Practice in Africa

While many regions of the world have multi-disciplinary clinical nutrition societies such as the American Society for Parenteral and Enteral Nutrition (ASPEN) and the European Society for Clinical Nutrition and Metabolism (ESPEN), Africa lacks a clinical nutrition organization that is able to develop culturally-relevant protocols to meet the unique challenges faced by African healthcare providers and institutions.

Ojofeitimi and Smith²² reported on the utilization of nutrition support and nutrition care provided in Nigeria in the 1980s. The authors described the categories of hospitals in Nigeria as either University teaching hospitals funded by the Nigerian government or government-owned hospitals.²² The hospitals were reported to be experiencing many barriers to optimal nutrition care including underfunding, overcrowding and lack of a functioning nutrition support team.²² At that time only a few of the Nigerian teaching hospitals had dietetic departments and few qualified dietitians.²² With lack of access to parenteral nutrition, enteral nutrition was the only option available for patients not able to feed orally.²² Dietitians are charged with developing low-cost

enteral feeding mixtures that can be provided to patients when oral feeding is not possible.²² A nutrition support team of surgeons, internal medicine physicians, pediatricians and a nutritionist was formed in 1983 at the University of Ife Teaching Hospitals Complex (IUTHC) and provided outpatient nutrition education, though its services did not expand to include care for inpatients.²²

Klek and colleagues⁴⁵ completed an international study evaluating clinical nutrition services and utilization of nutrition support in twenty-six countries from around the world.⁴⁵ Enteral and parenteral nutrition (EN and PN, respectively) were used to varying degrees in all countries with representatives of clinical nutrition societies responding to the survey.⁴⁵ In this study, Burkina Faso and the Republic of South Africa were the only two African nations with representation leaving information on the practice of nutrition support in remaining African countries sorely lacking.⁴⁵ Both EN and PN were reported as “potentially available” to all patients in hospital settings in all countries studied, though they are not routinely used in home care or palliative care centers in Burkina Faso.⁴⁵

When patients are unable to meet their nutritional needs orally enteral nutrition is preferred in SSA due to resources to provide EN being available and efficacy of treatment.⁴⁴ Parenteral nutrition is infrequently used in SSA due to expense, lack of availability and risk of complications.⁴⁴ It is unclear if parenteral nutrition would be utilized, if available, in patients that would be appropriate for enteral feeding, which, according to the American Society for Parenteral and Enteral Nutrition is accepted as a contraindication to PN.

Nutrition Support Practice in Ghana

Research on nutrition support in Ghana is extremely limited with only one article being published on the topic to date.³ Alhassan and colleagues³ from the University of Health and Allied Sciences in Ho, Volta Region, Ghana, evaluated the level of adherence to standard nasogastric feeding protocols among nurses. The authors note, “adherence to standard protocols in the management of NG tube feeding is particularly critical in resource poor settings in Africa where quality of healthcare delivery and safety remain significant challenges.”³ Nasogastric (NG) enteral feeding is the most commonly utilized tube feeding access in Ghana.³ The standard nursing protocol for NG tube feeding per the Nursing and Midwifery Council (NMC) is included in the required curriculum for all nursing trainees in Ghana.³ Professional nurses regularly insert NG feeding tubes in Ghana and though auxiliary nurse assistants are not legally permitted to insert feeding tubes, they are often the only health profession available to insert the tube due to lack of adequate human resources.³

Alhassan and colleagues³ evaluated adherence to standard nursing protocols and the barriers that impact compliance with the protocols using a self-reported questionnaire. This study was conducted at the 206-bed major regional referral hospital in the Volta region of Ghana.³ The hospital receives patients not only from Ghana, but also from its neighboring country, Togo. In 2018 the staff of the hospital included 262 nursing staff members and 31 medical officers.³ Alhassan et al³ found that self-reported adherence to the standardized NG tube feeding protocol was higher among auxiliary nurses than professional nurses (mean = 1.60 ± 0.34 vs mean = 1.39 ± 0.40 , respectively, $p=.005$).³

Nursing staff reported a lack of continuous professional development trainings as a barrier to adhering to the standard protocol.³

Nutrition Support and Undernutrition

Kwashiorkor, a form of severe protein-energy malnutrition, is endemic in Sub-Saharan Africa.¹³ In Malawi patients diagnosed with kwashiorkor are treated at Nutritional Rehabilitation Centres (NRCs). Brewster, Manary and Graham¹³ evaluated the impact of routine tube feeding and micronutrient supplementation versus standard care (no tube feeding) in patients with kwashiorkor. The authors found that routine tube feeding was associated with improved body weight gain and nutritional status compared with patients not receiving tube feeding in the treatment of malnutrition (8.24 g/kg/d vs 4.51 g/kg/d, respectively).¹³

Blenderized Enteral Nutrition

Blenderized, or homemade tube feeding diets, are becoming more common in the United States among those interested in whole foods diet for tube-fed patients.⁴⁶ In many low- and middle-income countries blenderized feedings are the only option for enteral nutrition provision. Tube feeding via blenderized diets has both risks and benefits. Concerns with blenderized enteral nutrition include increased risk for microbial contamination, particularly in areas where there is a lack of adequate sanitation, and variability of nutritional concentration.⁴⁶

Enteral feedings provided by Balumuka and colleagues⁴⁴ in Mwanza, Tanzania consisted of “millet porridge with mashed eggs, peanuts and milk, mashed plantain with mashed beans made sloppy by adding milk occasionally minced meat and mashed rice.

Sometimes passion fruit juice and fresh milk with sugar was given between meals.”⁴⁴ In the Ife Teaching Hospitals Complex (IUTHC) of Nigeria the dietetic kitchen utilizes high-calorie blenderized mixtures for the management of protein-energy malnutrition (PEM) and a low-protein, high-calorie mixture using locally available foods for enteral nutrition support of renal patients.²²

Dietetic Education and Practice in Ghana

The practice of dietetics in Ghana has evolved from “low-skilled cadre (catering officers) offering hospital-based meal services to the current era of available trained dietitians providing diet therapy in diverse settings.”¹ Retired dietitians report three key periods in the evolution of dietetic practice in Ghana.¹ The first period, occurring before the 1960s, was solely focused on dietary catering services with local training provided to catering officers in institutional management.¹ The second phase of dietetics practice began in the early 1960s when foreign-trained Ghanaian dietitians, primarily receiving training in the United Kingdom and the United States, were recruited to provide care in Ghanaian hospitals.¹ This second period of dietetics practice in Ghana was tumultuous with role conflicts between catering officers and dietitians about “who had superior decision-making authority over patients’ diets and supervision of meal preparation.”¹ In the 1960s there remained only a handful of dietitians in Ghana working in the hospitals in the urban centers of Accra and Kumasi.¹ To meet the need for dietitians the Ghanaian government began sponsoring students to study abroad in dietetics, though many of these dietitians refused to return to practice in Ghana upon completion of their training.¹ The third period began in 1998 when a “stop-gap program” was developed as a six-month

intensive training program in dietetics.¹ This program was initiated at Korle-Bu as a skill-based program to train graduates from Bachelor programs in nutrition and home sciences in the field of dietetics.¹ The stop-gap program trained two cohorts of dietitians who filled key dietitian positions in the Ministry of Health.¹ By 2013 there were 35 qualified dietitians practicing in public and private institutions in Ghana.¹ These dietitians were employed by the Ghana Health Service (GHS), the Ministries of Health and Defense and private hospitals.¹

After the success of the stop-gap program the School of Allied Health Sciences of the University of Ghana began a graduate program in Dietetics in 2004 followed by an undergraduate degree program in 2009.¹ Two additional programs were initiated in 2012 at the University of Health and Allied Sciences and the Kwame Nkrumah University of Science and Technology adding an additional 38 graduate level and 18 undergraduate level dietitians to the Ghanaian dietetic workforce.¹

There are currently four universities offering degree programs that meet the requirements for becoming a dietitian in Ghana.^{20,28,47} These include the University of Ghana, University of Health and Allied Sciences, Kwame Nkrumah University of Science and Technology and University of Cape Coast.^{20,47} At Ghanaian Universities offering the Bachelor of Science in Dietetics the course of study typically includes “an interdisciplinary program that incorporates the sciences of human biology, biochemistry, food, social” and business studies.⁴⁸ Students are admitted to the Dietetics program after successful completion in General Sciences, Home Economics with Science electives and Agricultural Sciences.⁴⁸ Students in undergraduate dietetics programs develop

knowledge, skills and competencies required of entry-level dietetics practitioners required by the Allied Health Professions Council.⁴⁸

To become a dietitian in Ghana students must complete either a four-year Bachelor of Science Degree in Nutrition and Dietetics or a two-year Post Graduate Master of Science in Nutrition and dietetics.⁴⁷ Graduates must then complete a one year internship under the supervision of a dietitian prior to taking the registration exam to become a licensed dietitian.^{20,41,47} Dietetic licensure in Ghana is overseen by the Allied Health Professionals Council.²⁰ The Health Professions Regulatory Bodies Act, 857, of 2013 requires the Allied Health Professions Council of Ghana to publish annually the list of professionals in good standing.⁴¹ Engaging the services of an unlicensed person practicing as an Allied Health Professional is a convictable offense.⁴¹ Nutrition services may be provided in Ghana by Allied Health Professionals licensed as Dietitians, Nutrition Technical Officers and Nutritionists.⁴¹

Nutrition education programs in West Africa have challenges to meeting the needs of the students including inadequate teaching staff, funding, infrastructure, equipment and access to technology.²⁸ These challenges have led Aryeetey and colleagues²⁸ to question the readiness of nutrition program graduates to fill positions requiring the application of nutrition knowledge. The Ghana Health Service and its partners assessed the knowledge and competencies of trainers, including those training nutrition technical officers, at undergraduate institutions in Ghana and found “poor or weak knowledge of essential nutrition actions (including infant and young child feeding, nutrition assessment, [and] community management of acute malnutrition).”²⁸ This

report of the Ghana Health Service suggests that dietetic program graduates have superior practical knowledge over their nutritionist and nutrition technical officer counterparts.

As of May 10th, 2018 there were 58 licensed Dietitians, 98 Nutrition Technical Officers and 161 Nutritionists licensed and in good standing with the Allied Health Professions Council in Ghana.⁴¹ Those seeking licensure as a Dietitian must hold a Bachelor of Science or Master of Science in Dietetics.⁴¹ The Allied Health field of Nutrition offers three tracks including Nutrition Assistant Certificate, Nutrition Technician Diploma and Nutritionist/Nutritionist Technical Officer licensure for those holding a Bachelor of Science or Master of Science in Nutrition.⁴¹ There are currently no institutions with degree programs in nutrition or dietetics listed as accredited by the Allied Health Professions Council (AHPC), which is likely a publishing error as satisfying all academic requirements of an accredited training institution recognized by the Council is a requirement for licensure.⁴¹ According to the AHPC, “a person may apply to the Registrar for permanent registration after practicing for one year with provisional registration and after successfully completing internship.”⁴¹ However, other sources note that continuing professional education is required to maintain registration.⁴⁷

In 2009 the Ghana Dietetic Association (GDA) was formed to “represent and develop the dietetic profession to contribute towards achieving optimal nutrition of all Ghanaians and provide most credible source of nutrition and knowledge applied to health and disease in Ghana.”¹ Following the formation of the GDA a code of ethics for dietitians was developed in 2010.¹ There are both local and national dietetic associations in Ghana, though resources for continuing education are limited.^{1,20} In 2012 the GDA

held its continuing professional development course for its members followed by a Nutrition Care Process (NCP) workshop for dietitians, dietetic students and interns in 2013 in collaboration with faculty and dietetic interns from Iowa State University.^{1,20} In 2016 Boateng and colleagues²⁰ surveyed NCP workshop participants and found that most had only partially implemented the NCP in their practice. A second NCP workshop was held in 2017 in collaboration with Iowa State University and faculty and doctoral students from the University of North Florida.²⁰ In the summer of 2018 a Nutrition-Focused Physical Exam (NFPE) workshop was held at the University of Ghana for dietitians, dietetic interns, dietetic students and nutritionists in collaboration with faculty and doctoral students from the University of North Florida in an effort to continue to elevate the level of practice of Ghanaian dietitians.⁴⁹

Despite GDA's efforts to expand the reach of dietitians throughout Ghana, there is an inadequate distribution of skilled dietitians with most dietitians predominantly located in the capital of Accra and some regions in Ghana having no dietitians.^{1,4,20} In 2013 there was approximately one dietitian for every 685,000 Ghanaian citizens.¹ There is a critical shortage of qualified dietitians throughout all regions of Ghana.^{1,4} Building pre-service, both undergraduate and graduate, nutrition education capacity has been proposed as an essential element to meeting the nutrition demands in Ghana.²⁸ In efforts to improve nutrition capacity in Ghana universities have worked to improve and expand pre-service, or undergraduate, training in nutrition and dietetics.⁵ Provision of nutrition care by unqualified dietitians is commonplace throughout Ghana.¹ In a survey of dietitians and dietetic interns the respondents reported many challenges to dietetic

practice in Ghana including, “inadequate access to in-service training and job aids, poor remuneration and rewards system, and absence of appropriate legal and regulatory framework to guide dietetic practice.”¹ Dietitians reported remaining in entry level positions for many years, despite promotion guidelines available in the public sector.¹ Due to these challenges many dietitian positions in the public sector remain unfilled.¹

Training Workshops and Workshop Evaluation

The purpose of a workshop is concentrated education, though overtime the workshop has shifted from an informal setting to a “more rigorously structured learning experience that is outcome oriented.”⁵⁰ The shift in workshop structure is largely due to a cultural shift toward accountability in all areas of education.⁵⁰

D'Eon and colleagues¹⁸ sought to establish construct validity and reliability of group self-assessments to measure workshop effectiveness. Self-assessments are easy to obtain, require minimal resources and can be used in the absence of baseline data.¹⁸ In the study by D'Eon et al¹⁸ participants completed pre-, post- and retrospective self-assessments on their perceived skill level. Self-assessments as an evaluation tool have been controversial, though this is largely due to the assessments being used as an assessment of the individual. To avoid this controversy the self-assessment should be used as an aggregate group assessment of the workshop effectiveness rather than as an assessment of the individual.¹⁸ Grouped self-assessments provide a valid and reliable measure of workshop effectiveness.¹⁸ A weakness of this approach is that many participants are unable to accurately assess themselves before the workshop.¹⁸ To address this weakness D'Eon proposes the use of retrospective self-assessments in which

participants are asked to think back to their level of and skill prior to the workshop.¹⁸ The authors assert that self-assessments can be used to measure workshop effectiveness.¹⁸

Lee and colleagues¹⁹ evaluated the impact of an electronic health record (EHR) training workshop on improving knowledge, attitude and skills of medical faculty. The authors conducted two training workshops, a four-hour workshop at Cleveland Clinic, and a condensed 1.5 hour workshop at The University of Chicago.¹⁹ Both workshops included a lecture and a Group-Objective Structured Clinical Exam (GOSCE).¹⁹ Participants at Cleveland Clinic attended a 75-minute lecture and 100-minute GOSCE breakout session including each participant having a twenty-minute interaction with a standardized patient, five minutes for feedback and twenty-five minutes of large-group debriefing.¹⁹ University of Chicago participants attended a twenty-minute lecture with a sixty-minute GOSCE consisting of ten-minute individual interactions with the standardized patient, five minute feedback and ten minutes of large group debriefing.¹⁹ The authors utilized a 23 item post-workshop self-reported survey to evaluate workshop impact provided to participants at the conclusion of the session.¹⁹ The post-workshop survey included items on knowledge, attitude and skills with a retrospective pre-test design asking the participants to rate these areas pre-workshop.¹⁹ Items were rated on a Likert-type scale with response options at the high end of the scale including agree or strongly agree.¹⁹ When compared with retrospective recollections of their knowledge, attitude and skills post-workshop there was a significant increase in knowledge of best practices (pre vs post; 3.1 [SD=0.8] vs 4.3 [SD=0.5], $p<0.001$) with no difference between the two workshop sites.¹⁹ The participants ($n=30$) reported they had gained new

knowledge and improved their EHR skills.¹⁹ Lee and colleagues¹⁹ suggest workshops as a feasible and effective short training modality to improve knowledge and skills among health care professionals.

