GROWNUT: Growing partnership for higher education and research in nutritional epidemiology in Democratic Republic of Congo

Internal evaluation report September 2020

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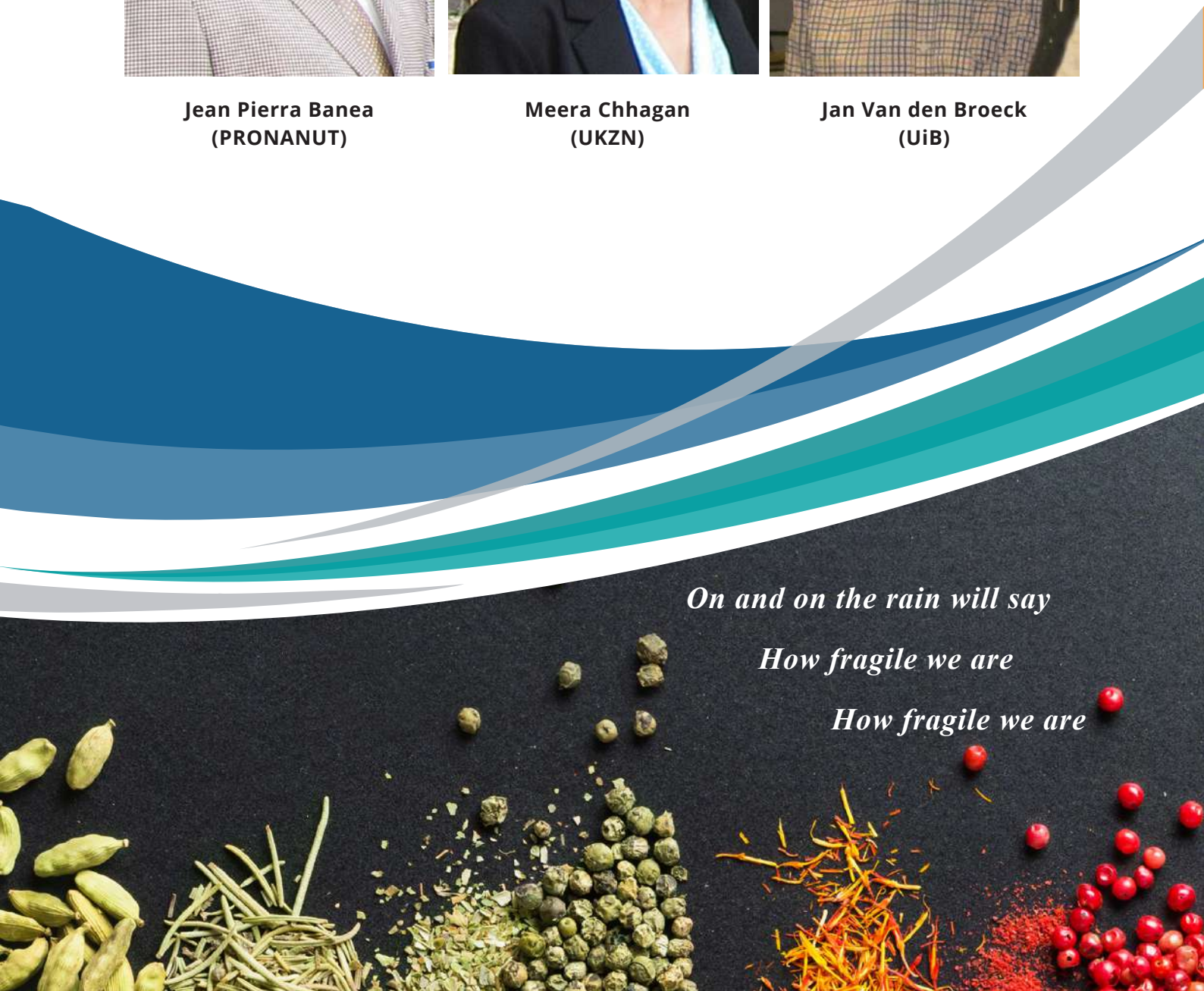
TRIBUTE

We would like to pay special tribute to three phenomenal members of the GROWNUT team who sadly passed away over the period of the GROWNUT project. The achievements of the project is a legacy to their vision and inspirational leadership in the development of the GROWNUT project.

Jean Pierra Banea (PRONANUT)

Meera Chhagan (UKZN)

Jan Van den Broeck (UiB)



GROWNUT: a North-South-South Partnership between University of Kinshasa, University of Bergen and University of KwaZulu-Natal

Internal evaluation report September 2020

North-South-South Partnership
University of Kinshasa, Kinshasa School of Public Health,

University of Bergen, Centre for International Health,

University of KwaZulu-Natal, Centre for Rural Health

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Ethics approval

Ethics approval was obtained from the following universities:

- University of Kinshasa School of Public Health Ethics Committee (ESP/CE/247/2019)
- University of KwaZulu-Natal Humanities and Social Sciences Research Ethics Committee (HSS/0258/019),
- Norwegian Centre for Research Data (Ref 466503).

