SOUTHERN AFRICAN INSTITUTE *for* POLICY AND RESEARCH

Occasional Papers Series

Human Capacity Building in Nutrition through Pre-Service Education and Training: A Study of the Existing and Proposed Nutrition Training Programmes in Zambia

Olivia Lee and Olivia Roche

12 August 2014

Occasional Paper #2014/02

Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
BSc	Bachelor of Science
CDC	Center for Disease Control and Prevention
DFID	Department for International Development (UK)
HIV	Human Immunodeficiency Virus
MDG	Millennium Development Goal
MCDMCH	Ministry of Community Development and Mother and Child Health
MOH	Ministry of Health
MPH	Master of Public Health
MSc	Master of Science
NAZ	Nutrition Association of Zambia
NRDC	Natural Resources Development College
NFNC	National Food and Nutrition Commission
NFNP	National Food and Nutrition Policy
NFNSP	National Food and Nutrition Strategic Plan
PhD	Doctor of Philosophy
SAM	Severe Acute Malnutrition
SDF	Staff Development Fellowship
SUN	Scaling Up Nutrition

THET	Tropical Health and Education Trust
UNICEF	United Nations Children's Fund
UNZA	University of Zambia
WHO	World Health Organisation

Abstract

Zambia has inadequate levels of highly trained nutrition professionals who can address the public health and clinical implications of malnutrition. What gaps exist in human capacity and how pre-service education programmes are filling those gaps have not been fully elucidated. Although there are needs for higher level training for nutritionists, until recently, only one diploma level programme existed to train professional nutritionists in Zambia. Currently, an existing Bachelor of Science in Human Nutrition sets the necessary foundation for filling gaps in human capacity. With improved communication among stakeholders, two proposed Master's level programmes at the University of Zambia will better address these gaps, specifically in policy and education. However, the programmes are limited from completely addressing all gaps because of limitations in lecturing staff, infrastructure, and communication between relevant stakeholders. This paper is based on a review of the relevant literature and working documents on nutrition education and human capacity building in Zambia. Interviews with involved stakeholders were conducted during June and July 2014 in Lusaka, Zambia.

Introduction

Zambia has one of the highest rates of stunting in the world, a high prevalence of infectious diseases and steadily increasing rates of non-communicable diseases. Health issues such as these associated with poor nutrition require trained nutritional professionals with multidisciplinary skills and knowledge to implement programmes and interventions effectively at both the clinical and policy levels. Until recently, Zambia has only had one diploma-level programme available to train professional nutritionists. However, diploma-level training is inadequate to prepare professionals for high-level, change-making positions in most areas. In addition, the wide range of diseases linked to nutrition mostly affects vulnerable groups and have grave implications for Zambia's development as a country. Building human capacity in the field of nutrition, is, therefore, imperative, and requires collaborative efforts with a multi-sectoral approach.

Effective implementation of a multi-sectoral approach to combat malnutrition calls for a comprehensive report and framework of existing training programmes (Shrimpton et al, 2013). It is important for those involved in combating malnutrition to understand Zambia's current human capacity in nutrition, recognise the gaps in capacity, and prioritise development plans in order to effectively combat malnutrition in the long-term. Recent efforts in strengthening pre-service training have significantly contributed to the general momentum towards combating malnutrition and building human capacity among nutritionists. This paper identifies the gaps in human capacity that still need to be filled by pre-service nutrition training programmes and further evaluates how the existing and proposed programmes are addressing these gaps. Currently, Zambia does not have the adequate human capacity to meet the country's needs in nutrition policy, research, dietetics, and education, although the newly established Bachelor of Science programme in Human Nutrition at the University of Zambia makes significant progress towards filling the identified gaps. With curricula modifications and collaboration among major stakeholders, the two proposed master's degrees could further contribute to filing the four identified

gaps, but there are constraints that prevent these programmes from completely filling the capacity gaps in policy, research, dietetics, and teaching.

Background

Malnutrition in Zambia

In general, the Zambian diet is based on carbohydrates. Cereals, predominantly maize, make up two-thirds of the dietary energy supply. This dependence on carbohydrates decreases consumption of fruits and vegetables, protein, and fats, and contributes to the high rates of malnutrition in the country.

With the prevalence of stunting at 45.4% as of 2007 (Zambia Central Statistical Office, 2009), Zambia has one of the highest rates of stunting in the world. Some rural provinces such as Northern, Eastern, and Luapula have even higher rates of stunting, with rates over 50% (Sitko et al., 2011). Stunting is an issue of national concern because compromised cognitive function, often seen in stunted individuals, leads to 'reduced productivity and income-earning capacity' (UNICEF, 2013), as well as increased need for medical care and lower productivity, which in turn result in lost income (National Food and Nutrition Commission, 2011). Furthermore, more than half of Zambian children are vitamin A deficient and anaemic, which poses a serious threat to their growth and development (UNICEF, 2013). On the other end of the malnutrition spectrum, as a result of increasingly westernised diets, Zambia is also facing increasing rates of overweight and obesity (Ministry of Health [Zambia] and World Health Organisation Country Office [Zambia], 2008).

Zambia grapples with a double burden of high rates of undernutrition and overnutrition. Many of these nutritional issues could be prevented with scaled up nutrition policies at the national level and treated with trained dietitians in clinical settings. However, Zambia currently has inadequate human capacity to combat malnutrition from a public health perspective or clinically treat malnutrition in clinical settings across the country.

Capacity Building to Combat Malnutrition

From an international perspective, intensified action in building nutrition capacity in countries like Zambia can contribute to the achievement of the first Millennium Development Goal (MDG) and can further help to achieve MDGs four and five (Bryce et al,

2008). Bryce and colleagues (2008) identified strategic capacity, including human capacity, and effective leadership in nutrition as prerequisites for country development. In the context of nutrition, human capacity can mean the success or failure of country-level nutrition interventions.

Inadequate human capacity has been consistently identified as a limiting factor in implementing effective nutrition interventions in low- and middle-income countries. *The Lancet* series on maternal and child undernutrition identified 'the shortage of appropriately skilled personnel' as one of the 'major constraints to better nutrition programming' and indicated strategic capacity as a key challenge for addressing undernutrition at a national level (Morris et al, 2008; Bryce et al, 2008). Not only does a deficit in human capacity limit a country's ability to implement effective policy and conduct programme-specific research, but it also limits the extent to which further professionals can be trained. Although capacity can be built in many areas in a national setting relating to nutrition, building human capacity is perhaps one of the most effective ways to combat malnutrition in low- and middle-income countries. In countries with low human resources capacity gaps in capacity can be filled through the creation of education programmes and job creation.

Momentum towards Building Capacity in Nutrition in Zambia

The government of Zambia has been producing policies regarding nutrition since the inception of the National Food and Nutrition Commission (NFNC) under the National Food and Nutrition Act in 1967 (Harris and Drimie, 2012*).* However, despite the inception of the NFNC several decades ago, the government did not strongly acknowledge the importance of implementing strong nutritional policies until very recently. Beginning in 2011, high-level government officials, including the Vice President, (Scott, 2014) gradually began to publicly recognise the severely high prevalence of stunting in Zambia and the negative economic and national development consequences of large-scale chronic malnutrition.

Researchers acknowledge 2011 as the year building nutrition capacity truly became a priority (Harris and Drimie, 2012). In 2011, the NFNC published the National Food and Nutrition Strategic Plan 2011-2015, which calls for the development and implementation

of nutrition programmes and interventions, an increase in pre-service and in-service training for nutritionists and the establishment of positions for food and nutrition officers in the ministries relevant to nutrition (National Food and Nutrition Commission, 2011). In the call for strengthened technical expertise, the government further prioritised the bridging of the massive gap between the nutritional needs of Zambian population and the low number of nutritionists available to meet those needs. Harris and Drimie (2012) believe that the NFNSP has potential to produce real action and results because it is based on the SUN initiative's international movement of 'proven, effective, and cost-effective food and nutrition interventions'. Successful implementation of the government's priorities and policies has serious potential to reduce the high levels of stunting and overnutrition in Zambia.