Akinyemi et al³¹ evaluated stroke knowledge among Nigerian non-neurologist health workers ($n=210$) in sub-Saharan Africa before and after a one-day stroke workshop using a quasi-experimental design with a self-administered stroke knowledge survey pre- and post-workshop. Workshop participants attended a one-day eight-hour intensive stroke workshop aimed at “building their capacity for early recognition, resuscitation, appropriate and prompt referral of suspected stroke cases as well as preventive and basic rehabilitative care.”³¹ Akinyemi and colleagues³¹ evaluated participants’ level of stroke knowledge before and after the intervention with a self-administered stroke literacy questionnaire developed by the authors. The authors found that participants’ knowledge was significantly increased following the workshop including knowledge of stroke risk factors ($p<0.001$), stroke symptoms ($p<0.001$) and how stroke develops ($p=0.009$).³¹ This study showed one-day intensive workshops are an effective form of training and increasing professional knowledge in low-resource settings in sub-Saharan Africa.

Arciniegas Calle and colleagues⁵¹ provided multiple, standardized one-day certification workshops to physicians in twelve Latin American countries aimed at improving physical activity prescription knowledge. Participants were evaluated using a 20-question multiple-choice pre- and post-test on physical activity topics.⁵¹ Throughout the duration of the study the authors provided 41 workshops to 1,417 participants in

twelve Latin American countries.⁵¹ The authors found that test scores improved, on average, from 67% before the workshop to 82% after the workshop ($p<0.001$) with an average individual relative knowledge gain of 29% [CI:26 to 32%].⁵¹ The authors reported that a one-day intensive workshop is an effective continuing education strategy.⁵¹

Gaps in Research

There is a paucity of research on nutrition support, continuing professional education and standards of dietetics practice in Ghana, Sub-Saharan Africa and low- and middle-income countries. Little is known about the curriculum covering nutrition support education for undergraduate and graduate dietetic students and the requirements for continuing professional education in nutrition support in Africa. There has not yet been research on the impact of continuing education for nutrition professionals on improving nutrition support knowledge, confidence and self-efficacy in low- and middle-income countries.

Chapter II: Theoretical Foundation for Study

Introduction to Theories

This research project was designed to provide and evaluate continuing professional development in nutrition support of Ghanaian nutritional professionals. Ghanaian dietitians, dietetic interns, dietetic students and nutritionists have varying levels of previous knowledge, skills and experience in nutrition support that was built upon by employing constructs of Knowles' Adult Learning Theory⁵², The Levels of Continuing Education Framework by Moore and colleagues⁵³ and Bandura's Social Cognitive Theory⁵⁴.

Knowles' Adult Learning Theory

In 1928 the psychologist Edward L. Thorndike reported that learning ability within itself does not decrease with age.^{50,55,56} Adults engage in learning for both personal enrichment and professional enhancement.⁵⁰ Psychologist Malcolm Knowles developed a theory of adult learning describing how adults learn differently from children.⁵⁷⁻⁵⁹ He defined adult education as "the art and science of helping maturing human beings learn."¹⁵ Knowles' theory stems from the theory of andragogy.

Andragogy, first described by Alexander Kapp in 1833 and introduced to the United States by Knowles in 1968, is in contrast to pedagogy, the "art and science of educating children" which focuses on teacher-directed instruction.^{15,57,60} The roots of andragogy and its difference from pedagogy are believed to stem from the work of Plato.⁶¹ Plato's theory on education of adults was described by Alexander Kapp in the 1800s.⁶¹ Knowles echoes this noting, "the great teachers of ancient times were teachers

of adults, not children. In ancient China, Confucius and Lao Tse were teachers of adults, not children. The Hebrew prophets and Jesus were teachers of adults, not children. The ancient Greeks-Socrates, Plato, Aristotle-were all great teachers of adults, not children.”⁶⁰

Pedagogy comes from the Greek word *paidos*, or children, and *agogus*, which means “to lead.”^{56,59,61} Andragogy is derived from the Greek word for adult, *aner* or *andra*.^{56,59,62} Pedagogy has been broadly used to describe the profession of teaching.⁶⁰ Pedagogical models are teacher-focused in which a teacher provides the content to the students.^{56,59} In a pedagogical model the experience of the learner is seen as having little value as a resource for learning.⁶²

Knowles described six key attributes of adult learners: “they like to be self-directed, they want to be actively involved in [the] learning processes, they learn best when they have a need to know, they connect new learning to past experiences, they need to apply their learning in the real world” and they are intrinsically motivated.^{15,55–57,63} These characteristics can evolve in learners as children advance into adulthood and into more self-directed study. Adult learners are prone to disengage when learning activities are perceived as not relevant to meeting professional or scholarly development needs.⁶⁴ Knowles’ notes that most adults are part-time learners which requires learning opportunities to be made available to them that are convenient, relevant and engaging.¹⁵

Andragogical teaching is learner-centered with a focus more on the process of learning rather than content alone and aids students in gaining skills and experiences that help the learner to advance his or her knowledge.^{59,62} A key difference between pedagogy and andragogy is that adults have lived and experienced more than children which

inherently impacts their intrinsic motivation and ability to build on previous knowledge.^{62,63} Adult learners are continuously expanding their knowledge based on their existing knowledge.^{62,63} Knowles' asserts that the pedagogical model excludes the andragogical assumptions while the andragogical model is a system which includes the pedagogical assumptions.⁶²

Knowles' adult learning theory differs from other theories of andragogy in that it describes the attributes of adult learners being on a continuum and focuses on helping adults learn.⁶¹ European theories of andragogy focus on adult learning as a means to achieve social goals while Knowles' theory departs from this with an emphasis on an individual's desire for personal growth.⁶¹ The societal aspect of adult learning marks a separation between Knowles' theory of adult learning and European andragogy as Knowles asserted the andragogical process must be conducted in a way that emphasizes honesty and integrity "so that it would not be mistaken for an attempt at social change."⁶¹

Malcolm Knowles' adult learning theory is practice oriented focusing on the changing needs of learners as they mature.⁶¹ Adult learners start with a different base of knowledge than children due to their larger body of life experiences and learn by applying information to build on their previous knowledge.⁶⁵ In the problem-based learning approach students are provided the knowledge they will need for later problem-solving and it encourages students to "learn to learn", a key tenant of Knowles' adult learning theory.⁵⁷

While Knowles' theory provides insight into engaging adult learners, it does not clearly describe how best to assess and evaluate the knowledge and skills gained by adult learners when utilizing an andragogical approach.

Moore et al⁵³ Framework on the Levels of Continuing Education Outcomes

The Levels of Continuing Education Outcomes Framework by Moore et al⁵³ was developed for medical education and has been applied to other health professionals.

Moore, Green and Gallis⁵³ developed a framework for the evaluation of continuing education program success “in achieving practice-oriented outcomes for health professionals.”⁶⁶ Effective programs should transmit actionable knowledge and a way for learners to demonstrate physical competencies.⁶⁶ Education activities for health practitioners must include domain knowledge in addition to “process-type knowledge such as adhering to clinical practice guidelines when treating patients.”⁶⁶ The successful continuing education activity will achieve participant command of domain knowledge and ability to connect and mobilize knowledge in an authentic problem-based scenario.⁶⁶ This nutrition support workshop is designed at a continuing education outcome Level 5 to provide the learner the ability to translate knowledge and skills gained from the workshop into practice in their work setting with the enteral nutrition (EN) questionnaire designed to measure Level 4 and Level 5 outcomes.

Figure 1. Moore et al⁶⁶ Levels of Continuing Education Outcomes

<i>Level</i>	<i>Description of Continuing Education (CE) outcomes</i>
Level 1	Tallies only participation or attendance
Level 2	Outcome focus is on learner satisfaction and the learner's ability to note if the education activity met the stated objectives
Level 3	Focuses on the learner expectations and the level to which the course meets or exceeds those expectations
Level 4	Examines competencies gained by the learner through the continuing education experience, this outcome level assesses ability to demonstrate knowledge in an educational setting
Level 5	Targets the learner's ability to translate the knowledge or skill into the performance of practice
Level 6	Reaches the patient experience and seeks benefit to the patient's condition as a result of the health practitioner's action
Level 7	The degree to which the health status of the community changes

Note: Adapted from: Zaghab RW, Maldonado C, Whitehead D, Bartlett F, Rodriguez de

Bittner M. Online Continuing Education for Health Professionals: Does Sticky Design Promote Practice-relevance? Electron J e-Learning [Internet]. 2015;13:466–74.

Moore et al's theory describes ways to design, implement and evaluate knowledge gains, but it does not address the traits of learners or ways to measure other aspects of learning experience, such as perceived benefit and self-efficacy.

Bandura's Social Cognitive Theory

In the 1960s and 1970s Albert Bandura adapted Social Learning Theory to describe determinants of social learning and behavior in the context of intellectual processing.⁶⁷ Bandura's Social Cognitive Theory focuses on individual's self-regulative capacities and self-efficacy.⁶⁷ Bandura's theory provides insight into how individuals operate cognitively, how this influences social experiences and how this leads to behaviors and development.⁶⁷ How individuals mentally represent themselves and their environments impacts their perceptions of self-efficacy and self-perception.⁶⁷ People

hold ideological positions despite changing situations because they have judgmental self-reactions that influence their behavior.⁶⁷ Bandura's theory explains that direct personal agency involves intentionality and forethought with self-reflectiveness about and self-reactiveness towards one's capabilities.⁵⁴ Individuals develop beliefs about their abilities and characteristics which guide their behavior and what they try to achieve.⁶⁷ These beliefs form a framework which guides how individuals put their knowledge into action.⁶⁷

Application of Theories and Frameworks to Research Involving Continuing Professional Development of Nutrition Professionals in a Low-Resource Setting

Continuous professional development is essential to maintaining a skilled workforce that can meet the nutrition care and health needs of communities. Some professional organizations, including the Japanese Nursing Association and the American Nurses Association, propose that "continuing education should be conducted within the adult learning theoretical framework."⁶⁸ Previous studies have shown that educational activities based upon Knowles' adult learning theoretical framework are effective in increasing learners' knowledge, awareness and skills.^{59,69,70}

Professional development is the ongoing commitment to maintain and advance professional knowledge and skill base. Increasing professional development opportunities in healthcare settings has been shown to improve provider retention and satisfaction.⁵⁸ Applying Knowles' adult learning theory to professional development activities enables the "development of competencies, knowledge, and abilities"⁶⁸ among

participants. Learning activities informed by Knowles' adult learning theory meet the learner's perceived learning needs and tap into their experience.⁶⁵

The Adult Learning Theory is essential in the design of professional development activities for learners in low resource settings that come with a foundation of knowledge and experience that are vastly different from educational activities designed for professionals in high resource settings. The gaps in knowledge and practice among Ghanaian dietitians are not due to lack of individual capacity, rather they are due to limited resources, limited opportunity for professional development and lack of culturally relevant nutrition therapy protocols. Ghanaian nutrition professionals are dissatisfied with the lack of continuing education opportunities¹ which is evidence of their desire to be involved in the learning process, self-direction and intrinsic motivation.

Alexander and colleagues⁷¹ evaluated the perceived benefit of an eight-week gentle yoga program in older, predominantly overweight adults. The authors used a “constructivist-interpretive approach to naturalistic inquiry.”⁷¹ Both qualitative and quantitative data were gathered with the participants completing weekly logs and an exit questionnaire at the end of the study.⁷¹ Amaah⁷² evaluated the knowledge, attitudes and social representations of cholera in Cameroon. These studies showed that research from an adult learner-centered approach can provide insight into perceived benefit of participants in an African context.

Application of Theories and Frameworks

The Adult Learning Theory is the most influential theory informing the development and evaluation of the nutrition support workshop. In addition to Knowles'

theory¹⁵, the Framework on the Levels of Continuing Education Outcomes by Moore et al⁵³ and Bandura's Social Cognitive Theory have guided design of the workshop and its activities. The enteral nutrition and self-efficacy questionnaire utilized in this study has been adapted to assess the dietetics practice and self-efficacy of adult learners in low resource settings. As practitioners in a middle-income country, Ghanaian dietitians have education in nutrition support in pre-service training, though limited opportunity for continued education. The enteral nutrition questionnaire draws on characteristics of the adult learner. Assessing responsibility for nutrition support and satisfaction with enteral nutrition knowledge will give evidence of the level of self-direction and intrinsic motivation of the Ghanaian nutrition professionals. Ability to apply what has been learned to the real world will be measured by assessing confidence level in providing nutrition support, nutrition support knowledge and a case study. Case studies are narrative evaluations based on real life situations and are a useful tool to evaluate skills enhancement and critical analysis.⁷³⁻⁷⁵ Case studies have been used in higher education courses to assess students' ability to demonstrate higher-level skills and synthesis of knowledge.⁷³