CONTENTS

ACRONYMS

CIH	Center for International Health
CRH	Centre for Rural Health
DRC	Democratic Republic of Congo
GROWNUT	Growing partnership for higher education and research in nutritional epidemiology in DRC
HIC	High- income country
KSPH	Kinshasa School of Public Health
LMIC	Low- and middle-income counties
Norad	Norwegian Agency for Development Cooperation
NORHED	Norwegian Programme for Capacity Development in Higher Education and Research for Development
PRONANUT	Programme National de Nutrition (National Nutrition Programme / Ministry of Health, DR Congo)
UIB	University of Bergen (Norway),
UKZN	University of KwaZulu-Natal (South Africa)
UNIKIN	University of Kinshasa (DRC)

PART ONE: BUILDING A PARTNERSHIP IN NUTRITIONAL EPIDEMIOLOGY

Introduction

Good nutrition and food security are the foundations for healthy societies. Malnutrition has severe developmental, economic, social, and medical consequences for individuals, families and communities, and for future generations. In particular, poor nutrition for children during the first 1000 days from conception to the age of two years can have lifelong consequences for educational and employment attainment, with individuals failing to achieve their full potential and as a result becoming trapped in cycles of poor health and poverty. Nutrition plays a foundational role in underpinning the immune system which protects against communicable diseases.

Malnutrition in all its forms is a leading cause of ill health globally, so that addressing nutrition challenges is a key priority in many low-income countries. Types of malnutrition include undernutrition (wasting, stunting, underweight), vitamin or mineral deficiencies, as well as overweight and obesity. Despite numerous interventions undernutrition rates remain high, particularly in Sub-Saharan Africa [1], where the burden of hidden hunger or micronutrient deficiency, resulting from predominantly calorie-dense unbalanced diets is disproportionately high. The Democratic Republic of Congo (DRC) has some of the highest rates of malnutrition globally, with a poor track record in health research [2, 3]. Thus, nutrition should be at the forefront of planning for the development of health and research priorities in DRC, to ensure that interventions to achieve optimal nutrition are evidence based and appropriate to the context

North-South partnerships

To effectively address the high human costs of undernutrition in low-income countries, including DRC, it is essential to develop context-specific research capacity. Low-income countries require local research skills to explore factors underlying poor health and nutrition, and to develop solutions to address these challenges. Thus, research capacity building to improve skills of local researchers has the potential to deliver strong health service delivery systems using effective evidence-based health interventions. However, many low-income countries, particularly in Sub-Saharan Africa, continue to experience high levels of poverty, struggling health systems and poor health indicators in communities. Further, many African countries lack the resources, including skilled researchers, required to develop the relevant high-quality evidence required to inform health policy. Researchers from LMIC are not adequately represented in research literature [2, 3].

To address this challenge, partnerships have been established between higher education institutions in northern hemisphere high-income countries and southern LMIC counterparts to build or strengthen research capacity [4-7], support and strengthen research infrastructure, and support and train doctoral [6, 8] and masters' degree [7, 9] students in the LMIC. Many of these collaborations, known as North-South partnerships, have been successful in improving training and education of health workers and researchers in LMIC, but have not led to improvements to the policy framework or to the health system. However, the collaborations have bi-directional benefits, with partners in LMIC countries gaining access to skills, new ideas, technical expertise, a wider audience for their research findings and

increased leverage for ongoing research, while partners in higher income countries gain opportunities to improve their skills and experience, and recognition for their work [10].

Although collaborations between higher education institutions and research partners in the global south and the global north have played a crucial role in strengthening health research capacity, these collaborations have also been widely criticised. Criticisms include that research in low-income countries has frequently focused on the requirements and research agendas of funders in the north, rather than on local needs. As a result, research partnerships have sometimes been counter-productive, with partners in the south being relegated to little more than data collectors, and talented in-country researchers being diverted away from local priorities [10]. This observation has been reflected in global changes in health research funding policy towards low-income countries to ensure that research results are locally appropriate, relevant and applicable. Regional networks, institutional mechanisms and funding agencies all have a key role to play in supporting evidence-based knowledge outputs and leadership in policy development to address the needs of society/ populations among partner countries.