Translating Policy into Action

The Zambian government has made efforts to follow through on its commitments to build human capacity in nutrition. For example, the Ministry of Finance provided funding for the scaling up of the line ministries at the district level, and the government has further collaborated with major international donors for the Scaling Up of Nutrition interventions and capacity building at the pre-service training level. In addition, government-funded universities have provided scholarships for students to pursue bachelor's degrees in Zambia, as well as post-graduate degrees outside of the country, thereby demonstrating a perceptible commitment to human capacity building in nutrition.

Despite this progress, more could be done on the part of the government to prioritise nutrition in order to meet its stated goals in the NFNSP. Despite the available positions for different cadres of nutritionists in the Ministry of Health, the payroll currently does not support these positions. Although Zambia is making progress towards the MDGs for 2015, if it is to meet the stated target for underweight children, its progress 'will need to quickly accelerate' (Harris and Drimie, 2012). Short-term interventions must be implemented and long-term strategies and goals to fill the capacity gap in nutrition, such as training programmes for nutritionists, must be acknowledged at the policy level.

Donor Involvement in Building Capacity

DFID and a consortium of donors known as the SUN Fund have been the major providers of funds for the development of degree programmes in nutrition at UNZA. The SUN fund is a consortium of donor organisations including DFID, SIDA and IrishAid. These international donors pool funds with the explicit purpose of contributing to the Scaling Up Nutrition initiative, which includes building capacity through pre-service training programmes. In 2011, the Tropical Health and Education Trust (THET) secured funding directly from DFID to providing funding for the newly established Bachelor of Science in Human Nutrition programme at the University of Zambia, which was supported in its development by the Nutrition Association of Zambia, until the graduation of the first cohort of students in 2015. THET provided the new BSc programme with temporary lecturers, a course coordinator, resources, and scholarships for students.

With the first cohort of students graduating in 2015, THET has received approval for a second round of funding from the SUN Fund to further support the BSc. The SUN Fund also has a portion of funding currently earmarked for the support of a Master's degree programme in nutrition.[1]

[1] Interview with Silke Seco-Grutz from DFID 17 June 2014

Methods

Initial data collection began in March 2014 at Cornell University in Ithaca, NY through a review of relevant literature. Online academic databases were used to collect journal articles and reports on capacity building and malnutrition in resource-poor countries using the terms 'nutrition', 'education' and 'capacity'. General country and nutritional status statistics were collected from World Health Organisation (WHO) websites. From 9 June 2014 to 21 July 2014, qualitative data were collected from in-person interviews, and a further review of the literature on nutrition education and capacity building in Zambia was obtained in Lusaka, Zambia.

In order to gain a comprehensive, objective understanding of Zambia's human capacity and the nutrition education at the diploma, bachelor's, and master's level, individual interviews were conducted with stakeholders from the academic institutions, donor organisations, professional organisations, and NGOs. Questions regarding the establishment and implementation of each nutrition education program were asked during individual interview. Some of the stakeholders included officials from the UNZA School of Agriculture, UNZA School of Medicine, Natural Resource Development College (NRDC), THET, DFID, NFNC, Ministry of Health, the Nutrition Association of Zambia (NAZ), Care International, CSO-SUN Zambia, and the WHO Zambia.

Results

Zambia currently has 259 nutritionists recorded in post. 57% of nutritionists work in the Ministry of Community Development Mother and Child Health, 20% of nutritionists work in the Ministry of Agriculture, and 16% work in the Ministry of Health (DFID Zambia, Government of the Republic of Zambia, and MQSUN, 2014). The remaining percentage of nutritionists is split between the Ministry of Local Government and Housing, NFNC, private organisations, and educational institutions such as the NRDC and UNZA (DFID Zambia, Government of the Republic of Zambia, and MQSUN, 2014).

Major Gaps in Human Capacity in Nutrition: Policymakers

A training pyramid published by the United Nations University and the International Union of Nutritional Sciences identified three levels of nutritional training: (1) policy and decision makers, (2) researchers, planners and trainers, and (3) programme implementers (Shrimpton et al, 2013). It became prominent, over the course of our interviews, that the major gaps existing in human capacity in Zambia were gaps in the policy workforce, in dietetics, and in academia, both in the research and lecturing workforce.

In order to effectively implement nutrition interventions and to magnify the nation's awareness of nutrition, nutrition needs to be priority on the country's agenda. Many policymakers in Zambia have 'limited knowledge' of nutrition (DFID, 2012), and diploma-level nutritionists currently working in Zambia lack a voice at the policy level[2]. They mostly work for lower-level managerial positions that have less influence on policy, according to Dr. Shindano from UNZA School of Agricultural Sciences. Currently, there are no senior nutritionists working in the national office of the Ministry of Health, although the positions are available (DFID Zambia, Government of the Republic of Zambia, and MQSUN, 2014). Advanced pre-service training at the undergraduate and post-graduate level is necessary to advance nutritionists to have a voice at policy level.

[2] Interview with Ms. Silke Seco-Grutz from DFID, 17 June 2014

Major Gaps in Human Capacity in Nutrition: Researchers

Research output in Zambia is still at a very fundamental level,[3] and there are very few Zambian master's or PhD degree holders in nutrition who are qualified to conduct their own research projects.[4] Thus, the vast majority of nutrition research studies conducted in Zambia are collaborations with foreign institutions. Although international collaboration is beneficial for exchanging new ideas, and those international institutions can provide funding for the projects, often the collaborating international institutions determine the research agenda. Therefore, the topics studied in these collaborations may not be directed towards filling Zambia's needs in research. An analysis of all published nutrition research online (Morris et al, 2008) noted that only 7% of all studies regarding food and nutrition focused on general undernutrition, the highest priority in nutrition for Zambia. Furthermore, studies regarding the nutritional context of traditional Zambian food are nonexistent,[3] which significantly limit the creation of appropriate nutrition policy in the context of Zambian culture. More research should be initiated and led by students and researchers in Zambia who can direct focus to areas of significant need.

Furthermore, there are too few research institutes which can financially support local researchers and sustain nutrition research as a career field in Zambia. Although there are tentative plans to create a research institution in conjunction with academic institutions, these plans have not come to fruition. The challenge in filling the capacity gap in research is complex: not only is there need to train nutritionists as research, but there is need to develop research as a sustainable career field in Zambia.

Major Gaps in Human Capacity in Nutrition: Educators

Gaps in human capacity will not be adequately filled in a reasonable amount of time if class sizes of pre-service education programmes are small. Stakeholders working to develop nutrition degree programmes cited an insufficiency of available lecturers as major factor constraining the development and growth of degree programmes at all levels in nutrition. According to researchers from the International Food Policy Research Institute, lack of

[3] Interview with Dr. Drinah Nyirenda from the UNZA School of Agriculture, 4 July 2014
[4] Interview with Interview with Dr. John Shindano, Dr. Nyambe Mkandawire, Dr. Pamela Marinda, and Ms. Vicky Veevers from UNZA School of Agricultural Sciences, 14 July 2014

teaching staff is one of the most important current human resources in health challenges for Zambia (Harris & Drimie, 2012). One of the key gaps limiting the growth and development for the new Bachelor's degree in nutrition at the University of Zambia is the limited faculty, which, until very recently, was not at critical mass. Limited faculty was again identified by the director of the Department of Food Science and Nutrition as one of the major challenges facing the new degree programme.