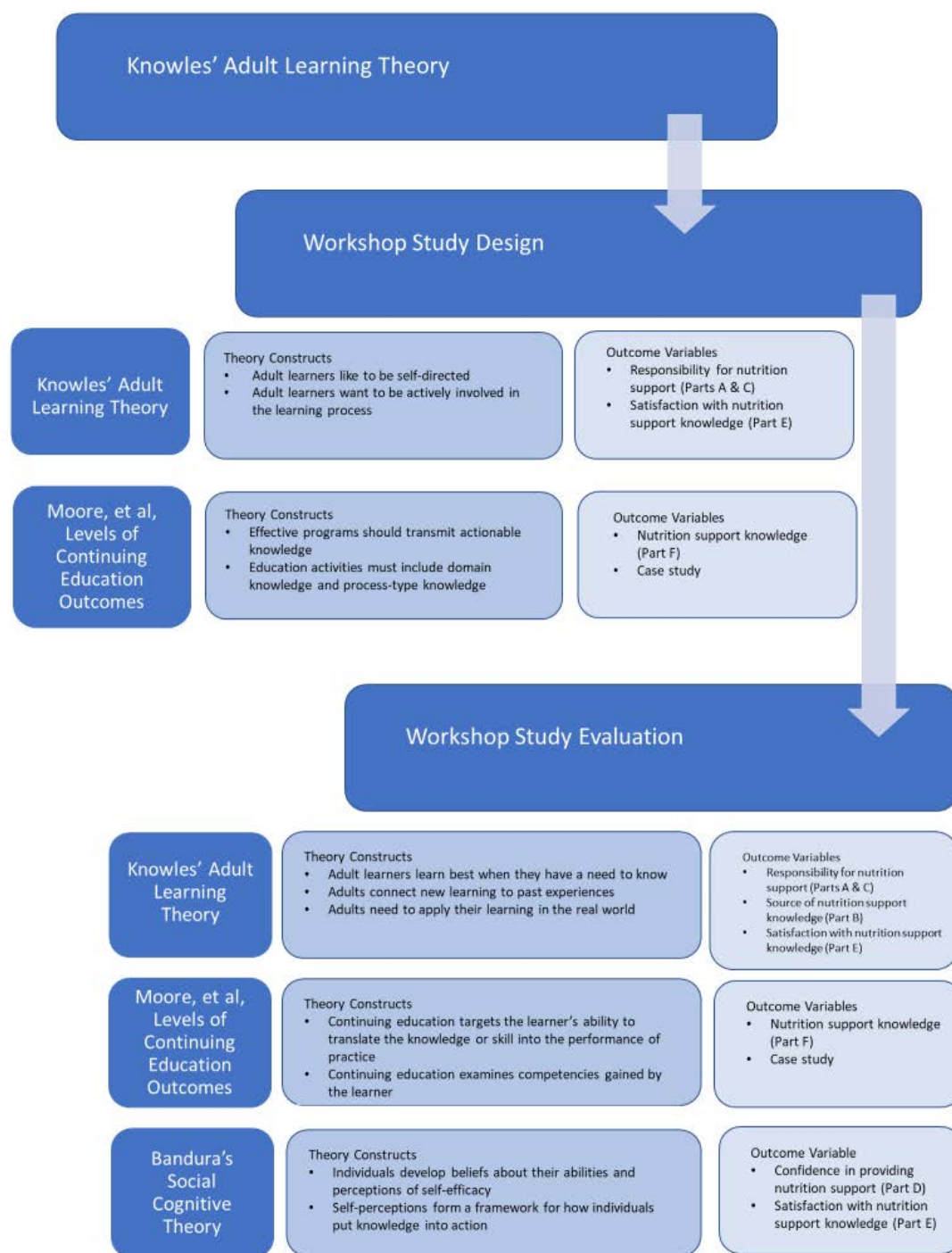


Figure 2. Application of Theories and Frameworks to This Study

Chapter III: Research Methods

Study Aims

The aims of this study were to improve the nutrition support knowledge and confidence in providing nutrition support of an estimated one-hundred Ghanaian nutrition professionals participating in a one-day intensive nutrition-support workshop described below. The workshop was aimed at dietitians, dietetic interns, dietetic students, nutritionists and nutrition technical officers in Ghana to elevate the level of nutrition support practice and thus nutrition capacity in Ghana. The research question was: when provided with an evidence-informed, culturally relevant nutrition support workshop, can Ghanaian nutrition professionals achieve actionable nutrition support knowledge and confidence in nutrition support practice?

Problem Statement

The purpose of this project was to evaluate the impact of providing a workshop on nutrition support for Ghanaian nutrition professionals.

Research Questions and Hypotheses

Research Question 1 and Hypothesis

Question 1:

Does providing a workshop on nutrition support for Ghanaian nutrition professionals impact their confidence in providing nutrition support care?

Null Hypothesis:

Participating in a nutrition support workshop has no impact on Ghanaian nutrition professionals' confidence in providing nutrition support care.

Alternative Hypothesis:

Participating in a nutrition support workshop will improve Ghanaian nutrition professionals' confidence in providing nutrition support care.

Research Question 2 and Hypotheses**Question 2:**

Does acquiring nutrition support skills impact Ghanaian nutrition professionals' satisfaction with their knowledge of nutrition support?

Null Hypothesis:

Participating in a nutrition support workshop does not impact Ghanaian nutrition professionals' satisfaction with their knowledge of nutrition support.

Alternative Hypothesis:

Participating in a nutrition support workshop will increase Ghanaian nutrition professionals' satisfaction with their knowledge of nutrition support.

Research Question 3 and Hypotheses**Question 3:**

Does participating in a nutrition support workshop impact the nutrition support knowledge of Ghanaian nutrition professionals?

Null Hypothesis:

The nutrition support knowledge of Ghanaian nutrition professionals will not change following a nutrition support workshop.

Alternative Hypothesis:

The nutrition support knowledge of Ghanaian nutrition professionals will increase following a nutrition support workshop.

Research Question 4 and Hypotheses

Question 4:

Does participating in a nutrition support workshop impact Ghanaian nutrition professionals' ability to apply their knowledge of nutrition support?

Null Hypothesis:

There will be no change in Ghanaian nutrition professionals' ability to apply their knowledge of nutrition support following a nutrition support workshop.

Alternative Hypothesis:

There will be an increase in Ghanaian nutrition professionals' ability to apply their knowledge of nutrition support following a nutrition support workshop.

Study Design

Based on the research question and accessibility to the population of interest the most appropriate study design was a quasi-experimental prospective, single cohort pre-test/post-test design.

The project focused on a nutrition support workshop that utilized experiential and problem-based learning approaches informed by Knowles' adult learning theory. Previous experience visiting Ghanaian hospitals and clinics and in-depth literature review guided the development of the workshop to be as culturally relevant and resource appropriate as possible. Ghanaian dietitians have nutrition support capabilities that lag behind their dietetics knowledge and critical thinking skills. A goal of this workshop was

to build upon the knowledge Ghanaian dietitians and nutritionists have from their undergraduate, internship, work and prior continuing education experiences to elevate their level of nutrition support practice.

Participants were asked to complete a socio-demographic survey, an enteral nutrition and self-efficacy questionnaire that was adapted from Persenius et al,⁷⁶ Raelin and Reddan,⁷⁷ and a case study. Self-assessment questionnaires have previously been shown to be a reliable and valid method for evaluating educational interventions.¹⁸ The case study evaluation demonstrated the participants' ability to think professionally about practice problems and situations.⁷⁴

Study Participants

The participants for this study were dietitians, dietetic students, dietetic interns, nutritionists and nutrition technical officers in Ghana. A convenience sample was used in the study based on accessibility of the subjects in the population.⁷⁸

The estimated minimum required sample size was calculated as 62 people using a sample size calculator.⁷⁹ The total population size of dietitians, nutritionists, dietetic students, dietetic interns and nutrition technical officers was unknown, though was estimated to be 660 people. There was a known population size of 58 dietitians, 98 nutritionists and 161 nutrition technical officers from the AHPC data of professionals in good standing in 2019.⁴¹ The population of undergraduate dietetic students was approximately 275 and graduate students was approximately 50 in 2013.⁴ There was an estimated 18 dietetic interns in training in Ghana based on historical data from Aryeetey, Boateng and Sackey.¹ With an estimated population of 660 people, confidence level of

90%, and margin of error of 10% the required minimum sample size was 62 participants. The workshop participation was anticipated to be about 100 nutrition professionals which would be adequate to meet the required sample size.

Participants were recruited by invitation through the Ghana Dietetic Association (GDA) by dietitians at the University of Ghana in Accra, Ghana. Over one hundred nutrition professionals voluntarily participated in the workshop.

Inclusion criteria consisted of profession (dietitian, nutritionist, nutrition technical officer, dietetic intern or student). Participants that did not submit either a pre-workshop or post-workshop survey were not included in data analysis.

Workshops have previously been conducted by researchers from the University of North Florida and the University of Ghana with a similar population of participants on the topics of the Nutrition Care Process and Nutrition-Focused Physical Examination. Participation in previous workshops was not an exclusion criterion as the goal of this workshop was to build on knowledge and skills learned during previous workshops.

Intervention

The intervention for this study was a nutrition support workshop in Ghana formed through the theoretical lens of Knowles' Adult Learning Theory¹⁵ and Moore's Continuing Education Framework.⁵³ The six-hour workshop included interactive didactic training designed from an andragogical approach using Knowles' Adult Learning Theory. Topics of the didactic training included nutrition support fundamentals, Nutrition Care Process (NCP) for nutrition support patients covering assessment, diagnosis, intervention (nutrition support access, initiation, advancement and weaning), monitoring and

evaluation (management of complications and acid-base balance), Nutrition-Focused Physical Examination (NFPE) for nutrition support patients (abdominal examination including auscultation and palpation) and micronutrient examination. Following the didactic portion of the workshop, the participants were guided through hands-on small group sessions focusing on NFPE skills of auscultation, palpation and micronutrient assessment as well as NCP skills of assessment and diagnosis, intervention, monitoring and evaluation and managing complications. Participants utilized the knowledge and skills gained during the didactic and skills portions of the workshop in application to case studies on enteral nutrition, parenteral nutrition and acid-base balance.

Objectives of the training included:

1. Participants will describe the application of the nutrition care process (NCP) for patients requiring nutrition support.
2. Participants will calculate enteral and parenteral nutrition support prescriptions.
3. Participants will explain enteral and parenteral nutrition initiation, advancement and weaning including management of nutrition support complications.
4. Participants will describe acid-base balance management for nutrition support patients.
5. Participants will perform nutrition-focused physical exam (NFPE) of a nutrition support patient including micronutrient examination, abdominal auscultation and palpation.
6. Participants will apply nutrition support fundamentals to case studies.

Data Collection

Outcomes of interest included characteristics of nutrition professionals in Ghana, perceptions of responsibility for enteral nutrition, source of knowledge of nutrition support, knowledge of nutrition support, confidence in providing nutrition support care and relevance of this workshop to their practice. The data collection instrument consisted of a two-part questionnaire comprised of a socio-demographic survey and an enteral nutrition questionnaire (see Appendices D and E). The socio-demographic profile included gender, age, nationality, undergraduate school or university, profession (dietitian, nutritionist, nutrition technical officer, dietetic intern, student or other), current area of practice/work, area of work interest, years in profession, participation in Nutrition Care Process Workshop in 2017, participation in Nutrition-Focused Physical Examination Workshop in 2018, and membership in professional organizations.

The Enteral Nutrition Questionnaire was adapted from a tool utilized by Persenius, Larsson and Hall-Lord.⁷⁶ This questionnaire included six-subsections containing fifty-three questions on knowledge of responsibility for nutrition, source of knowledge regarding nutrition, responsibility for enteral nutrition, satisfaction with enteral nutrition knowledge, enteral nutrition confidence and knowledge of enteral nutrition interventions. Parts A through E of the questionnaire were not accuracy-based questions; therefore these questions were analyzed based on change in response between the two measurements. Part F included the knowledge portion of the questionnaire. The knowledge accuracy score was calculated as a percentage of correct responses of the questions that were answered. A percent correct score was calculated for both the pre-workshop and post-

workshop questionnaires. Persenius and colleagues⁷⁶ utilized this tool to evaluate nurses' perceptions of responsibility, knowledge and documentation of nutrition support among nurses (n=44) in three intensive care units in Swedish hospitals. The authors found that effective enteral nutrition is often hindered by lack of knowledge and confidence in provision of nutrition support.⁷⁶

To evaluate the reliability of the enteral nutrition questionnaire, Persenius and colleagues conducted 40 bedside observations of the nurse participants' enteral nutrition practice.⁷⁶ The authors found significant differences between the nurses at the three units and the questionnaire reliably corresponded with observed nursing practice in the intensive care unit.⁷⁶ This tool was successful at identifying gaps between recommended, evidence-based enteral nutrition care and nutrition support knowledge and practice.⁷⁶

Perceived self-efficacy was measured by section D of the enteral nutrition questionnaire data collection instrument. Section D was adapted from the confidence section of the enteral nutrition questionnaire by Persenius et al⁷⁶ and the Work Self-Efficacy Inventory (WSEI).⁷⁷ This portion of the questionnaire evaluated the respondent's confidence in their skills and abilities in providing nutrition support care to patients in a work setting. The case study was utilized to evaluate participant knowledge gains and ability to translate knowledge gains into practice.⁷⁴

Participants were provided with workshop materials as they entered the workshop. Materials were contained in individual folders for each participant. Due to the evaluation tool being self-administered, the survey and questionnaire were printed on one-sided pages, rather than dual-sided front and back pages, to reduce the likelihood of

participants missing questions. The survey instruments were pre-labeled with a code for each participant and codes for pre- and post-surveys. Surveys were collected from participants prior to their leaving the workshop to increase response rate. Participant's personal identifying information was not collected.

Pre-workshop surveys (including Parts A through F and the case study) with a minimum of 53 of 62 questions with responses met the threshold of 85% completion and were included in this study. The post-workshop questionnaires included fewer questions than the pre-workshop due to parts A, B and C only being included in the pre-workshop questionnaire. Post-workshop surveys with 33 questions completed out of the 38 included met the threshold of 85% for inclusion for post-workshop survey data analysis.

Data Analysis

Demographic characteristics of participants, perceived responsibility for nutrition support and source of nutrition support knowledge were evaluated using descriptive statistics. Change in participant confidence, knowledge, satisfaction with knowledge, and knowledge application were evaluated using paired sample t-tests because only two data points were being compared: pre-workshop data and post-workshop data.

Responses from the enteral nutrition (EN) questionnaire section F, which assessed participants' nutrition support knowledge, were entered into SPSS with a raw score for the total number of accurate responses for both the pre-workshop and post-workshop questionnaire. Knowledge change from the pre-workshop to post-workshop time measurement was evaluated using a paired sample t-test.

The pre- and post-workshop case studies were graded using the rubric in Appendix G. Two separate, independent raters rated each case study. Cohen's kappa was used to assess for interrater reliability.⁷⁸

The required model assumptions for each statistic were checked to ensure that assumptions were not violated.⁷⁸ Scatterplots were used to visually assess data, Durbin-Watson statistics were calculated to determine independence, normality was evaluated with histograms, "skewness and kurtosis, a P-P plot, or statistical tests such as the Kolmogorov-Smirnov test or Shapiro-Wilk test,"⁷⁸ as appropriate.

Data analysis was conducted using SPSS version 25.0 software, and $p < 0.05$ was considered statistically significant.

Limitations

The response-shift bias is inherent to pre-test/post-test study design.¹⁸ Retrospective self-assessments have been shown in some studies to be more closely correlated with objective ratings than pre-intervention self-assessments.¹⁸ This difference between retrospective self-assessments and preintervention-self assessments is known as the response-shift bias.¹⁸ Due to time constraints with the workshop, completion of the full post-survey in addition to a retrospective self-assessment was determined to be impractical for this project.

Some areas of potential bias were anticipated in conducting this project. Self-selection bias was a concern for this study. A convenience sample, while practical for this research, posed the risk for having a sample that may not be representative of the population.⁷⁸ It is possible that participants upon reviewing the questionnaire decided not

to participate in the study leaving those that may have had higher initial confidence in their nutrition support knowledge and skills as participants which could have skewed results. The case study was identified as a potential source of objectivity/subjectivity bias.⁷⁴ To minimize this concern independent raters were utilized for case study evaluation.

Chapter IV: Presentation of the Results and Findings

Results

One-hundred and eleven participants returned questionnaires. Of the 111 participants returning a questionnaire, nine participants did not complete any portion of the pre-workshop questionnaire and twenty-six participants did not complete any portion of the post-workshop questionnaire leaving seventy-six participants with questionnaires included in data analysis. Some participants had questionnaires which were incomplete which is discussed in more detail below.

Characteristics of Nutrition Professionals

Tables 1, 2, and 3 show the demographic, professional and practice data of participants in the study. Of those meeting inclusion criteria for data analysis, participants were primarily between the ages of 21 and 30 ($n=49$, 66%), female ($n=55$, 73.3%), Ghanaian ($n=73$, 98.6%) and from the Greater Accra region ($n=39$, 65%), current or former students of the University of Ghana ($n=39$, 63.9%), dietitians or dietetic interns ($n=40$, 53.3%) and in practice for four or fewer years ($n=49$, 84.5%). Approximately half of participants included in data analysis reported their primary area of practice including inpatient duties in some capacity ($n=28$, 48.4%), though not as many participants reported Clinical Inpatient as an area they were interested in practicing ($n=25$, 41.4%).