Bachelor's degree courses must be taught, at minimum, by master's degree holders, and master's degree courses must be taught at minimum by doctoral-level nutritionists (DFID Zambia, Government of the Republic of Zambia, and MQSUN, 2014), but neither master's degree or doctoral degree training degree programmes currently exist in Zambia. Stakeholders invested in developing a Master's degree programme at the University of Zambia noted the need for developing a cadre of nutritionists at the master's degree level, but also recognised that, currently, there may not be enough Zambian PhD holders in nutrition to teach the courses at the master's level. Further, class sizes at all pre-service training levels are limited by the number of lecturers available to teach. If the number of lecturers is low, the capacity of programmes to produce nutritionists is also low. Simply stated, capacity building through pre-service training simply cannot occur if the capacity to train nutritionists is insufficient.

Major Gaps in Human Capacity in Nutrition: Dietitians

With the high prevalence of undernutrition and growing incidence of overnutrition resulting in nutrition-related diseases, a large number of dietitians are needed to provide nutritional counseling and care in clinical settings. Nearly every stakeholder identified dietetics as a serious gap in human capacity in nutrition. To quantify this gap, some stakeholders estimated that there should be at least one dietitian or, at minimum, one clinically trained nutritionist in each clinical setting.[5] As of 2012, there are 1,956 health facilities in Zambia, which, using the above recommendation, translates to a need for at least 1,956 dietitians in practice, excluding those in teaching roles. However, there currently exists only one Zambian registered dietitian working in clinical practice.

[5] Interview with Dr. Drinah Nyirenda from the UNZA School of Agriculture, 4 July 2014; Interview with Agnes Aongola, 21 July 2014

Stakeholders estimated that there are an additional three to six dietitians working in academic roles. This number of trained dietitians is grossly inadequate to address the serious clinical nutrition needs existing in Zambia.

There are available posts for dietitians in hospitals, but since few dietitians exist to fill these roles, diploma holding nutritionists or even individuals not trained in nutrition may even work in clinical nutrition.[6] Often, 'proxy nutritionists' such as food scientists will serve in a clinical nutrition role, even though they do not hold a degree or diploma in nutrition.[7] Many stakeholders believe that Zambian-trained nutritionists who are only trained up to the diploma level are not trained adequately to successfully fill the role of a dietitian in a hospital setting. Some students who are currently studying to upgrade their training from the diploma level cited a lack of confidence in clinical nutrition as one of the reasons they were seeking further training.

Pre-service Education at the Diploma Level

The Natural Resources Development College was the only institution offering nutrition training prior to the establishment of Bachelor of Science in Human Nutrition at University of Zambia School of Agricultural Sciences in 2011. The three-year diploma programme in Food and Nutrition has three streams of students: regular, parallel, and distance. The parallel programme was created to create space for additional students to enroll in the degree programme on campus, and the distance programme has been in a high demand from students who wish to pursue a career in nutrition but who do not have the ability to live full time in Lusaka. On average, each stream has fifty students per class, making 150 in total. Second- and third-year classes are smaller in size due to attrition.[8]

After graduation, most diploma-holders are recruited to work for the Ministry of Health, Ministry of Agriculture and Livestock, and Ministry of Community Development, Maternal and Child Health at district levels. Some diploma holders we spoke with felt inadequately prepared to work in clinical or management positions, possibly because the NRDC curriculum is more inclined toward agriculture and food security than clinical nutrition.

[6] Interview with Ms. Willa Zambezi from the Cancer Diseases Hospital, 14 June 2014
[7] Interview with Mr. Mike Mwanza from the NFNC, 23 June 2014
[8] Interview with Ms. Dorothy Nthani from Natural Resources Development College, 18 July 2014

The ability of the diploma programme to grow and expand is constrained by limited resources and teaching staff. Education materials such as books, periodicals, and classroom equipment are in limited supply (DFID Zambia, Government of the Republic of Zambia, and MQSUN, 2014), and despite a relatively large size of 150 in each class, there are only seven members of teaching staff.

Pre-service Education at the Bachelor's Level

Previously, those wishing to advance their education past the diploma level in nutrition had to either pursue education internationally or complete degree programmes in other fields, such as Food Science or Development Studies. Those helping to establish the new Bachelor's of Science programme at UNZA, specifically the NFNC and NAZ, hoped to train nutritionists at the degree level in-country, who would be qualified to work in roles in management, dietetics, and community nutrition that should be filled by a nutritionist with a Bachelor's degree, at minimum.

The BSc in Human Nutrition is a five-year programme, with the first year being completed in the School of Natural Sciences, unless students enter with prior nutrition training at the NRDC. In the second year, students truly begin coursework in nutrition. In the fifth and final year, BSc students can choose between specialising in either Dietetics or general Nutrition.

The department head and lecturers from the BSc programme described the programme as being both theoretical and hands-on, allowing students ample opportunity to apply what they learned in class through lab work, group projects, and fieldwork.[9] It is planned that dietetics students will have hands-on experience in the hospital setting during their final year at University Teaching Hospital, in conjunction with clinical coursework. However, some critics feel that, since the clinical rotation is not full time, it may not be enough hands on experience to fully prepare students to work in hospitals.[10] Students also expressed a desire to have additional practical experience, especially during their specialisation year.

[9] Interview with Dr. John Shindano, Dr. Nyambe Mkandawire, Dr. Pamela Marinda, and Ms. Vicky Veevers from UNZA School of Agricultural Sciences, 14 July 2014
[10] Interview with Dr. Charles Michelo from the UNZA School of Medicine, 11 June 2014

There are currently forty-four students total in the programme with an average annual intake of about fifteen to twenty students per class. The majority of the BSc students are diploma holding nutritionists, many of whom are on leave from positions in the Ministry of Health. Many of these students agreed that, after the training they have received thus far, they feel much more confident designing nutrition interventions, managing programmes, and working in a clinical setting than they did when working with diploma-level training. The BSc students complained about inconsistent lecturers, poorly-paced classes, and too much of a focus in the curriculum food science. However, the students who disliked the food science focus were employed at the Ministry of Health, where the knowledge is less useful. Furthermore, the university has made strides towards providing full-time permanent lecturers, and stakeholders from the programme explained that students often critique the focus on food because they come in with a preconceived notion of what they should be learning, based in their prior training at the diploma level and work experience.

The major stakeholders involved with building capacity at the Bachelor's level are confident that the number of lecturers teaching the programme is currently at critical mass.[11] Furthermore, by UNZA will be directly employing all nutrition staff, and will no longer require external funding for lecturers from DFID or the SUN Fund. Currently, the university has recently hired two full time staff, and two students are currently pursuing master's degrees on Staff Development Fellowships, with the commitment to teach in the BSc programme after they graduate. According to the stakeholders in the Department of Food Science and Nutrition, DFID Zambia's recommendation for eight additional lecturer posts would help the university programme to meet the needs for teaching staff and would help the programme to expand, but, working in conjunction with THET, UNZA has already added as many lecturers as it currently has the capacity to add.

According to DFID and the organisation that evaluates the effectiveness of its spending, ICAI, the BSc seems to be an effective way to produce the next cadre of nutritionists in

[11] Comment by Meg Langley from THET, 22 August 2014

Zambia. Not only was the ICAI impressed with the BSc, but they deemed it 'central' to capacity building in Zambia.[12]

Proposed Post-graduate Education Programmes: Master of Science in Human Nutrition

As of July 2014, the University of Zambia School of Agricultural Sciences is in process of approving the Master of Science in Human Nutrition. The curriculum in draft is currently in review by the UNZA Postgraduate Review Board. The plan to develop a Master of Science in Nutrition has been in discussion before the creation of Bachelor's programme, and has been supported by the Nutrition Association of Zambia since that time.[13]

The School of Agricultural Sciences hopes to enroll three students in its first cohort by 2015, according to the Dean of School of Agricultural Sciences. Currently, MSc is expected to begin in 2015, but the school administrators are still in process of recruiting two PhD holders to be lecturers. THET, which currently supports the BSc programme at School of Agriculture, plans to meet infrastructure needs for MSc as well. A portion in the SUN Fund has been allocated to support a master's degree programme as well as the BSc.[14]

Stakeholders are in favour of establishing a postgraduate programme in nutrition. They were of the opinion that graduate training in nutrition is 'necessary for advancement'[15] and a MSc programme would qualify nutritionists to 'meet Zambia's present and future need'[16] in implementing the First 1000 Most Critical Days Programme and other interventions. It is further planned that the MSc will, in the future, supply lecturers for the BSc in Human Nutrition. Currently, there are no plans for the MSc to include for a dietetics training component.[17]

---

[12] Interview with Ms. Silke Seco-Grutz from DFID, 17 June 2014
[13] Interview with Ms. Vicky Veevers from THET 14 July 2014
[14] Interview with Ms. Silke Seco-Grutz from DFID, 17 June 2014
[15] Interview with Ms. Wila Zambezi from the Cancer Diseases Hospital 14 June 2014
[16] Interview with Dr. Mick Mwala from the UNZA School of Agriculture 16 July 2014
[17] Interview with Dr. John Shindano, Dr. Nyambe Mkandawire, Dr. Pamela Marinda, and Ms. Vicky Veevers from the UNZA School of Agricultural Sciences, 14 July 2014

Proposed Post-graduate Education Programmes: Master of Public Health in Public Health Nutrition

The School of Medicine currently houses the Department of Public Health, which provides master's level degrees in Epidemiology and Health Promotion and Education, among others. In early 2014, the department also proposed the creation of a sixth degree programme: a Master's of Public Health (MPH) in Public Health Nutrition. The School of Medicine stressed the importance of nutrition in disease progression, and desired to create a programme with a preventative focus.[18] The MPH in Public Health Nutrition is, therefore, designed with the explicit purpose to train nutritionists with a public health foundation in order to develop and manage interventions and policies to combat malnutrition.

The first class of newly admitted students, hoped to matriculate in the fall of 2016, is estimated to admit between five and ten new students, with an average of five to ten students per class. Any students with a Bachelor's degree in a science related field may be considered for admission. Two lecturers have already been identified to teach the nutrition courses in the curriculum; the other courses will be taught by their existing lecturers in the department.

Since the MPH in Public Health Nutrition is a newly devised programme, the curriculum is still under development, although a tentative curriculum map does exist. In the two-year programme, students first develop a background in core public health competencies, and then receive further training in public health nutrition. A requirement for the school of Public Health, students begin a research project in their first year, and spend the last half of their second year working extensively on their dissertation. As the curriculum undergoes review, however, it may be modified so that students would conduct a practicum experience instead of a dissertation during their final year, in order to provide them with more hands on experience in project management and policy development.

Stakeholders who were less familiar with the curriculum expressed skepticism towards the proposed master's degree. Those who were invested in developing the BSc thought that, alone, the MPH would be limiting to students who were interested in an advanced nutrition

[18] Interview with Dr. Charles Michelo from the UNZA School of Medicine 11 June 2014

degree but who were not necessarily interested in public health.[19] They were further concerned that the training it provides in nutrition is inadequate, especially if those who enter the programme do not have a background in nutrition. Some of the current bachelor's degree students, however, were excited about the potential to focus their studies in public health nutrition at an advanced degree level. Other stakeholders felt that the MPH, founded on a public health core curriculum but providing students with additional courses in clinical nutrition provides strong training for students wishing to pursue a career as public health nutritionist.[20]

Although the Department of Public Health has entered into discussions with the Nutrition Association of Zambia for assistance with curriculum development, they have not contacted THET or donors from the SUN fund for financial assistance. Even without outside funding, according to the School of Medicine, other programmes have been largely successful with minimal donor assistance. The School of Medicine is, however, interested in pursuing assistance from the SUN fund and from the Ministry of Health for the development of the MPH in Public Health Nutrition.[21]

[19] Interview with Dr. Drinah Nyirenda from the UNZA School of Agriculture, 4 July 2014
[20] Interview with Ms. Agnes Aongola, 21 July 2014
[21] Interview with Dr. Charles Michelo 18 July 2014

Discussion

Filling Gaps in Capacity at the Diploma Level

The Food and Nutrition diploma programme produces about 150 nutritionists annually. Most of the programme's graduates are recruited for positions in the government at the community or district level, but have difficulty advancing to higher level positions due to inadequate qualifications and gaps in nutrition knowledge. Despite its weaknesses, the diploma provides necessary pre-service training for positions needed at district offices of Ministry of Health, Ministry of Agriculture and Livestock, and the Ministry of Community Development, Maternal and Child Health.

The diploma programme is high in demand and well-known in secondary schools as an educational track. The diploma can complement the BSc programme, but it is not designed explicitly as a preliminary requisite for the BSc programme. However, most of the current BSc students in the first graduating cohort are diploma holders and already employed at government sectors.

As a whole, the diploma programme does not adequately address the identified gaps in policy, clinical dietetics, teaching, or research. It is a combination of gaps in nutrition knowledge needed to optimally serve and the qualification in degree required for higher positions.

Stakeholders agreed on the need to strengthen the diploma training and curriculum. In order to prepare the graduates with more in-depth nutrition knowledge, the programme should offer more basic sciences and nutrition courses.

Filling Gaps in Capacity at the Bachelor's Level

In order for nutritionists to work as dietitians in a clinical setting, qualify to work in management or in a policymaking role, a bachelor's degree is the minimum requirement. As the first degree programme of its kind in Zambia, the BSc in Human Nutrition at the School of Agriculture serves in a much needed role in filling human resources gaps in Zambia, mainly by filling a gap in degree-based qualification. The creation of the BSc

programme was initiated by the NFNC, with input by the NAZ, and the course began before funding from DFID and support by THET was provided.

Since the BSc provides students with courses in general nutrition, community health, and dietetics, it has the potential to produce nutritionists that can fill gaps in dietetics, policy, education, and can move students towards filling gaps in research. Immediately after graduation, graduates can find employment in community nutrition facilities, in clinical nutrition settings, in leadership and management roles, and as lecturers for the diploma programme. In addition, the BSc serves as a promising stepping stone for students who would like to pursue graduate training in order to fill roles in management, research, and teaching roles. The BSc requires students to defend a dissertation in their fifth and final year, thereby giving them practical research experience.

Further, 22 students will be graduating in 2015 from the first cohort of BSc students. In the near future, projected class sizes are expected to be of similar numbers, but THET believes that, with the MSc serving as an opportunity to provide additional lecturers for the BSc, the programme might eventually grow to between 75 and 100 students per class. With this number of students, graduates of the BSc could reasonably fill many of the existing gaps in lower level policy, public health management, and dietetics. It is recommended that, in order to allow for programme growth, additional lecturer posts, especially those in dietetics, are added through the SDF programme.