Table 1. Demographics of Participants Included ($n=76$) and Excluded ($n=35$) from Data Analysis

Variable	Participants Excluded from Data Analysis $n=35$		Participants Included in Data Analysis $n=76$	
	n	%	n	%
Age (in years)	25		74	
< or =20	1	4.0	7	9.5
21-25	6	24.0	25	33.6
26-30	12	48.0	24	32.4
31-35	2	8.0	8	10.9
36-40	3	12.0	7	9.5
41-45	1	4.0	2	2.7
46+	0	0.0	1	1.4
Gender	25		75	
Male	9	36.0	20	26.7
Female	16	64.0	55	73.3
Nationality	25		74	
Ghanaian	24	96.0	73	98.6
Nigerian	1	1.0	1	1.4
Undergraduate School or University	16		61	
University of Ghana	12	75.0	39	63.9
University of Allied Health Sciences	4	25.0	7	11.5
University of the Cape Coast	0	0.0	2	3.3
KNUST	0	0.0	9	14.8
Other	0	0.0	4	6.5

Note: Some participants omitted answers on the demographic survey and as such the number of responses for was not $n=35$ for excluded participants or $n=76$ for included participants for all items.

Table 2. Professional Data of Participants Included (n=76) and Excluded (n=35) from Data Analysis

Variable	Participants Excluded from Data Analysis <i>n</i> =35		Participants Included in Data Analysis <i>n</i> =76	
	<i>n</i>	%	<i>n</i>	%
Profession	26		75	
Dietitian	16	61.5	28	37.3
Nutritionist	2	7.7	7	9.3
Dietetic Intern	5	19.2	12	16.0
Dietetic Student	3	11.5	26	34.7
Other	0	0.0	2	2.7
Years in Profession	22		58	
Less than 1 year	5	22.7	22	37.9
1-4 years	9	40.9	27	46.6
5-9 years	8	36.4	5	8.6
10 or more years	0	0.0	4	6.9
Ghanaian Region of Practice	25		60	
Savannah Region	0	0.0	1	1.7
Northern	0	0.0	1	1.7
Ashanti	1	4.0	7	11.7
Eastern	4	16.0	3	5.0
Western	0	0.0	2	3.3
Western North	0	0.0	1	1.7
Central	1	4.0	2	3.3
Upper West	0	0.0	1	1.7
Upper East	1	4.0	0	0.0
Brong Ahafo	1	4.0	0	0.0
Volta	2	8.0	1	1.3
Greater Accra	14	56.0	39	65.0
Other Regions & Outside of Ghana	1	4.0	2	3.3

Note: Some participants omitted answers on the demographic survey and as such the number of responses for was not *n*=35 for excluded participants or *n*=76 for included participants for all items.

Table 3. Practice and Professional Organization Data of Included (n=76) and Excluded (n=35) Participants

Variable	Participants Excluded from Data Analysis <i>n</i> =35		Participants Included in Data Analysis <i>n</i> =76	
	<i>n</i>	%	<i>n</i>	%
Current Area of Practice	22		57	
Clinical Inpatient	5	22.7	6	10.5
Clinical Inpatient and Clinical Outpatient	6	27.3	9	15.8
Clinical Inpatient, Clinical Outpatient and Pediatrics	0	0.0	9	15.8
Clinical Inpatient, Clinical Outpatient and Community	1	4.5	0	0.0
Clinical Inpatient, Clinical Outpatient, Pediatrics and Community	0	0.0	3	5.3
Clinical Inpatient, Clinical Outpatient and Education	0	0.0	1	1.8
Clinical Outpatient	7	31.8	8	14.0
Pediatrics	1	4.5	0	0.0
Community	1	4.5	2	3.5
Education	0	0.0	12	21.1
Other	1	4.5	7	12.3
Area of Interest for Practice	24		63	
Clinical Inpatient	7	29.2	17	27.0
Clinical Inpatient and Clinical Outpatient	0	0.0	2	3.2
Clinical Inpatient, Clinical Outpatient, and Other	1	4.2	0	0.0
Clinical Inpatient and Pediatrics	0	0.0	2	3.2
Clinical Inpatient, Clinical Outpatient and Pediatrics	0	0.0	1	1.6
Clinical Inpatient, Clinical Outpatient, Pediatrics, and Community	1	4.2	0	0.0
Clinical Inpatient, Clinical Outpatient and Education	0	0.0	1	1.6
Clinical Inpatient, Clinical Outpatient, Pediatrics, and Industry	0	0.0	2	3.2
Clinical Inpatient, Pediatrics and Community	0	0.0	1	1.6
Clinical Outpatient	5	20.8	7	11.1
Clinical Outpatient and Education	0	0.0	1	1.6
Clinical Outpatient and Community	0	0.0	1	1.6
Pediatrics	2	8.3	9	14.3
Industry	4	16.7	4	6.3
Community	2	8.3	2	3.2
Education	1	4.2	11	17.5
Other	1	4.2	2	3.2
Membership in Professional Organizations	25		71	
Yes	23	92.0	47	66.2
Ghana Dietetic Association (GDA)	18	81.8	34	73.9
Academy of Nutrition and Dietetics (AND)	0	0.0	4	8.7
GDA & AND	4	18.2	8	17.4
No	2	8.0	16	22.5
Not sure	0	0.0	8	11.3

Note: Some participants omitted answers on the demographic survey and as such the number of responses for was not *n*=35 for excluded participants or *n*=76 for included participants for all items.

Attendance at Previous Workshops

Most participants reported they did not attend the previous Nutrition Care Process (NCP) workshop in 2017 ($n=48$, 66.7%) or the Nutrition-Focused Physical Exam (NFPE) workshop in 2018 ($n=45$, 60.0%).

Perceived Responsibility for Enteral Nutrition

Part A of the Enteral Nutrition Questionnaire was provided to participants during the pre-workshop survey. This section of the survey assessed participants' responsibility for and perceptions of their responsibility for enteral nutrition (see Table 4 and Figure 3). Few participants reported having written guidelines at their workplace regarding enteral nutrition ($n=17$, 25.0%). However, most participants reported that a dietitian and a nutritionist were responsible for nutrition at their workplace ($n=60$, 85.7% and $n=44$, 63.8%, respectively). Many participants reported having a nutritional team at their place of work ($n=53$, 75.7%), though fewer reported having a nutritional team at the ward level ($n=37$, 56.1%). About half of the participants reported that there were key persons they could consult about enteral nutrition at work and outside of their workplace ($n=36$, 53.7% and $n=28$, 41.2%, respectively). Most participants reported a dietitian, sometimes with the aid of other healthcare providers including physicians, nurses, nutritionists and dietetic interns, was primarily responsible for prescribing the amount, type and rate of enteral nutrition at their workplace ($n=57$, 86.4%).

Table 4: Responsibility for Enteral Nutrition Among Participants Included in Data Analysis ($n=76$)

	<i>Yes</i>	<i>No</i>	<i>Don't know</i>
	<i>(n)</i>	<i>(n)</i>	<i>(n)</i>
Are there any written guidelines regarding enteral nutrition where you work?	17	35	16
Is there a dietitian responsible for nutrition where you work?	60	5	5
Is there a nutritionist responsible for nutrition where you work?	44	19	6
Is there a nutritional team on your ward?	37	23	6
Is there a nutritional team at your hospital or where you work?	53	14	3
Are there other key persons to consult about enteral nutrition where you work?	36	17	14
Are there other key persons to consult about enteral nutrition outside of where you work?	28	20	20
Note: Some participants omitted answers on the questionnaire and as such the number of responses was not $n=76$ for all items.			

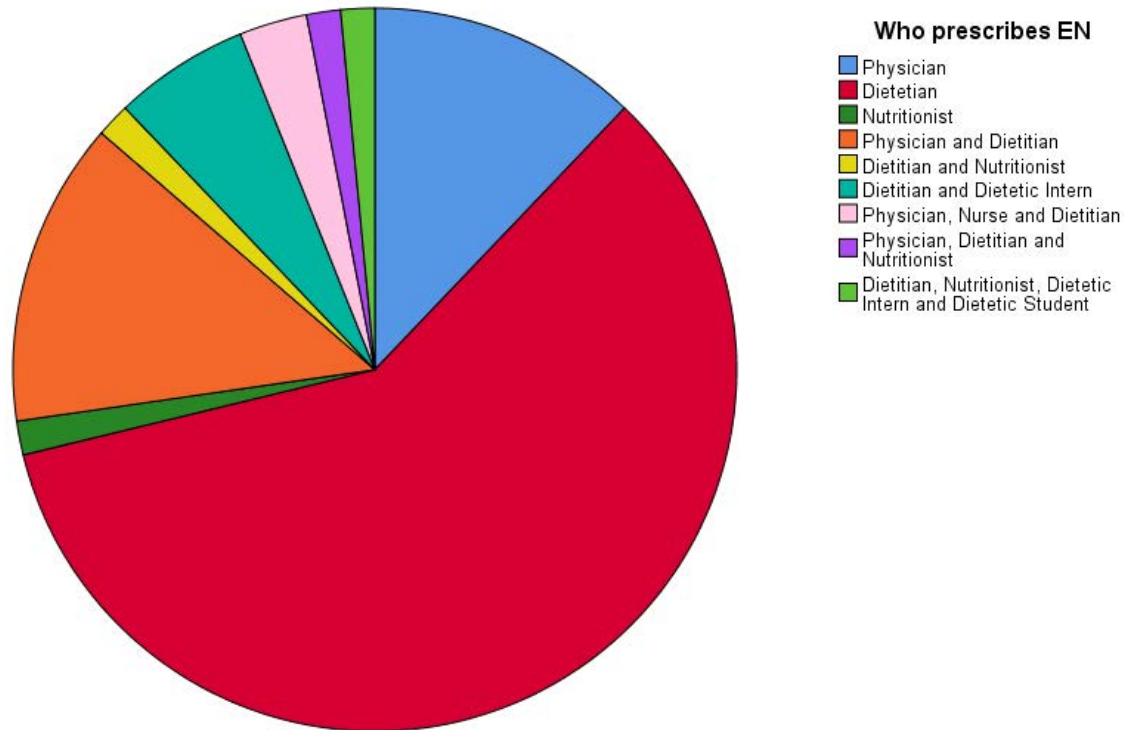


Figure 3. Individual(s) Responsible for Prescribing Enteral Nutrition

Source of Nutrition Support Knowledge

Source of nutrition support knowledge is presented in Table 5. Participants reported they gained nutrition support knowledge to a small or very small extent from enteral nutrition courses ($M=2.10$, $SD=1.22$), workshops ($M=2.26$, $SD=1.29$), in-service training ($M=2.49$, $SD=1.32$), scientific journals ($M=2.83$, $SD=1.19$) and other literature ($M=2.63$, $SD=1.19$). Prior to this workshop participants reported they gained nutrition support knowledge to neither a small nor a great extent from colleagues ($M=2.90$, $SD=1.45$), the internet ($M=3.04$, $SD=1.38$), college or university ($M=3.13$, $SD=1.29$), dietetic or nutrition internship ($M=3.18$, $SD=1.35$), and lectures ($M=3.20$, $SD=1.26$).

Table 5: Participants' ($n=76$) Source of Enteral Nutrition Knowledge

	<i>Mean</i>	<i>S.D.</i>
Colleagues	2.90	1.45
Lectures	3.20	1.26
College or University	3.13	1.29
Dietetic or Nutrition Internship	3.18	1.35
In-service Training	2.49	1.32
Enteral Nutrition Courses	2.10	1.22
Workshops	2.26	1.29
Scientific Journals	2.82	1.19
Other Literature	2.63	1.19
Internet	3.04	1.38

Note: *S.D.* = Standard Deviation

Perception of Responsibility for Nutrition Support

Participants' perceived responsibility for nutrition support is presented in Table 6.

Participants reported a great extent of responsibility for assessment of nutritional status ($M=4.11$, $SD=1.12$), nutrition diagnosis ($M=4.08$, $SD=0.98$), setting the enteral nutrition goal or prescription ($M=3.34$, $SD=1.45$), planning and implementing enteral nutrition interventions ($M=3.41$, $SD=1.50$), and monitoring and evaluation of enteral nutrition ($M=3.46$, $SD=1.51$). Despite having responsibility for many areas of nutrition support care, participants reported limited responsibility for preventing enteral nutrition complications ($M=3.13$, $SD=1.47$).

Table 6: Areas of Perceived Responsibility for Nutrition Support ($n=76$)

	<i>Mean</i>	<i>S.D.</i>
Assessment of Nutritional Status	4.11	1.12
Nutrition Diagnosis	4.08	0.98
Setting the EN Goal or Prescription	3.34	1.45
Planning and Implementing EN Interventions	3.41	1.50
Monitoring and Evaluation of EN	3.46	1.51
Preventing EN Complications	3.13	1.47

S. D.= standard deviation, EN = Enteral Nutrition

Confidence in Nutrition Support Practice

Participants rated their confidence in providing nutrition support both before and after the workshop (see Table 7). Participants were significantly more confident ($p=.000$) in their nutrition support skills in all areas following the workshop. Some participants did not complete all questions on the confidence section of the questionnaire; therefore, the number of responses and degrees of freedom vary slightly between items.

Table 7: Confidence in Enteral Nutrition Skills ($n=76$)

	Pre-workshop		Post-workshop		<i>t</i>	<i>P</i> value
	<i>Mean</i>	<i>S.E.</i>	<i>Mean</i>	<i>S.E.</i>		
Confidence with skills regarding assessment of nutritional status	3.82	.12	4.32	.08	-4.16	.000*
Confidence with skills regarding nutrition diagnosis	3.69	.10	4.15	.10	-4.39	.000*
Confidence with skills regarding setting the EN goal or prescription	3.03	.13	3.96	.12	-8.69	.000*
Confidence with skills regarding planning and implementing EN interventions	3.00	.13	3.93	.12	-8.30	.000*
Confidence with skills regarding prevention of EN complications	2.74	.13	3.81	.11	-7.82	.000*
Confidence with skills regarding monitoring and evaluation of enteral nutrition	3.06	.15	4.03	.11	-7.62	.000*

Note: EN= enteral nutrition, PN= parenteral nutrition, S. E.= standard error of the mean, *= statistically significant

Confidence in nutritional assessment skills improved significantly following the workshop (pre-workshop $M=3.82$, $SE=.12$, post-workshop $M=4.32$, $SE=.08$; $t(71) = -4.16$, $p=.000$). Participant confidence in nutrition diagnosis skills (pre-workshop $M=3.69$, $SE=.10$; post-workshop $M=4.15$, $SE=.10$; $t(70) = -4.39$, $p=.000$), skills in setting the EN goal or prescription (pre-workshop $M=3.03$, $SE=.13$, post-workshop $M=3.96$, $SE=.12$; t

(38) = -8.69, $p=.000$), skills in planning and implementing EN interventions (pre-workshop $M=3.00$, $SE=.13$, post-workshop $M=3.93$, $SE=.12$; $t(68) = -8.30$, $p=.000$), skills regarding prevention of EN complications (pre-workshop $M=2.74$, $SE=.13$, post-workshop $M=3.81$, $SE=.11$; $t(69) = -7.82$, $p=.000$) and monitoring and evaluation of patients on EN significantly improved following the workshop (pre-workshop $M=3.06$, $SE=.15$, post-workshop $M=4.03$, $SE=.11$; $t(67) = -7.62$, $p=.000$).

Satisfaction with Nutrition Support Knowledge

Participants' satisfaction with their knowledge of nutrition support improved significantly in all areas after the workshop (see Table 8).

Table 8: Satisfaction with Nutrition Support Knowledge ($n=76$)

	Pre-workshop		Post-workshop			
	<i>Mean</i>	<i>S.E.</i>	<i>Mean</i>	<i>S.E.</i>	<i>t</i>	<i>P value</i>
Satisfaction with knowledge of assessment of nutritional status	3.51	.13	4.34	.09	-6.16	.000*
Satisfaction with knowledge of nutrition diagnosis	3.44	.12	4.19	.09	-5.647	.000*
Satisfaction with knowledge of setting the EN goal or prescription	3.03	.14	3.99	.11	-7.91	.000*
Satisfaction with knowledge of planning and implementing EN interventions	3.06	.14	3.91	.11	-6.76	.000*
Satisfaction with knowledge of prevention of EN complications	2.83	.13	3.92	.12	-8.37	.000*
Satisfaction with knowledge of monitoring and evaluation of enteral nutrition	3.06	.14	4.08	.11	-7.48	.000*

EN= enteral nutrition, PN= parenteral nutrition, S. E.= standard error of the mean, *= statistically significant

Most participants reported the workshop was highly relevant to their practice and they planned on making changes to their practice based on knowledge and skills acquired during the nutrition support workshop on the pre-workshop survey ($n=48$, 66.7%; and $n=47$, 66.2%; respectively). There was no significant difference in participants' reporting of the relevance of the workshop to their practice or plans to make changes in their practice based on the workshop between pre- and post-workshop surveys ($p=.248$ and $p=.328$, respectively, see Table 8).

Nutrition Support Knowledge

Overall nutrition support knowledge was assessed in Part F of the nutrition support questionnaire with an accuracy score being calculated for the pre-workshop and post-workshop questionnaires (See Figure 4). Participants scores were calculated based on the percentage of correct answers out of the total number of questions answered. Any questions that were omitted on either the pre-test or post-test were not included as these questions were not able to be paired to determine a change in accuracy between the pre-workshop and post-workshop measurements. Participants scored significantly higher in nutrition support knowledge following the workshop with a mean score of 74% accuracy compared with a pre-workshop accuracy score of 65% (pre-workshop: $M=64.97$, $SE=2.19$, post-workshop: $M=73.70$, $SE=1.76$; $t(73) = -3.94$, $p=.000$).

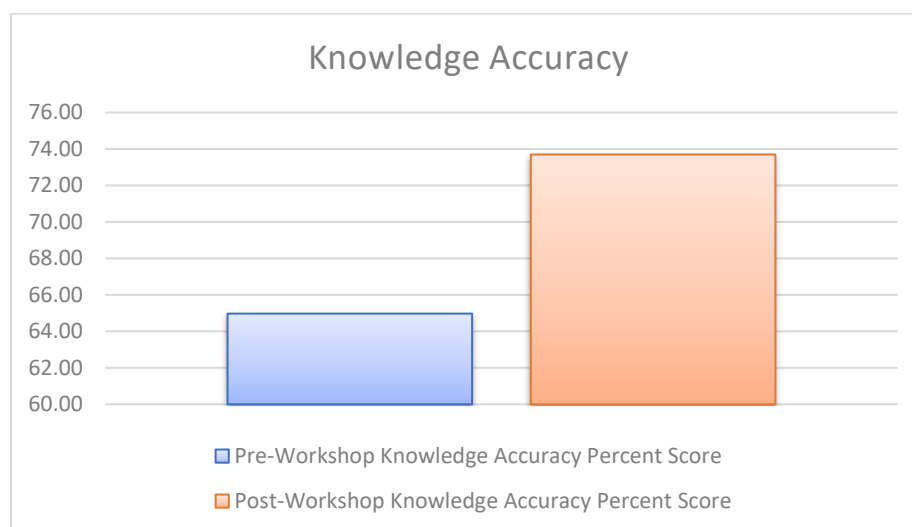


Figure 4. Pre-workshop vs Post-workshop Knowledge Accuracy Scores

Nutrition Support Knowledge Change

Nutrition support knowledge improved significantly in many areas following the workshop (see Table 9). Participants' knowledge of needing to flush the feeding tube before administration of medications (pre-workshop $M=1.10$, $SE=.05$, post-workshop $M=1.00$, $SE=.00$; $t(71)=2.16$, $p=.034$), need to inspect nostrils for enteral nutrition patients daily (pre-workshop $M=1.71$, $SE=.11$, post-workshop $M=1.39$, $SE=.09$; $t(69)=2.70$, $p=.009$), need to perform an abdominal exam for nutrition support patients daily (pre-workshop $M=2.08$, $SE=.08$, post-workshop $M=1.92$, $SE=.05$; $t(62)=2.20$, $p=.032$), risk for malnutrition among patients receiving enteral nutrition (pre-workshop $M=1.86$, $SE=.06$, post-workshop $M=1.71$, $SE=.06$; $t(68)=2.09$, $p=.040$), risk for micronutrient and macronutrient deficiencies among enteral nutrition patients (pre-workshop $M=1.99$, $SE=.07$, post-workshop $M=1.84$, $SE=.05$; $t(66)=2.19$, $p=.032$), checking of gastric residual volumes (pre-workshop $M=2.22$, $SE=.08$, post-workshop $M=1.85$, $SE=.074$; $t(67)=3.75$, $p=.000$), and enteral nutrition schedule should allow for a night of rest for the

patient (pre-workshop $M=2.01$, $SE=.11$, post-workshop $M=1.56$, $SE=.09$; $t(69)=4.939$, $p=.000$), and elevating the enteral nutrition patient's head-of-bed (pre-workshop $M=2.04$, $SE=.05$, post-workshop $M=1.91$, $SE=.04$; $t(67)=2.247$, $p=.028$).

For some knowledge questions the pre-workshop knowledge was high making the improvement in score not significant. While knowledge did improve on many indicators, which is clinically significant, the change in knowledge was not statistically significant in the areas of risk for macronutrient deficiency among enteral nutrition patients (pre-workshop $M=1.71$, $SE=.08$, post-workshop $M=1.53$, $SE=.08$; $t(67)=1.935$, $p=.057$), not holding enteral nutrition feedings for patients with diarrhea (pre-workshop $M=2.00$, $SE=.09$, post-workshop $M=1.86$, $SE=.05$; $t(68)=1.69$, $p=.096$), utilizing enteral nutrition rather than parenteral nutrition based upon gastrointestinal function (pre-workshop $M=1.31$, $SE=.08$, post-workshop $M=1.20$, $SE=.06$; $t(70)=1.47$, $p=.15$), and verifying placement of enteral nutrition tube prior to administering feeding (pre-workshop $M=1.11$, $SE=.05$, post-workshop $M=1.02$, $SE=.02$; $t(65)=1.623$, $p=.109$).

In three areas the percentage of accuracy decreased from the pre-workshop to post-workshop measurement. This suggests that these areas were not adequately covered during the workshop. Knowledge accuracy decreased significantly in the areas of need to flush enteral nutrition tube after medication administration (pre-workshop $M=2.00$, $SE=.04$, post-workshop $M=1.89$, $SE=.04$; $t(70)=2.04$, $p=.045$) and that medications not to be crushed may not be crushed and administered via enteral nutrition tube (pre-workshop $M=1.64$, $SE=.08$, post-workshop $M=1.46$, $SE=.10$; $t(38)=2.04$, $p=.033$). Knowledge accuracy decreased in the area of utilizing enteral nutrition versus parenteral

nutrition based on resource availability, though the change was not significant (pre-workshop $M=1.71$, $SE=.09$, post-workshop $M=1.54$, $SE=.07$; $t(68)=1.886$, $p=.064$).

Table 9: Knowledge Change by Question ($n=76$)

	Pre-workshop		Post-workshop		<i>P</i> value
	<i>n</i> accurate	%	<i>n</i> accurate	%	
Feeding tube flushed before administration of nutrition or medication	67	93.1	76	100.0	.034*
Feeding tube does not need to be flushed after administration of nutrition or medication	66	91.7	66	88.0	.045*
Patients receiving EN should have nostrils inspected daily	41	56.9	54	74.0	.009*
Patients receiving EN only need an abdominal exam if they are having abdominal symptoms	41	60.3	57	81.4	.032*
Patients receiving EN are not at risk for malnutrition	55	77.5	53	72.6	.040*
Micronutrient deficiencies are uncommon for patients receiving EN	50	72.5	59	80.8	.032*
Patients receiving EN are at risk for macronutrient deficiencies	34	49.3	40	54.1	.057
Medications not to be crushed may be administered in crushed form through feeding tube	26	60.5	29	43.9	.033*
Gastric residual volumes should only be checked for patients with vomiting	33	47.8	46	61.3	.000*
Patients with diarrhea should have their enteral feedings held until diarrhea resolves	33	46.5	59	79.7	.096
The decision to use EN versus PN should be based on gastrointestinal function	58	81.7	65	86.7	.145
The decision to use EN versus PN should be based on resource availability	30	42.9	32	42.7	.064
Enteral feeding schedule should allow for a night of rest	27	38.0	43	57.3	.000*
Enteral feeding tube placement should be confirmed before feeding is started	64	94.1	72	98.6	.109
Patients on enteral nutrition do not need their head of bed elevated	56	80.0	66	89.2	.028*

Note: Some participants omitted answers on the questionnaire and as such the number of responses was not $n=76$ for all items. EN = enteral nutrition, PN = parenteral nutrition,

* = statistically significant

Case Study

Inter-rater Reliability. Case studies were rated by two independent raters with intraclass correlation of .978 for pre-workshop case studies and .930 for post-workshop

case studies showing 97.8% and 93% consistency in ratings between rater 1 and rater 2 for pre-workshop and post-workshop case studies, respectively.

Case Study Scores. Change in application of nutrition support knowledge was evaluated with a case study. Of the 76 participants completing both the pre-workshop and post-workshop questionnaires, 39 participants completed both the pre-workshop and post-workshop case studies. The results show significantly higher case study scores after the workshop than before the workshop (pre-workshop, column 1: $M=9.00$, $SE=.83$; post-workshop, column 2: $M=14.51$, $SE=.60$; $t(38) = -7.289$, $p=.000$, see Figure 5).

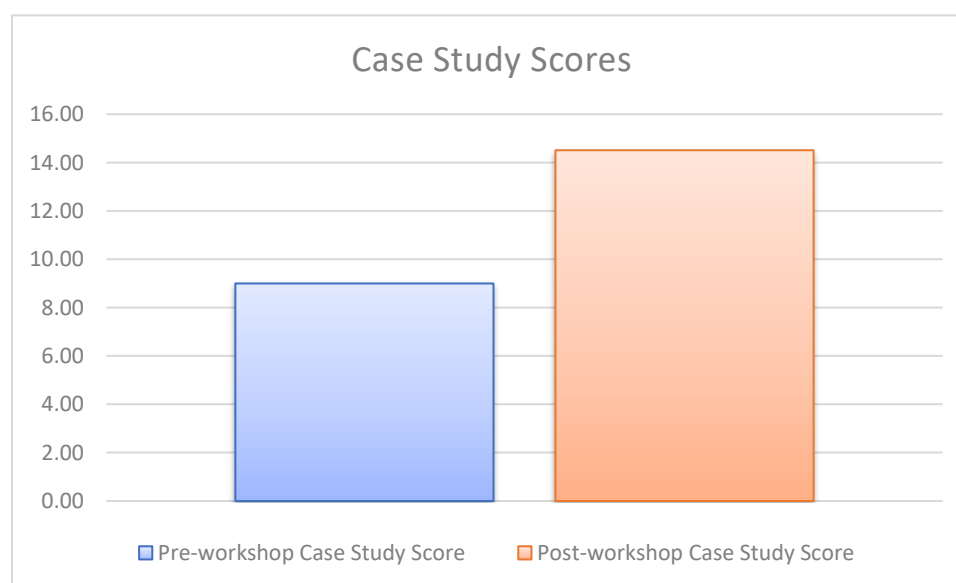


Figure 5. Pre-workshop vs Post-workshop Case Study Scores

Chapter V: Discussion

Discussion

“Health work teaches us with great rigour that action without knowledge is wasted effort, just as knowledge without action is a wasted resource.”⁶—Lee Jong-wook,

WHO Director-General

The workshop was held in Accra, Ghana in September 2019 with over one hundred and twenty-five participants. Despite having a high number of workshop participants, after excluding participants that did not return a pre-workshop or post-workshop questionnaire, seventy-six participants were included in the data analysis.

The Ghanaian nutrition professionals demonstrated increased confidence, knowledge, knowledge application, and satisfaction with their nutrition support knowledge following the workshop. These improvements are consistent with previous research showing that Ghanaian nutrition professionals are seeking opportunities for continuing professional education to advance their knowledge and skills.¹ Capacity development occurs at many levels within the healthcare system.⁸¹ Capacity development is a “process by which individuals, groups, organizations and societies increase their ability to perform, solve problems, define objectives, understand and deal with development needs to achieve objectives in a sustainable manner.”⁸¹ Shrimpton noted that capacity building can occur by improving health professionals’ in-service training.⁸¹

Nutrition professionals are key stakeholders in the nutrition care systems within Ghana. Many advances have been made in nutrition care in Ghana during this “Decade of Action on Nutrition,” however, the 2015 Global Nutrition Report described a slow rate

of change despite Scaling Up Nutrition initiatives, [including] persistent gaps, [and] suboptimal capacity to address malnutrition at the country-level.⁸²

A key issue in scaling-up nutrition has been “bridging the know-do gap.”⁶ Translating current evidence into practice in developing nations, referred to as knowledge translation (KT), has been identified by the World Health Organization (WHO) as “pos[ing] the greatest opportunity for strengthening health systems.”⁶ Knowledge translation “is defined as ‘the synthesis, exchange and application of knowledge by relevant stakeholders to accelerate the benefits of global and local innovation in strengthening health systems and improving people’s health.’”⁶ Providing this workshop to nutrition professionals in Ghana has strengthened the nutrition support care systems in their facilities. Ghanaian nutrition professionals have a great extent of responsibility for and confidence in providing nutrition care to nutrition support patients including nutritional assessment, nutrition diagnosis, setting the enteral nutrition goal or prescription, planning enteral nutrition interventions, and monitoring and evaluating enteral nutrition. The WHO identified “platforms for knowledge exchange and sharing,”⁶ such as workshops, as key strategies for bridging the “know-do gap.”⁶ Tim Evans, WHO’s Assistant Director-General, Evidence and Information for Policy, “underscored the importance of harnessing knowledge to overcome health system constraints and to scale up effective interventions.”⁶

In addition to the “know-do gap”⁶, Choi and colleagues⁸³ noted that a lack of operational capacity “at all levels of the health system hinders ability to scale-up.” Choi et al⁸³ found that application and scenario-based learning creates deep rather than surface

learning which allows the learner to actively construct meaningful knowledge that is relevant to their learning needs and builds upon their existing knowledge and experience. Participants' confidence in their nutrition support knowledge and skills improved significantly following the workshop. This increase in confidence will allow the dietetic students, dietetic interns, nutritionists, and dietitians to be more effective in providing nutrition support care and in collaborating with colleagues. Nutrition professional's confidence in providing nutrition support care is essential in increasing capacity to provide expert nutrition support care in Ghana.