Since the curriculum for the BSc was reviewed by Zambian stakeholders from the MOH, NFNC, and NAZ, as well as some participation from international nutritionists, it was explicitly designed to meet Zambian needs in capacity. However it is possible that, since the curriculum for the BSc is broad in scope, it may lack depth. Those invested in the programme designed it so that in the fifth year students may specialise in either general nutrition or in dietetics. However, some critics commented[22] that this specialisation is not fully adequate for students to successfully work in a policy setting and especially in patient care. Especially for dietetics, hands-on work experience is needed, and although administrators in the Department of Food and Nutrition are working to get students

[22] Interview with Dr. Charles Michelo from the UNZA School of Medicine 18 July 2014

experience in the hospitals, it will only be in conjunction with coursework, and not a full-time experience. BSc students interested in public health complained that the curriculum didn't focus enough on policy and programme implementation; students interested in dietetics felt they had not received enough hands on experience. It is recommended that the Department of Public Health in the School of Medicine consider allowing students to specialise in their training earlier in the programme, and conduct a practicum experience in their fifth and final year.

Going forward, the programme also should consider how it would like to recruit students for the BSc, since, currently, most students are recruited directly from the industry. It is quite probable that the BSc may run out of demand from diploma holding nutritionists and will need to increase their efforts to recruit from high schools. Students coming directly from secondary school are, as of now, generally unaware of the programme and its workforce applications. Although efforts have been made to promote the programme, including radio advertisements, it is recommended that in the next round of planning, advertising to secondary school students is prioritised.

Potential to Fill Gaps through the Master of Science in Human Nutrition

According to the director of the Food Science and Nutrition Department at the University of Zambia, job descriptions for nutritionists increasingly require that nutritionists hold a master's degree. Beginning in 2015, the MSc programme in the UNZA School of Agriculture expects to enroll three students as first year and three more for second year. By 2016, it is hoped that six students with MSc degrees will be trained.

As a whole, the MSc programme fills the gaps of workforce in policy and education. MSc degree holders are better qualified than BSc holders to handle policy formulation and implementation at higher-level positions. It is also projected that graduates will be qualified to work in middle- and high-level positions at provincial and national offices. With the exception of highest-level positions, the master's programme adequately targets the gap in policy. The highest-level positions in policy will have to be filled by individuals with a doctorate.

The MPH curriculum's inclusion of independent research in Year 2 exposes students to more in-depth research than the BSc programme. At the Bachelor's level, students learn background knowledge in nutrition and begin to see the gaps in nutrition. Master's degree holders are qualified to initiate their own research questions. However, system capacity is insufficient to provide for the hiring and funding of researchers, especially in nutrition. The Master's degree is a necessary step in the progress towards training researchers at the preferred doctoral level.

Additionally, it is anticipated that the graduates of the MSc will contribute to filling the gaps in lecturers at the BSc and diploma level programmes in nutrition. As of July 2014, the draft of the MSc curriculum does not specifically address the need to specialise nutritionists to dietitians.

Potential to Fill Gaps through the Master of Public Health in Public Health Nutrition

As a degree with a strong public health curriculum providing the core for master's level nutrition education, the proposed MPH in Public Health nutrition, if established, would provide significant depth to nutrition training at the post-graduate level in Zambia. Since Zambia faces a range of severe public health nutrition issues, but on the whole, lacks highly trained nutritionists in policy making positions, with time, an MPH in Public Health Nutrition could help to fill the gap in policy and management with highly qualified, well-trained public health nutritionists. If students are further allowed a managerial practicum experience, as suggested, they would be highly prepared to design and oversee the implementation of successful nutritional interventions in Zambia.

The students who were interested in the MPH also expressed interest in pursuing teaching later in their career. Therefore, the MPH has the potential to help to fill gaps in both research and education, although it is not explicitly designed to do so.

The NFNC and the line ministries are planning to hire several high level nutritionists with master's degree-level training (DFID Zambia, Government of the Republic of Zambia, and MQSUN, 2014). Therefore, there is a significant need for a number of nutritionists with postgraduate degrees to work in policy making and management positions, positions that the MPH would adequately train them for. However, the number of nutritionists needed at

this level is not as high as the need for nutritionists at the diploma and bachelor's level, so, for the resources it currently has, 5-10 graduates per class is adequate to fill the gaps in policy.

It is highly recommended that those involved with the development of the MPH seriously consider tailoring the programme more towards dietetics, as suggested by stakeholders at the Ministry of Health. Since the Department of Public Health is situated in the School of Medicine, dietetics students would have easy access to medical courses and setting up a practical experience in the hospital could be easily accomplished. Since the Department of Public Health at the School of Medicine explicitly designed the Public Health Nutrition programme to address nutrition from a preventative perspective, it would require significant restructuring of the proposed curriculum to change the perspective from a preventative to a curative focus. However, the curriculum in the School of Medicine is still in the early phases of development, so it is feasible in this stage to development for the programme to incorporate a dietetics component.

The MOH highly recommended that the administrators of the MPH consider adding a dietetics component to their curriculum. The MOH only provides funding to educational programmes that they believe will further their goals as a ministry, and they have identified dietetics as a priority. As of yet, dietetics has not yet been incorporated into the MPH curriculum. However, the MOH has asserted that they are able to support pre-service training programmes in Public Health Nutrition, Clinical Nutrition, and Dietetics, as long as the courses are approved in the School of Medicine.

If the MPH chooses to tailor the curriculum more towards dietetics, it may be an issue of concern that students are not required to enter with a bachelor's degree in nutrition, since the MPH does not focus its curriculum on providing a nutrition background, but rather on training students in the core public health sciences. The minimum requirement for entry into the programme is a bachelor's degree in any science related field. Therefore, it may be recommended that students entering into the MPH either have taken or will take the core sciences necessary for understanding nutritional sciences: biology, general and organic chemistry, biochemistry, and microbiology.

Projected Outcomes of Capacity Building through Pre-service Education

In March 2009, a meeting of nutritional professionals met in Dakar, Senegal to discuss public health nutrition research and training capacities. Although their recommendations are specifically tailored to West Africa, the recommendations could loosely apply as well for Zambia. The meeting recommended each country have 100-500 Bachelor of Science nutrition graduates, 10-50 post-graduate Master of Science graduates, and 5-25 Philosophy of Science degrees in nutrition per every 5 million people. For Zambia, with a population of 14.08 million people, this translates to a recommended:

BSc: 282 – 1408

MSc: 28 – 141

PhD: 14 – 70

These numbers seem to align reasonably well with quantitative recommendations made by stakeholders.[23]

It is estimated that currently, in Zambia, there are 342 nutritionist posts, 259 nutritionists in post, and 104 registered nutritionists. The NRDC graduates about 150 diploma holding nutritionists to serve as 'nutrition technicians' each year (DFID Zambia, Government of the Republic of Zambia, and MQSUN, 2014). The School of Agriculture estimates that by July 2016, at least 25 students will have obtained BSc degrees with 50 more in progress. Twenty-five of these graduates are expected to be dietitians. However, THET projected that, with the establishment of Master's degree programmes, this number may expand in the near future to 75-100 students per class. It is further hoped that by 2016, 3 MSc degrees will have been completed with a further 6 MSc degrees in progress. If the programme is approved, the School of Medicine hopes to have between 8-13 MPH degrees in progress by 2016. This is significant progress in a short amount of time, from only a diploma programme existing in Zambia, to a Bachelor of Science and potentially two Master's degrees in nutrition in only four years. However, if the programmes do not grow

[23] Interview with Dr. Drinah Nyirenda from the UNZA School of Agriculture, 4 July 2014; Interview with Ms. Meg Langley from Tropical Health Education Trust, 21 July 2014

to admit more students it will take decades for Zambia to meet the recommended number of nutritionists.

Recommendations for Harmonising the BSc and Diploma Programmes

Since stakeholders in many institutions have noted the need for nutritionists to specialise during their pre-service education period, it is tentatively recommended that the NRDC and UNZA discuss the possibility of students specialising in their education earlier in the process. For example, students at UNZA only take specialised classes in their fifth and final year of the course, but in the fourth year, all students take coursework in public health nutrition and clinical nutrition. If students could specialise as early as their third or fourth year, they may be able to reduce their coursework and reduce the time spent in the BSc by avoiding taking classes outside of their area of specialisation.

Comparison of the MPH and MSc

The MSc and MPH programmes are each designed to produce nutritionists who have the potential fill the gap in public health. The two programme curricula share courses such as policy, management, biostatistics, and advanced nutrition, and research methods. Both would produce students capable of addressing public health nutrition issues, designing and implementing nutritional interventions, conducting nutritional or public health research, and teaching at either the bachelor's or diploma level. However, the MSc in Human Nutrition in the School of Agriculture has a much broader, generalised curriculum, while the MPH in Public Health Nutrition focuses more on public health competencies.

There is an opportunity for the programmes to share lecturers and classroom space in order to fully maximise classroom space, since some courses in the two programmes overlap in their content or educational goal. However, the significant overlap in coursework and focus between the two degrees make it less likely that the Graduate Review Board will approve both programmes in their current forms.

It is likely that the curriculums of the programmes will undergo revisions as they each undergo the approval process by the university to prevent redundancy. If the programmes could explicitly address different gaps in nutrition human capacity in Zambia, it would be feasible and recommended for donors and supporting organizations like the MOH to

pursue methods of financially and logistically supporting both. Although as of yet, there has been insufficient effort to communicate between the two schools, stakeholders from both the School of Medicine and the School of Agriculture expressed interest in collaboration. With increased collaboration between the schools occurs in the near future, both the MSc in Human Nutrition at the School of Agriculture and the MPH in Public Health Nutrition at the School of Medicine could become sustainable, effective postgraduate programmes that have the potential to significantly help to fill human capacity gaps in Zambia. However, without any modifications, there is too much overlap between the two programmes for them to both receive approval from the University, funding from the SUN Fund, and funding from the MOH, even though all three institutions have expressed intent to support pre-service training in public health nutrition, general nutrition, and dietetics.

Currently, both programmes are designed to be sustainable. The MSc at the School of Agriculture already has acquired lecturers to teach the courses and has secured funding from the SUN fund to help with the establishment of the programme. It is moving towards being sustained entirely by UNZA. The MPH, too, has secured lecturers for its course and is supported by the existing Department of Public Health.

In terms of donor involvement, the two proposed Master's degrees are somewhat different. Although the MSc (and BSc) in the School of Agricultural Sciences were envisioned, designed, and started by Zambian nutritionists with the NFNC and NAZ, the two programmes in the School of Agricultural Sciences have largely been funded and supported by international donors. In many ways, this has been advantageous for the development of nutrition programmes in the School of Agriculture. THET's involvement in the development and implementation of the BSc allowed for highly skilled lecturers from other countries to teach the courses, provided funding for some facilities, and provided some scholarships for students. This assistance helped the first degree programme of its kind in Zambia to begin to educate students in nutritional sciences at the bachelor's degree level, and has allowed for the near approval of a post-graduate programme in a short period of time. Although the MPH in the School of Medicine was also designed with input by major Zambian stakeholders in nutrition, the programme design originated in an existing university department, and the curriculum was based on existing structures from that department.

The Department of Public Health has not yet entered into discussions with DFID, THET, or other administrators of the SUN fund, which has money set aside for the support of a post-graduate degree. In many ways, having a programme that is completely sustained by the University from the inception of the programme alleviates many of the issues that the BSc has experienced with obtaining full time lecturers on the University Payroll and eliminates the programmes reliance on international aid. However, there is aid available for the MPH programme if the administrators of the SUN fund deem it acceptable, and experienced organisations like THET may be able to provide useful logistical advice for running the MPH, since currently its administrators are not nutritionists. According to the *Lancet* series on maternal and child malnutrition, although 'locally generated solutions to questions about how to best organise nutrition are most likely to be successful' in terms of the implementation of nutrition institutes, international guidance is desired in how to 'develop and manage programmes, train various cadres of workers, do research and employ future graduates' (Bryce et al, 2008). It is recommended that administrators from the School of Public Health, who have yet to do so, contact representatives from THET, DFID, and the SUN Fund, for possible sources of support, guidance, and funding.

Neither programme trains nutritionists fully in clinical nutrition or dietetics, a gap that still desperately needs to be filled. In order to avoid redundancy and incorporate the strengths of each department, it is highly recommended that administrators from the School of Medicine consider incorporating training students further in clinical nutrition, to fill a much needed gap in dietetics. If this were to be done, the programmes would address different gaps and work jointly to address the gaps in human capacity in Zambia.

Communication and Collaboration between All Parties

There is significant need for more communication and collaboration between the Department of Food Science and Nutrition at the University of Zambia and the NRDC Department of Nutrition. Both parties similarly agreed that they should be meeting more frequently than they currently are, since most students in the BSc are graduates of the diploma programme. Although it is still early for revision of the BSc curriculum, it is important that representatives from both institutions at least meet together to discuss how

they might be potential for the two programmes, degree and diploma, might work together to allow students to advance their training and careers as quickly as possible without sacrificing quality of education.

There is an urgent need for increased communication and collaboration among the School of Medicine, School of Agricultural Sciences, and the bodies involved with administering the SUN Fund. Those who were invested in developing the master's programmes recognized the existence of the other programme, but they were not well aware of the details or recent updates of the progress. It is imperative that, in order to develop useful, sustainable, and efficient post-graduate programmes to fill gaps for highly trained nutritionists, there needs to be more communication between schools at the University of Zambia and between educators and donors. Stakeholders from the School of Medicine, the School of Agriculture, and DFID all expressed willingness to collaborate, but as it is, only the School of Agriculture has entered into serious discussions with donors. If the two programmes are to both succeed in building human capacity in nutrition in Zambia, it is imperative that they meet together and take action towards collaboration between the proposed MSc and the proposed MPH.

Developing Dietetics Programmes in Zambia

As it stands, most nutritionists in Zambia, including diploma holders themselves, consider the diploma to be inadequate preparation for students to work as clinical nutritionists. Diploma holders must, in order to be hired in hospitals, receive additional on –the-job training to even begin to work as clinical nutritionists, and even then, some of the students we spoke with in the BSc programme recollected feeling unprepared to handle some of the cases they were faced with. The BSc programme allows students to specialise in dietetics during their final year, and provides students with significant coursework in dietetics. However, some say that the preparation for dietetic students in the BSc is too didactic. As it stands, students will most likely have some amount of clinical experience during their final year, but it will not be anywhere close to the clinical rotations that dietitians complete in other parts of the world. In a similar study in Mozambique, researchers recommended the

establishment of a 'provincial nutrition undergraduate internship programme' in order to give students 'supervised practical experience to become competent practitioners (Robertson, 2012). Neither proposed master's degree programme includes a dietetic component.

It is recommended that the BSc in the School of Agriculture either consider expanding their dietetic curriculum and collaborate with the School of Medicine and UTH on how to gain their students significant practical experience or that the University of Zambia consider implementing a separate Bachelor of Science degree specifically in Dietetics. The School of Medicine may be considering working to develop such a programme, but it is, as of now, only conceptual.

Implementing Online Learning

Stakeholders from the NRDC, UNZA School of Agriculture, and UNZA School of Medicine all believed that online distance education is a useful approach, but each provided varying levels of reservations. Currently, over a third of the students enrolled in the NRDC nutrition department are distance students. They come in for short periods of intensive coursework study at NRDC when regular full-time students are on recess, and then take home learning material and assignments until their next meeting time. Since NRDC expressed that they are unable to expand the diploma programme further because of facility constraints, implementing online courses may allow them to expand both the regular streams of students and the distance learners.