Nutrition professionals were significantly more satisfied with their knowledge of nutrition support and scored significantly higher on the nutrition support knowledge test following the workshop. This is both statistically and clinically significant as dietitians in Ghana have previously been unsatisfied with opportunities for continuing education. Providing one-day intensive nutrition education sessions such as this may be a key training method to improve continuing education opportunities and satisfaction among Ghanaian nutrition professionals and throughout West Africa.

Nutrition support care in developing nations lags behind current evidence due to a combination of factors. In a study by Schoeman and colleagues,⁸⁴ 42% ($n=23$) of pediatric oncology units lacked access to total parenteral nutrition (68.4% of those were in low income countries and 44.4% in lower middle-income countries). The authors found that enteral products were not available in 18.5% ($n=10$) of pediatric oncology units, including 11.1% ($n=2$ of 18) in lower middle-income countries.⁸⁴ In addition to these logistic challenges, 22.2% ($n=4$ of 18) of lower middle-income countries (LMICs)

reported having no access to commercial nutritional supplements.⁸⁴ Homemade blenderized enteral nutrition products were frequently relied upon in LMICs (16.7%).⁸⁴ A blenderized tube feeding (BTF) “is a mixture of food and liquid that is pureed and administered through a feeding tube.”⁸⁵ In developed nations in the mid-1900s nasogastric feeding became a viable mode of nutrient delivery and concurrently commercial enteral nutrition formulas were being developed, though BTFs remained the primary source of nutrition for patients receiving tube feedings.⁸⁵ BTFs remain more economical than commercial formulas and “in developing countries, usage of commercial formula for long-term EN may be financially unsustainable, thus making BTFs a necessary option.”⁸⁵

Most participants reported that there were no written EN guidelines at their workplace, though dietitians were responsible for nutrition at their place of work. This presents a great opportunity for dietitians to shape the future of nutrition support practice in Ghana. Ghana has been described as a country in West Africa with the greatest capacity to “support the expansion of a nutrition workforce.”⁴ With dietitians having responsibility for nutrition at their place of work they have the expertise required to develop and implement EN guidelines at their places of work and to implement a “unified nutrition information system that could guide decision-making processes.”⁴

In 2018, de Jager et al²⁴ reported that food-based dietary guidelines (FBDGs) aide policy makers, consumers and the private sector to “redesign food systems and to improve diets of vulnerable populations.” Similarly, nutrition support guidelines would allow policy makers and healthcare professionals to redesign nutrition support care

systems to address logistic challenges, maximize patient benefit, improve patient safety and ensure consistency of care across institutions. Nutrition support standards and guidelines are present in developing nations, though these guidelines may not meet the needs of patients and providers in developing nations. Developing nutrition guidelines at a local level will be beneficial to patient care as “organized nutrition support services (or teams) are associated with improved patient outcomes, decreased length of hospitalization, and improved cost effectiveness.”⁸⁶

This workshop was feasible due to an ongoing partnership between the University of North Florida and the University of Ghana. Many participants reported knowledge of nutrition support was gained only to a small extent from in-service training. This may be an area where dietitians can expand practice and it shows the benefit of this workshop as in-service training opportunities are likely limited in many areas. Mormina and colleagues⁸⁷ noted that “Global health partnerships (GHP) between high or low-middle income countries are considered one of the best approaches to health systems strengthening.” These partnerships “typically involve highly skilled healthcare workers who volunteer to deliver capacity strengthening projects overseas, often in the form of peer-to-peer support through training and mentoring.”⁸⁷ In developing nations limited access to “training, education, mentoring and continuous professional development (CPD) are all contributing factors that undermine the morale and commitment of healthcare workers.”⁸⁷ GHP are “long-term, sustainable and usually voluntary collaborations between institutions with similar objectives for the mutual exchange of skills, knowledge and experience.”⁸⁷ Aiga and colleagues⁸⁸ evaluated reasons for

participating in continuing professional education among healthcare professionals in Ghana and found that “reasons for participation in continuing professional education (CPE) programs among health workers importantly determine the level of post-CPE application in daily servicing practice and finally the quality of health services.” The reasons for positive outcomes of CPE programs included “‘to maintain and improve professional knowledge and skills’, ‘to interact and exchange views with colleagues’ and ‘to obtain a higher job status.’”⁸⁸ CPE “for health workers has been recognized as an effective means for the improvement of the health status among local populations, through equipping them with updated technical knowledge and skills and improving morale and attitude towards work.”⁸⁸ Healthcare workers’ limited number and unequal distribution “in Ghana...is currently one of the most critical issues that prevent improved access to and quality of health services”⁸⁸ throughout the country. The Ghanaian Ministry of Health (MOH) emphasizes the importance of CPE with the In-Service Training Policy (ISTP) which was first developed in 1997 and calls for the systematic delivery of CPE.⁸⁸ The Ghanaian MOH adopted the policy that at least one CPE opportunity should be ensured every three years.⁸⁸ Aiga and colleagues⁸⁸ found that only self-perceived CPE needs produced significant odds ratios in dependent variables to the order of the extent to which proactive post-CPE application is expected. Most participants in the nutrition support workshop reported the workshop as relevant to their practice suggesting that the knowledge and confidence gained from participating in the workshop will be applied in their practice.

A limited number of participants reported having key persons to consult about nutrition which represents an area of potential growth for dietitians. If dietitians seek to take on this role, this could elevate the scope of practice and ensure other healthcare providers continue to look to dietitians as experts in nutrition support. Ongoing collaboration between the University of Ghana and Ghana Dietetic Association (GDA) with the University of North and the Academy of Nutrition and Dietetics (AND) will not only meet the needs of Ghanaian nutrition professionals and their patients, but is consistent with advancing the strategic plan of the AND. The AND's strategic plan involves prioritizing "programs and initiatives to demonstrate significant impact in...prevention and well-being, health care and health systems, food and nutrition safety and security."⁸⁹ The AND seeks to do this by "collaborat[ing] to provide evidence on the effectiveness of food- and nutrition-related interventions using internationally accepted processes and terms"⁸⁹ and "advance[ing] global influence through effective alliances."⁸⁹ This nutrition support workshop project aligns with the AND's strategic plan by offering "interprofessional training and professional development opportunities through strategic partnerships and partner organizations."⁸⁹

Following the workshop, participants were significantly more able to apply their nutrition support knowledge utilizing the Nutrition Care Process. This is consistent with previous research conducted by Wright et al⁴⁹ on the 2018 Nutrition-Focused Physical Exam Workshop conducted by faculty and students of the University of North Florida and the University of Ghana which demonstrated that workshop participants had significant increases in knowledge, self-efficacy and application of

malnutrition diagnosis criteria. As Ghana strives to improve its nutrition framework and infrastructure the ability to apply knowledge gained from continuing education will become increasingly important as policies are enacted that standardize the provision of nutrition care. The ability for Ghanaian nutrition professionals to utilize the Nutrition Care Process and international standardized language demonstrates that Ghanaian nutrition professionals have the capacity to scale up nutrition including the implementation of standards for nutrition professionals throughout Africa. Capacity building and knowledge exchange are important for all stakeholders⁶

Limitations of This Research Project

This research was conducted among a sample of the population of nutrition professionals in Ghana. This research may not be applicable to nutrition professionals in countries other than Ghana or among healthcare professionals that are not nutrition professionals. The workshop was conducted as a one-day, hands-on workshop and results may not be applicable to workshops that are shorter or longer in duration or conducted in a virtual setting.

Challenges of This Research Project

Logistic, statistical and cultural challenges were anticipated while doing this research. There were some barriers to receiving completed surveys including traffic preventing participants from arriving on time, limited parking near the workshop site, and participants needing to leave the workshop early to return to work. It is also anticipated that the length of the survey and complexity of some questions may have been barriers to full completion of the questionnaires.

A challenge that was anticipated was limited control over the recruitment process due to the workshop and research being conducted at an international location. To mitigate this concern faculty at the University of Ghana recruited participants using their network of dietitians, interns, students and nutritionists in Ghana.

Data analysis and reporting were anticipated challenges for this research study. The data collection instrument for demographics has not previously been used and the enteral nutrition questionnaire has been adapted for this study. As these tools have not previously been used in their current form validity and reliability were anticipated to present a challenge. To mitigate these challenges the survey tool was chosen due to its length to be more reliable as “the shorter the tool is the less reliable it will be.”⁷⁸ Inter-rater reliability statistics were conducted to insure the case study rubric was reliable.

Further challenges with this research included the cultural barriers and lack of first-hand experience in practicing nutrition support in Ghana. The workshop was designed to be as culturally relevant and resource appropriate as possible, though it was anticipated that some cultural and practice nuances were missed. To minimize this challenge, the workshop was coordinated with faculty at the University of Ghana to best meet the needs of the participants.

Nutritional Implications

While this project was conducted as a stand-alone workshop, the projected impact of the research is far-reaching. The participants in this workshop were current and future nutrition professionals in Ghana. These nutrition professionals will be better able to advocate for policy advancement in nutrition support to standardize practice, improve

patient outcomes and reduce cost of care and length of hospital stays. Many of the participants in the workshop represented their work facilities with the goal of taking the knowledge and skills gained back as trainers within their organizations. This is a “strong predictor of sustainability because of its potential for up-skilling the workforce rapidly, cheaply and exponentially by developing local educators.”⁸⁷

This project continued to foster relationships between leaders in dietetics education and research in Africa and the United States. As nutrition professionals expand their knowledge, skills and confidence they will be better equipped to advocate for their patients and the profession within Ghana. Ghanaian nutrition professionals have developed the skills that will allow them to advocate for the development and implementation of local nutrition policies to standardize evidence-based nutrition care, allow dietitians to be seen as subject matter experts in nutrition and as such worthy of order-writing privileges, and develop culturally-relevant and resource appropriate nutrition guidelines within Ghana and West Africa.

The knowledge and confidence gained by the nutrition professionals participating in the workshop is anticipated to elevate the level of nutrition support practice in Ghana. Ghanaian nutrition professionals are faced with the nutrition transition which is causing them to respond and adapt to providing nutrition care for patients that are malnourished as well as those with overweight and obesity which are increasing the prevalence and incidence of cardiovascular disease and stroke¹⁷. As the incidence of stroke increases the need for nutrition support is anticipated to rise as patients will have difficulty with self-feeding and will require nutrition support to prevent malnutrition and optimize lean body

mass, health and healing. Ghanaian nutrition professionals will be better able to “promote safe, accurate, and effective nutrition support therapy based on the patient’s needs and clinical condition and will provide resource-efficient and fiscally responsible care”⁸⁶

Future Research

This research is anticipated to lead to future research in the areas of nutrition support in low- and middle-income countries and continuing professional education for nutrition professionals in developing nations.

Future research will be needed to assess the implementation of knowledge and skills gained from the workshop into practice by Ghanaian dietitians. Translation of knowledge and skills gained into practice should be evaluated by assessing patient outcomes including morbidity, mortality, disease burden and length of hospital stay. Future studies would likely be best if conducted as mixed-methods studies with follow-up self-reported surveys on nutrition support practice at various time intervals after the workshop, observed nutrition support practice of Ghanaian dietitians, assessment of patient outcome indicators and in-depth interviews with Ghanaian dietitians attending the workshop to address barriers to implementing the knowledge and skills gained.

Expansion of culturally-relevant continuing education nutrition workshops to other Anglophone, or English-speaking, developing nations would be a next step for this area of research. With the aide of the Ghana Dietetic Association (GDA), and possibly the African Nutrition Society (ANS), expanding workshops to the Anglophone SSA countries of Kenya, Liberia, Nigeria, Sierra Leone and The Gambia would be a crucial next step in expanding nutrition capacity in low- and middle-income countries. Similarly,

this research could be expanded to Anglophone low- and middle-income countries in other areas of the world, such as Antigua and Barbuda, the Bahamas, Barbados, Belize, Guyana, and Asian countries with English as a national language including the Philippines and India.

Prospective epidemiologic studies to evaluate the utilization of enteral and parenteral nutrition support, length of stay of patients utilizing nutrition support, disease and economic burden of nutrition support patients in Ghana and its neighboring SSA developing countries is warranted. An epidemiologic study that could follow would be to identify prevalence rates of tube feeding among inpatients and identify characteristics associated with morbidity and mortality and compare rates of morbidity and mortality among those receiving care by a dietitian and those not receiving care by a dietitian. Evaluating length-of-stay for patients receiving enteral nutrition, number of days under care by a dietitian, and prevalence of malnutrition among nutrition support patients would be helpful in understanding where care by a dietitian in Ghanaian hospitals could be most impactful.

Future research could include development and implementation of a nutrition support in low-resource settings toolkit and expanded continuing education opportunities for nutrition professionals in Ghana and SSA. Additional continuing education opportunities could include web-based distance learning, social media and video platforms. If continuing education sessions were offered via distance learning and as face-to-face opportunities the impact on knowledge gains, confidence in providing care and translation to changes in practice could be compared across modalities.

Further research using qualitative research methods evaluate policy, infrastructure and system-based barriers to improving dietetic practice and nutrition support care in Ghana is warranted as Ghana has been noted to be a key nation with capacity to scale up nutrition.

References

1. Aryeetey RNO, Boateng L, Sackey D. State of Dietetics Practice in Ghana. *Ghana Med J.* 2014;48(4):219-224.
2. Laar AK, Aryeetey RNO, Mpereh M, Zotor FB. Improving nutrition-sensitivity of social protection programmes in Ghana. *Proc Nutr Soc.* 2017;76(4):516-523.
doi:10.1017/s0029665117001136
3. Alhassan RK, Tsikata R, Tizaawaw RN, et al. Adherence to standard nursing protocols on nasogastric tube feeding in a secondary referral hospital in Ghana : comparing self- ratings by professional and auxiliary nurses. *BMC Health Serv Res.* 2019;6:1-9.
4. Sodjinou R, Bosu WK, Fanou N, et al. A systematic assessment of the current capacity to act in nutrition in West Africa: Cross-country similarities and differences. *Glob Health Action.* 2014;7(1):1-12.
5. Laar AK, Aryeetey RNO, Annan R, et al. Contribution of scaling up nutrition Academic Platforms to nutrition capacity strengthening in Africa: local efforts, continental prospects and challenges. *Proc Nutr Soc.* 2017;76(4):524-534.
6. World Health Organization. *Bridging the “Know–Do” Gap Meeting on Knowledge Translation in Global Health.* Vol 25.; 2005.
7. Calabro KS, Bright KA, Bahl S. International perspectives: The profession of dietetics. *Nutrition.* 2001;17(7-8):594-599.
8. Sodjinou R, Bosu WK, Fanou N, De L, Baker S, Kupka R. Nutrition training in medical and other health professional schools in West Africa: the need to improve

current approaches and enhance training effectiveness. 2014;1(5).

doi:10.3402/gha.v7.24827

9. Aryeetey RNO, Laar A, Zotor F. Capacity for scaling up nutrition: A focus on pre-service training in West Africa and a Ghanaian case study. *Proc Nutr Soc.* 2015;74(4):533-537.
10. Association for Nutrition. Association for Nutrition.
<http://www.associationfornutrition.org/>. Published 2019. Accessed May 7, 2019.
11. Peregrin T. Revisions to the Code of Ethics for the Nutrition and Dietetics Profession. *J Acad Nutr Diet.* 2018;118(9):1764-1767.
doi:10.1016/j.jand.2018.05.028
12. Fornari A. Approaches to ethical decision-making. *J Acad Nutr Diet.* 2015;115(1):119-121. doi:10.1016/j.jand.2014.10.026
13. Brewster DR, Manary MJ, Graham SM. Case management of kwashiorkor : an intervention project at seven nutrition rehabilitation centres in Malawi. *Eur J Clin Nutr.* 1997;51:139-147.
14. Berg A. Sliding toward nutrition malpractice: Time to reconsider and redeploy. *Am J Clin Nutr.* 1993;57(1):3-7.
15. Knowles MS. Adult Education: New Dimensions. *Educ Leadersh.* 1975:85-88.
16. Audain K, Carr M, Dikmen D, Zotor F, Ellahi B. Exploring the health status of older persons in Sub-Saharan Africa. *Proc Nutr Soc.* 2017;76(4):574-579.
17. Ofori-Asenso R, Agyeman AA, Laar A, Boateng D. Overweight and obesity epidemic in Ghana - A systematic review and meta-analysis. *BMC Public Health.*

2016;16:1239.