In the BSc, department administrators noted that the idea of distance learning had been thought about but not given serious consideration. Like the diploma programme, using some sort of online class format may serve as temporary or permanent solution with lecturers not yet at critical mass. Furthermore, it may allow for the programme to expand class numbers quickly, and educate students who live in areas outside of Lusaka. The School of Medicine has seriously considered online learning formats, and noted that distance learning could be helpful, in some programmes more than others. However, all stakeholders noted access to reliable computers and internet sources to be an issue, at least for the time being. Although the Dean of Agriculture pointed out that the university is

currently working on laying fibre-optic cables, and the director of the Department of Public Health noted that the Ridgeway campus, where the School of Medicine is located, now has internet access in student dormitories, students not on campus may have a more difficult time with reliable internet. The director of the department of nutrition at NRDC, for example, noted that many distance students live in rural areas and simply do not have internet access on a daily basis. Stakeholders from the School of Agriculture recommended that, until connectivity is less of an issue in Zambia, distance learning with commuting and take-home assignments may be a more feasible form of education than online coursework.

Building Capacity through Doctorate Education

The momentum towards building pre-service education programmes at the Bachelor's and Master's degree levels has led programme administrators and donors to consider the implementation of doctoral level programmes in nutrition. Postgraduate programmes, if established accordingly, will slowly but effectively address the workforce gaps in policy, research, and education with time. There are no immediate plans to establish a PhD programme as of now, but establishing a PhD programme will not be difficult once a Master's programme is in place, since Master's programme lecturers could also serve as PhD advisors. PhD graduates could, in turn, teach Master's and Bachelor's level students.

Depending on the demand for the programme, a PhD programme will eventually be established. In the long run, training scholars outside the country is not the most effective way to fill the gaps. Zambia needs its own postgraduate and doctoral degree to train nutritionists. Once established, the programme will attract many scholars from surrounding countries in Sub-Saharan Africa. Nutritionists with PhD level training will be able to better target the gaps in policy, education, and especially research. Graduates of this programme are well qualified to work as lecturers at diploma, bachelors, and master's level. The programme will also well prepare the graduates to practice and develop in-depth research projects, which will significantly contribute to the huge current gap in research.

Acknowledgments

We would like to thank the individuals and organisations that devoted their time to contribute to our research. Professors and administrators at the University of Zambia, School of Medicine and School of Agricultural Sciences assisted us greatly in understanding the development of education programmes in Zambia. We also thank Silke Seco-Grutz from DFID for guiding us on refining our research. Last but not least, we thank Dr. Marja Hinfelaar and Dr. Jessica Achberger from the Southern African Institute for Policy and Research (SAIPAR) for all of their support and guidance throughout our time in Zambia.

References

Bryce, Jennifer, Coitinho, Denise, Darnton-Hill, Ian, Pelletier, David, Pinstrup-Andersen Per. 2008. 'Maternal and child undernutrition: effective action at national level'. *Lancet* 2008 , no. 371: 510-26

DFID. 2012.Tackling Undernutrition in Zambia: Nutrition Audit of DFID Zambia Programmes. Lusaka, Zambia : DFID.

DFID. 2014. 'Nutrition Workforce Planning Report, Version 2'. DFID Working Document Version 2. Lusaka, Zambia : DFID.

Goodman, Robert, Spears, Marjorie, McLeory, Kenneth, Fawcett, Stephen, Kegler, Michelle, Parker, Edith, Rathgeb Smith, Steven, Sterling, Terrie, Wallerstein, Nina. 1998. 'Identifying and Defining the Dimensions of Community Capacity to Provide a Basis for Measurement'. Health Education Behaviors, no. 25: 258-278

Harris, Jody and Drimie, Scott. 2012. 'Toward an Integrated Approach for Addressing Malnutrition in Zambia: Literature review and institutional analysis'. IFPRI Discussion Paper 01200. Washington, D.C. : International Food Policy Research Institute

Kuriyan, Rebecca, Griffiths, Jeffery, Finkelstein, Julia, Thomas, Tinku, Raj, Tony, Bosch, Ronald, Kurpad, Arnold, Duggan Christopher. 2014. 'Innovations in nutrition education and global health: the Bangalore Boston nutrition collaborative'. BMC Medical Education 14:5.

Ministry of Health. 2006. 'National Food and Nutrition Policy' Lusaka: Zambia

Ministry of Health [Zambia] and World Health Organization Country Office [Zambia]. 2008. Prevalence rates of the common non-communicable diseases and their risk factors in Lusaka district, Zambia 2008. Lusaka, Zambia: Ministry of Health and World Health Organization.

Morris, Saul, Cogill Bruce, Uauy, Ricardo. 2008. 'Effective international action against undernutrition: why has it proven so difficult and what can be done to accelerate progress?' *Lancet* 2008 no. 371:608-21

National Food and Nutrition Commission. 2011. 'National food and nutrition strategic plan for Zambia 2011-2015 with a strategic direction on the first 1000 critical days to prevent child stunting'. Lusaka: Zambia

Robertson, Aileen. 2012. 'Assessment of the Public Health Nutrition Capacity in Mozambique. Summary Report'. Mozambique: Royal Danish Embassy

Scott, G. 2014. : First 1000 Most Critical Days Programme. [Speech transcript]'. Retrieved from http://scalingupnutrition.org/wp-content/uploads/2013/04/Zambia_Vice-President-Guy-Scott-Speech_1000-MCDP-LAUNCH-201s.pdf

Shrimpton, Roger, Hughes, Roger, Recine, Elisabetta, Mason, John, Sanders David, Marks G, Margetts B. Nutrition capacity development: a practice framework. Pub Health Nutr 17(3): 682-688

Sodjinou Rodger, Fanou, Nadia, Deart Lucie, Tchibindat Felicite, Baker, Shawn, Bosu William, Pepping, Fre, Delisle Helene, and The Regional Nutrition Working Group. 2013. 'Region-wide assessment of the capacity for human nutrition training in West Africa: current situation, challenges, and way forward'.

UNICEF. 2013. Statistics, 2013. Retrived from http://www.unicef.org/infobycountry/zambia_statistics.html

Zambia Ministry of Health. 2011. 'National Health Strategic Plan 2011-2015'. Lusaka: Ministry of Health

Zambia Ministry of Health. 2013. 'The 2012 List of Health Facilities in Zambia'. Preliminary Report, version 15. Lusaka: Ministry of Health

Appendix A: Definitions

Capacity: The ability to do, experience, or understand something. (Goodman et al, 1998)

Capacity building: The process by which societies increase their ability to solve problems, define objectives, understand and deal with development needs to achieve objectives in a sustainable manner. (LaFond et al, 2002)

Dietetics: The branch of knowledge concerned with the diet and its effects on health, esp. with the practical application of a scientific understanding of nutrition.

Pre-service training: Training and education to build the capacity of a professional that occurs before a professional enters the field at that level of education. It may be differentiated from in-service training, which occurs to build the capacity of a professional in the midst of their career at a particular level of service and training.

Appendix B: Nutritionists and their place of work

Nutritionists/food technologists	Place of work
Public health nutritionists	Community
Clinical nutritionists	Health facilities
Food scientists and food technologists	Ministry of Agriculture and the community

DFID. (2014). Nutrition Workforce Planning Report, Version 2. Working Document. Lusaka: DFID

Appendix C: Dietitians and their place of work

Dietitians	Place of work
Clinical dietitians—provide care to patients	Hospitals, other health care facilities
Community dietitians—conduct home visits	Public health settings and community
Gerontological—nutrition for the aged	Work in nursing homes, government agencies for policies and universities
Neonatal—nutrition for premature newborns	Neonatal intensive care units
Administrative dietitians—oversee large-scale meal service operations	Work in hospitals, schools and government agencies

DFID. (2014). Nutrition Workforce Planning Report, Version 2. Working Document. Lusaka: DFID

Appendix D: Diploma Curriculum

1st year

Length of Course/Term	Course Name
Full year	Basic computer skills
Full year	Human biology
1st semester	Botany
1st semester	Physical and analytical chemistry
1st semester	Mathematics
1st semester	Communication skills
2nd semester	Farm accounts
2nd semester	Production economics
2nd semester	Zoology
2nd semester	Organic chemistry

2nd semester	Principles of human nutrition

2nd year

Length of Course/Term	**Course Name**
Full year	Biochemistry
Full year	Industrial/Field Attachment
1st semester	Introductory statistics
1st semester	Rural sociology
1st semester	Fundamentals of organic chemistry
1st semester	Fundamentals of macro-economics
1st semester	Applied Human nutrition
1st semester	Public health nutrition
2nd semester	Applied statistics

2nd semester	Agricultural extension
2nd semester	Basic food science
2nd semester	Food service management and entrepreneurship
2nd semester	Introduction to research methods

3rd year

Length of Course/Term	**Course Name**
Full year	Dietetics
1st semester	Project management
1st semester	Pig and poultry production
1st semester	Applied food science
1st semester	Intro to IT and communication
1st semester	Introduction to research

	methods
2nd semester	Beef and dairy production
2nd semester	Introduction to crop science
2nd semester	Community nutrition and food security
2nd semester	Community education and health promotion

Appendix E: BSc Curriculum

2nd year

Length of Course/Term	Course Name
Full year	Fundamentals of human anatomy and physiology
Full year	General and food microbiology
1st semester	Fundamentals of micro-economics
1st semester	Fundamentals of organic chemistry
1st semester	Intro to IT and communication
2nd semester	Fundamentals of macro-economics
2nd semester	Principles of human nutrition

2nd semester	Nutritional Assessment Practice
2nd semester	Introduction to biochemistry
2nd semester	Vacation practical

3rd year

Length of Course/Term	**Course Name**
Full year	Nutrition communication and health promotion
1st semester	Nutrition assessment
1st semester	Food chemistry
1st semester	Rural sociology
2nd semester	Human nutrition
2nd semester	Principles of dietetics
2nd semester	Introductory statistics for

	agriculture
2nd semester	Instrumental methods in food analysis

4th year

Length of Course/Term	**Course Name**
Full year	Diet formulation and dietetic management
Full year	Participatory approaches to development
Full year	Public health and nutrition
1st semester	Research methods and epidemiology for nutritionists
1st semester	Nutrition disorders
2nd semester	Nutrient and drug interactions
2nd semester	Food safety and quality

	management

5th year

Length of Course/Term	Course Name	Dietetics or nutrition speciality
1st semester	Food service systems management	Both
1st semester	Food and nutrition security	Both
1st semester	Project planning and appraisal	Both
1st semester	Processing and preservation of plant products	Both
2nd semester	Hospital based dietary management	Dietetics only
2nd semester	Obstetric and paediatric nutrition care	Dietetics only
2nd semester	Nutrition care in general medicine	Dietetics only
2nd semester	Nutrition in oncology, trauma, and surgery	Dietetics only
2nd semester	World food issues	Nutritionists only
2nd semester	Nutrition in emergencies	Nutritionists only

2nd semester	Project monitoring and evaluation	Nutritionists only
2nd semester	Processing and preservation of animal products	Nutritionists only

**Students also complete coursework in Communication Research Methods and conduct a Research Project*

Appendix F: MPH Tentative Curriculum Outline

1st year

Length of Course	Course Name
1st semester	Introduction to Global Health
1st semester	Research methods
1st semester	Epidemiology and Biostatistics
1st semester	Health Promotion and Education
1st semester	Health Policy and Management
1st semester	Anatomy/Physiology for Nutrition
2nd semester	Advanced Human Nutrition
2nd semester	Nutritional Assessment

	Practice
2nd semester	Nutritional Epidemiology
2nd semester	Lifecycle Nutrition: Perspectives
2nd semester	Community and Clinical Nutrition

2nd year

Length of Course	**Course Name**
1st semester	Approved protocol (defended and cleared by IRB)
1st semester	Global TB Epidemiology
1st semester	Llifestyle Disorders: Cardiovascular Diseases Determinants (Hypertension, Diabetes, Nutrition)

1st semester	HIV Epidemiology and global research challenges in prevention
1st semester	Global Nutritional challenges: preventative and restorative consideration
2nd semester	Dissertation and Defence; Journal Publication

*****MSc curriculum from the School of Agriculture not provided due to pending approval from the University

Appendix G: List of stakeholders and their positions

Name of Stakeholder	Position of Stakeholder
Dr. Yusef Ahmed	Researcher and Professor in the UNZA School of Medicine
Agness Aongola	Chief Nutrition Officer in the Ministry of Health
Dr. Phoebe Bwembya	Nutrition Professor in the School of Medicine
William Chilufa	Director of the CSO-SUN Initiative
Meg Langley	Programme Coordinator for THET in Zambia
Dr. Pamela Marinda	Professor in the Department of Food Science and Nutrition in the School of Agricultural Sciences
Dr. Charles Michelo	Head of the UNZA Department of Public Health in the School of Medicine
Dr. Nyambe Mkandawire	Professor in the UNZA Department of Food Science and Nutrition in the School of Agricultural Sciences
Raider Mugode	Nutritionist for NFNC
Dr. Mick S. Mwala	Dean of the UNZA School of Agricultural Sciences

Mike Mwanza	Nutritionist for NFNC
Dorothy Nthani	Head of Food and Nutrition Department at NRDC
Dr. Drinah Nyirenda	Professor in the Department of Food Science and Nutrition in the School of Agricultural Sciences
Silke Seco-Grutz	Nutrition Advisor for DFID
Dr. John Shindano	Head of the UNZA Department of Food and Nutrition in the School of Agricultural Sciences
Ruth Siyandi	Secretary General for NAZ/Nutritionist for UNICEF
Vicky Veevers	BSc coordinator in the Department of Food and Nutrition in the Department of Agricultural Sciences
UNZA BSc Student #1	4th year BSc student specialising in dietetics
UNZA BSc Student #2	4th year BSc student specialising in general nutrition
UNZA BSc Student #3	4th year BSc student specialising in general nutrition
UNZA BSc Student #4	4th year BSc student, specialisation undecided
UNZA BSc Student #5	4th year BSc student, specialisation undecided

Willa Zambezi	Clinical Dietitian at the Cancer Diseases Hospital

Appendix H: Limitations

As undergraduate students from the United States, we acknowledge that we have come towards our analysis of pre-service training programmes with a specific perspective. We chose to simply evaluate pre-service training programmes because we do not have the capacity ourselves to fully analyse all of the social, economic, and political factors that go into successfully or unsuccessfully build nutrition capacity in a country. We hoped to evaluate the effectiveness of these programmes in filling the existing gaps in human capacity in nutrition in Zambia. However, since we are students who desire for all gaps in capacity to be filled, and not donors or administrators with budgetary constraints, we acknowledge that we would like all of the possible training programmes to succeed, which may not be a realistic bias. Furthermore, our opinions and analysis rely on the stakeholders we interviewed. Although we tried to meet with stakeholders in education, government, NGOs, and donor organisations, we acknowledge that we were not fully able to address all stakeholders involved with building human capacity in nutrition.