18. D'Eon M, Sadownik L, Harrison A, Nation J. Using self-assessments to detect workshop success: Do they work? *Am J Eval*. 2008;29(1):92-98.
19. Lee WW, Alkureishi ML, Isaacson JH, et al. Impact of a brief faculty training to improve patient-centered communication while using electronic health records. *Patient Educ Couns*. 2018;101(12):2156-2161.
20. Dorfman L. Interview with Laurene Boateng. International Affiliate of the Academy of Nutrition and Dietetics.
<https://eatrightinternational.org/2018/01/09/interview-with-laurene-boateng-ghana-country-representative-copy/>. Published 2018. Accessed January 7, 2019.
21. Williams CD. A nutritional disease of child-hood associated with maize. *Arch Dis Child*. 1933:423.
22. Ojofeitimi EO, Smith LF. Nutrition Support and Malnutrition in Nigeria. *Nutr Clin Pract*. 1988;3:242-245.
23. Darteh EKM, Acquah E, Darteh F. Why are our children wasting: Determinants of wasting among under 5s in Ghana. *Nutr Health*. 2017;23(3):159-166.
24. Jager I De, Giller KE, Brouwer ID. Food and nutrient gaps in rural Northern Ghana : Does production of smallholder farming households support adoption of food-based dietary guidelines ? *PLoS One*. 2018:1-26.
25. Cederholm T, Jensen GL, Correia MITD, et al. GLIM criteria for the diagnosis of malnutrition – A consensus report from the global clinical nutrition community. *J Cachexia Sarcopenia Muscle*. 2019;10:207-217.

26. Bose I, Baldi G, Kiess L, de Pee S. The “Fill the Nutrient Gap” analysis: An approach to strengthen nutrition situation analysis and decision making towards multisectoral policies and systems change. *Matern Child Nutr.* 2019;(July 2018):1-11.
27. Schulte-Herbrüggen B, Cowlshaw G, Homewood K, Rowcliffe JM. Rural protein insufficiency in a wildlife-depleted West African farm-forest landscape. *PLoS One.* 2017;12(12):1-22.
28. Aryeetey RNO, Laar A, Zotor F. Capacity for scaling up nutrition: A focus on pre-service training in West Africa and a Ghanaian case study. *Proc Nutr Soc.* 2015;74(4):533-537.
29. Blössner M, Onis M De, Prüss-Üstün A, Campbell-Lendrum D, Corvalán C, Woodward A. *Malnutrition: Quantifying the Health Impact at National and Local Levels.* World Health Organization; 2005.
30. Jonah CMP, Sambu WC, May JD. A comparative analysis of socioeconomic inequities in stunting: A case of three middle-income African countries. *Arch Public Heal.* 2018;76(1):1-15.
31. Akinyemi RO, Owolabi MO, Adebayo PB, et al. Task-shifting training improves stroke knowledge among Nigerian non-neurologist health workers. *J Neurol Sci.* 2015;359(1-2):112-116.
32. Mitchell HK, Thomas R, Hogan M, Bresges C. Miracle baby: managing extremely preterm birth in rural Uganda. *BMJ Case Rep.* 2014:1-4.
33. Kelly P, Musonda R, Kafwembe E, Kaetano L, Keane E, Farthing M.

- Micronutrient supplementation in the AIDS diarrhoea-wasting syndrome in Zambia : A randomized controlled trial. *AIDS*. 1999;13:495-500.
34. Adotey DK, Stibilj V, Serfor-armah Y, Nyarko BJB, Ja R. Dietary supply of selenium for adolescents in three residential care orphanages in Southern Ghana. *Sci Total Environ*. 2011;411:72-79.
 35. Lazzarini-viti V. Western Foods and Traditional Diet in Ghana Author (s): Veronica Lazzarini-Viti Source : Paideuma : Mitteilungen zur Kulturkunde , Bd . 24 (1978), pp . 103-109 Published by : Frobenius Institute Stable URL : <http://www.jstor.org/stable/40341604> WESTER. 2017;24(1978):103-109.
 36. Acquah E, Darteh EKM, Amu H, Adjei DKA. Predictors of underweight in children under-five years in Ghana. *Ghana Med J*. 2019;53(1):71.
 37. Atsu BK, Guure C, Laar AK. Determinants of overweight with concurrent stunting among Ghanaian children. *BMC Pediatr*. 2017;17(1):1-12.
 38. Boateng L, Ansong R, Owusu WB, Steiner-Asiedu M. Coconut oil and palm oil's role in nutrition, health and national development: A review. *Ghana Med J*. 2016;50(3):189-196.
 39. Baatiema L, Aikins A, Sav A, Mnatzaganian G, Chan CKY, Somerset S. Barriers to evidence-based acute stroke care in Ghana: a qualitative study on the perspectives of stroke care professionals. *BMJ Open*. 2017;7:1-11.
 40. Goldsmith P, Andrade J, Cornelius M, Asigbee M, Atim P, Tamimie C. National School Lunch Nutrition and Cost Profile: A Case Study of the Ghana School Feeding Programme. *Food Nutr Bull*. 2019;40(1):41-55.

41. Allied Health Professions Council--Ghana. <http://www.ahpcghana.org/>. Published 2019. Accessed January 7, 2019.
42. Elke G, van Zanten ARH, Lemieux M, et al. Enteral versus parenteral nutrition in critically ill patients: An updated systematic review and meta-analysis of randomized controlled trials. *Crit Care*. 2016;20(1).
43. Ukleja A, Freeman KL, Gilbert K, et al. Standards for Nutrition Support: Adult Hospitalized Patients. 2010;25(4). doi:10.1177/0884533610374200
44. Balumuka DD, Chalya PL, Mahalu W. Oesophageal Perforation: A diagnostic and therapeutic challenge in a resource limited setting. A report of three cases. *J Cardiothorac Surg*. 2011;6(1):116.
45. Klek S, Chourdakis M, Abosaleh DA. Health insurance or subsidy has universal advantage for management of hospital malnutrition unrelated to GDP. *Asia Pac J Clin Nutr*. 2017;26(2):247-254.
46. Walia C, Van Hoorn M, Edlbeck A, Feuling MB. The Registered Dietitian Nutritionist's Guide to Homemade Tube Feeding. *J Acad Nutr Diet*. 2017;117(1):11-16.
47. Abban PY. How to Become A Registered Dietitian in Ghana: A Step by Step Guide. Diet Care Ghana. <https://dietcareghana.com/become-dietitian-ghana/>. Published 2018. Accessed April 7, 2019.
48. Department of Nutrition and Dietetics, University of Health and Allied Sciences. <http://sahs.uhas.edu.gh/en/nutrition-and-dietetics>. Published 2019. Accessed January 7, 2019.

49. Wright L, Marrero A, Thompson L, et al. Culturally Adapted, Hands-on Malnutrition Workshop for Dietitians in Ghana Increases Self-efficacy, Knowledge, and Skills. *Top Clin Nutr.* 2020;35(2):116-120.
doi:10.1097/TIN.0000000000000210
50. Andrews GJ. Workshop Evaluation: Old Myths and New Wisdom. *New Dir Adult Contin Educ.* 1997;1997(76):71-85.
51. Calle MCA, Lobelo F, Jiménez MA, et al. One-day workshop-based training improves physical activity prescription knowledge in Latin American physicians : a pre-test post- test study. *BMC Public Health.* 2016;16:1-12.
52. Knowles M. 1975 Looking Ahead... *Train Dev J.* 1975;29(1):20.
<http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=7476654&site=ehost-live>.
53. Moore DE, Green JS, Gallis HA. Achieving desired results and improved outcomes: Integrating planning and assessment throughout learning activities. *J Contin Educ Health Prof.* 2009;29(1):1-15.
54. Bandura A. Social Cognitive : An Agentic Perspective. *Annu Rev Psychol.* 2001;52(1):1-26. doi:10.1146/annurev.psych.52.1.1
55. Knowles MSM. Separating the Amateurs from the Pros in Training. *Train Dev J.* 1976;30:16.
56. Taylor B, Kroth M. Andragogy's Transition Into the Future: Meta-Analysis of Andragogy and Its Search for a Measurable Instrument. *J Adult Educ.* 2009;38(1):1-12.

57. Blaylock BK. Recreating the Quantitative Classroom for Adult Learners. 2008;13(2):8-17.
58. Cooper E. Creating a Culture of Professional Development: A Milestone Pathway Tool for Registered Nurses. *J Contin Educ Nurs*. 2009;40(11):501-508.
59. Gilstrap D. Why Do We Teach? Adult Learning Theory in Professional Standards as a Basis for Curriculum Development. *Coll Res Libr*. 2013;74(5):501-518.
60. Peterson CM, Ray CM. The Evolution of Neologisms. *J Adult Educ*. 2013;42(2):80-85.
61. Loeng S. Various ways of understanding the concept of andragogy. *Cogent Educ*. 2018;5:1-16.
62. Knowles M. Malcolm Knowles on My Farewell Address...Andragogy--No Panacea, No Ideology. *Train Dev J*. 1980:48-50.
63. Franco MS. Instructional strategies and adult learning theories: an autoethnographic study about teaching research methods in a doctoral program. *Education*. 2019;139(3):178-185.
64. Kitchel A, Cannon J, Duncan D. Professional Development Priorities of Idaho Business Teachers: an Examination of a Set of Competencies Associated With Teaching and Learning. *Delta Pi Epsil J*. 2010;52(3):138-151.
65. Meeker PB, Byers JF. Data-driven graduate curriculum redesign: A case study. *J Nurs Educ*. 2003;42(4):186-188.
66. Zaghab RW, Maldonado C, Whitehead D, Bartlett F, Rodriguez de Bittner M. Online Continuing Education for Health Professionals: Does Sticky Design

- Promote Practice-relevance? *Electron J e-Learning*. 2015;13(6):466-474.
67. Grueses JE. Social Learning Theory and Developmental Psychology- the Legacies of Robert Sears and Albert Bandura.Pdf. *Dev Psychol*. 1992;28(5):776-786.
 68. Inoue M, Fabbro L Del, Mitchell M. Assessing the educational needs of mental health nurses working in an adolescent inpatient psychiatric ward in Japan. *J Child Adolesc Psychiatr Nurs*. 2017;30(4):181-185.
 69. Kirkpatrick RN Mary K E, Brown RN Sylvia E. Efficacy of an international exchange via the Internet. *J Nurs Educ*. 1999;38(6):278-281.
 70. Kennan S. The (Lack of) Influence of Age and Class Standing on Preferred Teaching Behaviors for Online Students. *Online Learn*. 2018;22(1):163-182.
 71. Alexander GK, Innes KE, Selfe TK, Brown CJ. ““More than I expected””: Perceived benefits of yoga practice among older adults at risk for cardiovascular disease. *Complement Ther Med*. 2013;21(1):14-28.
 72. Amaah P. Quantitative and qualitative analysis of the knowledge, attitudes and social representations of cholera in the extreme northern region of Cameroon: the case of Maroua I, Maroua Ii And Mokolo. *Pan Afr Med J*. 2014;17:1-6.
 73. Reyneke Y, Shuttleworth CC. Accounting education in an open distance learning environment: Case studies for pervasive skills enhancement. *Turkish Online J Distance Educ*. 2018;19(3):140-155.
 74. Ulanoff BSH, Fingon JC, Beltran D. Using Case Studies To Assess Candidates ' Knowledge and Skills in a Graduate Reading Program. *Teacher*. 2009;36(2):125-143.

75. McClam T, Woodside M. Using Case Studies: An International Approach. *Int Educ.* 2005;34(2):36-45.

<https://ezp.lib.unimelb.edu.au/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ847709&site=eds-live&scope=site%0Ahttp://cehhs.utk.edu/publications/IE/generalinfo.html>.
76. Persenius MW, Larsson BW, Hall-Lord ML. Enteral nutrition in intensive care: Nurses' perceptions and bedside observations. *Intensive Crit Care Nurs.* 2006;22(2):82-94.
77. Reddan G. The role of work-integrated learning in developing students' perceived work self-efficacy. *Asia-Pacific J Coop Educ.* 2016;17(4):423-436.
78. Kim M, Mallory C. *Statistics for Evidence-Based Practice in Nursing*. 2nd ed. Burlington, MA: Jones & Bartlett Learning; 2016.
79. Survey Monkey. Sample Size Calculator.

<https://www.surveymonkey.com/mp/sample-size-calculator/>. Published 2019. Accessed May 7, 2019.
80. Savitzky D. Tips for Increasing Survey Completion Rates. Survey Monkey.

<https://www.surveymonkey.com/curiosity/tips-increasing-survey-completion-rates/>.
81. Shrimpton R, Hughes R, Recine E, et al. Nutrition capacity development: A practice framework. *Public Health Nutr.* 2014;17(3):682-688.

doi:10.1017/S1368980013001213
82. Aryeetey R. Optimism for the UN Proclamation of the Decade of Action on

- Nutrition: An African Perspective. *Glob Heal Sci Pract*. 2016;4(2):354-355.
doi:10.9745/ghsp-d-16-00117
83. Choi S, Yuen HM, Annan R, et al. Effectiveness of the Malnutrition eLearning Course for Global Capacity Building in the Management of Malnutrition: Cross-Country Interrupted Time-Series Study. *J Med Internet Res*. 2018;20(10):e10396.
doi:10.2196/10396
 84. Schoeman J, Ladas EJ, Rogers PC, Aryal S, Kruger M, Phil M. Unmet Needs in Nutritional Care in African Paediatric Oncology Units. 2018:1-8.
doi:10.1093/tropej/fmy068
 85. Bobo E. Reemergence of Blenderized Tube Feedings: Exploring the Evidence. *Nutr Clin Pract*. 2016;31(6):730-735. doi:10.1177/0884533616669703
 86. Ukleja A, Gilbert K, Mogensen KM, et al. Standards for Nutrition Support: Adult Hospitalized Patients. *Nutr Clin Pract*. 2018;33(6):906-920.
 87. Mormina M, Pinder S. A conceptual framework for training of trainers (ToT) interventions in global health. *Global Health*. 2018;14(1):1-11.
doi:10.1186/s12992-018-0420-3
 88. Aiga H. Reasons for participation in and needs for continuing professional education among health workers in Ghana. *Health Policy (New York)*. 2006;77(3):290-303. doi:10.1016/j.healthpol.2005.07.023
 89. The Academy of Nutrition and Dietetics. Academy of Nutrition and Dietetics Strategic Plan.

Appendix A: Maps of Africa and Ghana



Image from politicalsnapshots.wordpress.com



Image from www.ghanadistricts.com

Appendix B: Nutrition Support Workshop Program

University of North Florida – University of Ghana 2019 Nutrition Support Training Workshop

September 2019, 9:00-4:00 pm

Objectives:

1. **Describe the application of the nutrition care process (NCP) for patients requiring nutrition support.**
2. **Calculate enteral and parenteral nutrition support prescriptions.**
3. **Explain enteral and parenteral nutrition initiation, advancement and weaning including management of nutrition support complications.**
4. **Describe acid-base balance management for nutrition support patients.**
5. **Perform nutrition-focused physical exam (NFPE) of a nutrition support patient including micronutrient examination, abdominal auscultation and palpation.**
6. **Apply nutrition support fundamentals to case studies.**

Agenda:

- 9:00 Welcome/Introductions/Pre-workshop questionnaire
- 9:15 Review of Nutrition Support Fundamentals
- 9:45 Nutrition Care Process (NCP) for Nutrition Support Patients Part 1
- Assessment and Diagnosis
 - Intervention (Nutrition Support Access, Initiation, Advancement and Weaning)
- 10:30 NCP for Nutrition Support Patients Part 2: Monitoring and Evaluation
- Management of Complications
 - Acid-Base Balance
- 11:15 NFPE for Nutrition Support Patients
- Abdominal Examination: Auscultation and Palpation
 - Micronutrient Examination
- 11:45 Q&A
- 12:00 Lunch

Training of Trainers Session

- 1:00 Nutrition Support Workshop:
- Group 1: NFPE for Nutrition Support Patients: Auscultation and Palpation
 - Group 2: NFPE for Nutrition Support Patients: Micronutrients
 - Group 3: NCP for Nutrition Support Patients: Assessment and Diagnosis
 - Group 4: NCP for Nutrition Support Patients: Intervention
 - Group 5: NCP for Nutrition Support Patients: M&E, Managing Complications
- 2:30 Application to Case Studies – EN, PN, Complications & Acid-Base Balance
- 3:15 Report out and Facilitating Advancing Practice with Other Dietitians
- 3:35 Post-workshop questionnaire
- 4:00 Adjourn

Appendix C: Informed Consent Document

Dr. Lauri Wright and Sarah Zeola are inviting you to participate in a socio-demographic survey and enteral nutrition questionnaires as part of a doctoral research project at the University of North Florida. The purpose of this research is to gain more knowledge on the practice of nutrition support in Ghana and the success of the workshop. Your participation is voluntary and greatly appreciated. You may discontinue participation in this study at any time. There will be no monetary compensation for participation in this study. Benefits of your participation include continuing professional education. To protect your confidentiality no personally identifying information or consent signature will be gathered in this study. By completing this survey your consent to participate is implied. If any questions or concerns arise before, during, or after your participation you may contact Dr. John Kantner, Chair of the UNF Institutional Review Board at +1 (904) 620-2498 or irb@unf.edu. The researchers may be reached at l.wright@unf.edu and

Redacted

Appendix D: Socio-demographic Survey Instrument

Nutrition Support Workshop 2019: Socio-demographic Survey

Age: _____

Gender: ☐ Male ☐ Female

Nationality: _____

Undergraduate School or University: _____

Profession: ☐ Dietitian ☐ Nutritionist ☐ Nutrition Technical Officer ☐
Dietetic Intern

☐ Dietetic Student ☐ OtherYears in Profession: ☐ Less than 1 year ☐ 1-4 years ☐ 5-9 years ☐ 10 or more yearsIn what Ghanaian region do you work? ☐ Upper West ☐ Upper East ☐ North East☐ Savannah Region
☐ Northern ☐ Brong Ahafo ☐ Bono East ☐ Oti ☐ Ahafo ☐ Ashanti ☐
Eastern ☐ Volta
☐ Western North ☐ Western ☐ Central ☐ Greater Accra ☐ I work outside GhanaWhat is your current area of practice? ☐ Clinical Inpatient ☐ Clinical Outpatient ☐

Pediatrics

☐ Community ☐ Industry ☐ Education ☐ Other:

What area of practice are you most interested in? ☐ Clinical Inpatient ☐ Clinical
Outpatient

☐ Pediatrics ☐ Community ☐ Industry ☐ Education ☐ Other:Are you a member of professional organizations? ☐ Yes ☐ No ☐ Not sureIf yes, please select all that apply: ☐ Ghana Dietetic Association (GDA)☐ Academy of Nutrition and Dietetics (AND)☐ International Affiliate of the Academy of Nutrition and Dietetics (IAAND)

Did you attend the Nutrition Care Process (NCP) Workshop at the University of Ghana in 2017?

☐ Yes ☐ No ☐ Not sureDid you attend the Nutrition-Focused Physical Exam (NFPE) Workshop at the University of Ghana in 2018? ☐ Yes ☐ No ☐ Not sure

Appendix E: Enteral Nutrition Questionnaire

Part A:

1. Are there any written guidelines regarding enteral nutrition where you work?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
2. Is there a dietitian responsible for nutrition where you work?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
3. Is there a nutritionist responsible for nutrition where you work?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
4. Is there a nutritional team on your ward?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
5. Is there a nutritional team at your hospital or where you work?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
6. Are there other key persons to consult about enteral nutrition where you work?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
7. Are there other key persons to consult about enteral nutrition outside of where you work?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
8. Who prescribes the amount, type and rate of enteral nutrition and tube feedings where you work? (Select all that apply)	<input type="checkbox"/> Physician <input type="checkbox"/> Nurse <input type="checkbox"/> Dietitian <input type="checkbox"/> Nutritionist <input type="checkbox"/> Dietetic Intern <input type="checkbox"/> Dietetic Student

Response Options for Parts B and C:

- 1 – to a very small extent
 2—small extent
 3—neither a small nor great extent
 4—great extent
 5—very great extent

Part B: *Thinking about yourself in the area of Nutrition Support knowledge, to which extent have you gained knowledge of enteral nutrition from:*

9. Consulting colleagues?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
10. In-service training?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
11. Lectures?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
12. Workshops?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
13. Scientific journal articles?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
14. Other literature?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
15. College or university?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
16. Dietetic or nutrition internship?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
17. Enteral nutrition courses?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
18. The internet?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5

Part C: *Thinking about yourself in the area of Nutrition Support responsibility, to which extent do you have responsibility for:*

19. Assessment of nutritional status?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
20. Nutrition diagnosis?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
21. Setting the enteral nutrition goal or prescription?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
22. Planning and implementation of enteral nutrition interventions?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
23. Prevention of enteral nutrition complications?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
24. Monitoring and evaluation of enteral nutrition?	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5

- Response Options for Parts D and E:**
- 1 – to a very small extent
 - 2—small extent
 - 3—neither a small nor great extent
 - 4—great extent
 - 5—very great extent

Part D: Thinking about your confidence in the area of Nutrition Support practice, to which extent are you confident with:

25. Your skills regarding assessment of nutritional status?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
26. Your skills regarding nutrition diagnosis?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
27. Your skills regarding setting the enteral nutrition goal or prescription?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
28. Your skills regarding planning and implementation of enteral nutrition interventions?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
29. Your skills regarding prevention of enteral nutrition complications?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
30. Your skills regarding monitoring and evaluation of enteral nutrition?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

Part E: Thinking about yourself in the area of satisfaction with Nutrition Support knowledge, to which extent are you satisfied with your knowledge regarding:

31. Assessment of nutritional status?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
32. Nutrition diagnosis?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
33. Setting the enteral nutrition goal or prescription?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
34. Planning and implementation of enteral nutrition interventions?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
35. Prevention of enteral nutrition complications?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
36. Monitoring and evaluation of enteral nutrition?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
37. To what extent is this workshop relevant to your practice?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
38. To what extent do you plan to make changes based on things you learned in this workshop?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

Part F:

39. The feeding tube should be flushed <i>before</i> administration of nutrition or medication.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
40. The feeding tube does not need to be flushed <i>after</i> administration of nutrition or medication.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
41. Patients receiving enteral nutrition should have nostrils inspected daily.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
42. Patients receiving enteral nutrition only need an abdominal exam if they are having abdominal symptoms.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
43. Patients receiving enteral nutrition are not at risk for malnutrition.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
44. Micronutrient deficiencies are uncommon for patients receiving enteral nutrition.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
45. Patients receiving enteral nutrition are at risk for macronutrient deficiencies.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
46. Medications not to be crushed may be administered in crushed form through feeding tube.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
47. Gastric residual volumes should only be checked for patients with vomiting.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
48. Patients with diarrhea should have their enteral feedings held until diarrhea resolves.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
49. The decision to use enteral nutrition versus parenteral nutrition should be based on gastrointestinal function.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
50. The decision to use enteral nutrition versus parenteral nutrition should be based on resource availability.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
51. Enteral feeding schedule should allow for a night of rest.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
52. Enteral feeding tube placement should be confirmed before feeding is started.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure
53. Patients on enteral nutrition do not need their head of bed elevated.	<input type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Not Sure

Case Study:

Mr. Acheampong is a 46-year-old male admitted to the hospital after a motor vehicle accident. Mr. Acheampong has been unconscious since the accident 4 days ago and is unable to take food orally. No past medical history is available. Admission lab values are per the table provided. Patient's admission height is 167.64 cm (66 inches) and weight is 64 kilograms (140.8 pounds).

Test	Result	Reference Range
Sodium	138	135-148 mEq/L
Potassium	4.2	3.5-5.0 mEq/L
Chloride	101	98-112 mEq/L
CO ₂	13	24-31 mEq/L
BUN	15	6-20 mg/dL
Creatinine	0.7	0.5-0.9 mg/dL
Blood Glucose	114	65-99 mg/dL

1. What factors are a concern for this patient's nutrition intake?
2. A. What do the admission labs indicate for this patient? B. Which values are abnormal?
3. What will you look for in a physical examination of this patient?

Calculate the patient's estimated needs:

4. Energy Needs:
5. Protein Needs:
6. Fluid Needs:
7. Write an intake-related nutrition diagnosis (PES statement including problem, etiology, signs and symptoms) for this patient.
8. Write a nutrition prescription for this patient including EN access, plan for initiation, advancement and goal EN regimen (rate, volume, feedings per day, etc.). Include your choice of formula for this patient (blenderized/recipe/commercial product).
9. Describe your plan for monitoring and ongoing evaluation of this patient.

Appendix F: Part F Grading Rubric

	<i>Correct Response</i>	<i>SPSS Code</i>	<i>Pre-workshop Score</i>	<i>Post-workshop Score</i>
Question 1: (F39 & F15) Flush EN Tube Before	True	1		
Question 2: (F40 & F16) Flush EN Tube After	False	2		
Question 3: (F41 & F17) Check Nostrils	True	1		
Question 4: (F42 & F18) Abdominal Exam	False	2		
Question 5: (F43 & F19) Malnutrition Risk	False	2		
Question 6: (F44 & F20) Micronutrient Deficiency	False	2		
Question 7: (F45 & F21) Macronutrient Deficiency	False	2		
Question 8: (F46 & F22) Crushing Medications	False	2		
Question 9: (F47 & F23) Checking Gastric Residual Volumes	False	2		
Question 10: (F48 & F24) Diarrhea	False	2		
Question 11: (F49 & F25) EN vs PN by GI function	True	1		
Question 12: (F50 & F26) EN vs PN by Resource Availability	False	2		
Question 13: (F51 & F27) Night of Rest	True	1		
Question 14: (F52 & F28) Tube Placement	True	1		
Question 15: (F53 & F29) Head-of-Bed Elevated	False	2		
Number of Correct Responses				
Number of Questions Answered				
Percent of Correct Responses				

Appendix G: Case Study Grading Rubric

	<i>Not Met</i>	<i>Somewhat Met</i>	<i>Met</i>	<i>Score</i>
Question 1: Nutrition Intake Concerns	(0 points) 1 factor or no factors related to concern for nutrition intake included.	(1 point) Two factors of concern for nutrition intake included.	(2 points) Three or more factors of concern for nutrition intake included.	
Question 2A: Admission lab value indications	(0 points) Admission lab indications missing or completely inaccurate.	(1 point) One accurate admission lab indication included.	(2 points) Two or more accurate admission lab indications included.	
Question 2B: Abnormal lab value identification	(0 points) Abnormal lab values missing or inaccurate.	(1 point) One abnormal lab value identified.	(2 points) Two or more abnormal lab values identified.	
Question 3: Physical examination assessment plan	(0 points) Physical examination assessment plan missing or poorly described.	(1 point) One physical examination assessment area included.	(2 points) Two or more physical examination assessment areas included.	
Question 4: Estimated Energy Needs	(0 points) Estimated energy needs missing or calculated without use of a published predictive equation or simplistic weight-based equation.	(1 point) Estimated energy needs calculated with some errors while using a published predictive equation or simplistic weight-based equation.	(2 points) Estimated energy needs calculated accurately using a published predictive equation or simplistic weight-based equation.	
Question 5: Estimated Protein Needs	(0 points) Estimated protein needs missing or calculated without use of a published predictive equation or simplistic weight-based equation.	(1 point) Estimated protein needs calculated with some errors while using a published predictive equation or simplistic weight-based equation.	(2 points) Estimated protein needs calculated accurately using a published predictive equation or simplistic weight-based equation.	
Question 6: Estimated Fluid Needs	(0 points) Estimated fluid needs missing or calculated without use of a published predictive equation or simplistic weight-based equation.	(1 point) Estimated fluid needs calculated with some errors while using a published predictive equation or simplistic weight-based equation.	(2 points) Estimated fluid needs calculated accurately using a published predictive equation or simplistic weight-based equation.	
Question 7: PES Statement	(0 points) Diagnosis statement not intake-related. Intake-related diagnosis missing or inaccurate in two or more areas (problem, etiology, or signs and symptoms). Diagnosis statement includes three or more standardized language errors.	(1 point) Intake-related diagnosis missing or inaccurate in one area (problem, etiology, or signs and symptoms). Diagnosis statement includes two standardized language errors.	(2 points) Intake-related diagnosis includes problem, etiology and signs and symptoms. Diagnosis statement includes one or fewer standardized language errors.	
Question 8: Nutrition Prescription and Intervention	(0 points) Nutrition prescription missing or includes four or more errors in: EN access; plan for EN initiation and advancement; goal EN includes rate, volume, feedings per day and formula composition (blenderized or commercial).	(1 point) Nutrition prescription includes two or three errors in: EN access; plan for EN initiation and advancement; goal EN includes rate, volume, feedings per day and formula composition (blenderized or commercial).	(2 points) Nutrition prescription includes one or fewer errors in: EN access; plan for EN initiation and advancement; goal EN includes rate, volume, feedings per day and formula composition (blenderized or commercial).	
Question 9: Monitoring and Evaluation	(0 points) Monitoring and evaluation plan missing or does not include any nutrition-support related areas for monitoring and evaluation.	(1 point) One nutrition-support related area for monitoring and evaluation included.	(2 points) Two or more nutrition-support related areas for monitoring and evaluation included.	
Pre-Test	Post-Test	Case Study Number:	Total Case Study Raw Score	