Establishing successful international partnerships for research and education confers benefits to individuals, higher education institutions, and organisations, as well as benefitting the health policy framework of the LMIC partner. Training personnel in the field of epidemiology, public health and research creates an enabling environment where academic leadership can flourish, influencing research agendas, as well as tapping into international research networks. The value of providing research skills and knowledge to researchers in low-income countries is that context specific knowledge enables local researchers to tailor the research agenda to the specific needs of the country, leading to health benefits for the population. The integration of gender analysis and mainstreaming and a critical use of research partnerships are also some tools to mitigate the gaps in setting the research agenda. The GROWNUT (GROwing partnership for higher education and research in NUTrition epidemiology in Democratic Republic of Congo) project was developed to achieve these goals by establishing a postgraduate programme in nutritional epidemiology in the Kinshasa School of Public Health (KSPH), DRC.

Nutritional Epidemiology

Nutrition is a field where interventions are often context specific, and where local research expertise is particularly important to develop and evaluate affordable, acceptable, evidence-based policies at country and local level. Nutritional epidemiology is a relatively new field of study in public health and had not previously been offered by KSPH or in the DRC. Nutritional epidemiology focusses on the relationship between diet and disease, specifically patterns, causes and solutions to nutritional problems. Training in nutritional epidemiology improves the skills and capacity of health professionals and researchers to undertake research to define and explore food insecurity, malnutrition and micronutrient deficiencies which are central to the large burden of nutrition problems across the lifespan, especially in areas facing nutrition transition.

GROWING PARTNERSHIP FOR HIGHER EDUCATION AND RESEARCH IN NUTRITIONAL EPIDEMIOLOGY IN DRC (GROWNUT)

The GROWNUT project was a collaboration between three universities, the University of Kinshasa, the University of Bergen, and the University of KwaZulu-Natal, working in partnership with the DRC National Nutrition Programme (PRONANUT).

Project Collaborators

The **University of Kinshasa** was one of two universities established in the DRC by the Belgium colonial authority in the 1950's. In 1971 these Universities were amalgamated to form the University of Zaire and unbundled 10 years later when the University of Kinshasa (UNIKIN) was formally established. Despite being chronically underfunded UNIKIN has expanded, offering undergraduate and postgraduate degree programmes in all the major fields of study including science, engineering, technology, business, management, law, humanities, social sciences, and health sciences. Partners who financially supported UNIKIN in those early years were USAID and the Belgium Cooperation.

Public health training was not initially provided at UNIKIN, and scholars wishing to pursue a career in public health had to travel to Europe or the United States of America to study. By 1983 USAID and the then Government of Zaïre were persuaded that a local public health school would spearhead effective and efficient training of public health professionals as well as provide on-going support for health through applied research. Funding for a KSPH at UNIKIN was provided from USAID in 1984 through the Tulane University consortium including Harvard University, the University of Alabama, and the Belgium Cooperation. The funding was provided for supporting institutional development, including infrastructure, ICT, administrative systems and capacity building for faculty staff. Master level public health programmes and short-term courses were established as well as research opportunities. However, as funding dried up

in 1990s further collaborations were established, one of which was with the Centre for International Health (CIH) at the University of Bergen, which is committed to supporting research institutions and creating academic centres of excellence in LMIC. KSPH has continued to expand its teaching capacity and has gained a solid reputation for excellence. It currently has 5 departments (Community Health, Epidemiology and Biostatistics, Environmental Health, Health System Management, and Nutrition) and prior to the GROWNUT project, offered four master's degree programmes in public health, health economics, bioethics, and Field Epidemiology and Laboratory Training Program (FELTP).

The **University of Bergen** (UiB) is an internationally recognised, academically diverse, research university in Norway. It has a staff compliment of more than 4,000 with around 18,500 students in seven faculties. PhD candidates at the UiB are considered employees, making it a particularly attractive opportunity for both national and international students. Each faculty has a number of departments and centres, such as the Faculty of Medicine where CIH is housed under the Department of Global Public Health and Primary Care. CIH is committed to research, education and leadership to address global health challenges in LMICs. CIH aims to improve health in the low-income countries of the world through research, teaching and capacity building in global health. UiB, through the CIH, has had a longstanding (at least 20 years) relationship with the KSPH through research endeavors and supervising PhD students from the DRC, some of whom were staff members at KSPH.

The **University of KwaZulu-Natal** (UKZN) is a large university in South Africa spread across five different campuses and two cities. It has a staff compliment in excess of 3,400 staff, catering for more than 45,000 students. UKZN follows the college system with four main colleges supporting 19 schools and many departments. Research centres are positioned within schools, such as the Centre for Rural Health (CRH) which is an externally funded research centre, located within the School of Nursing and Public Health. Consisting of more than 30 staff members, CRH aims to undertake research to strengthen health systems, increase human resources for health and to ensure health equity and social justice through research. For many years, UKZN has collaborated with UiB conducting both nutrition research and student supervision in a number of different African countries.

Based on these relationships, a formal collaboration was established between the KSPH, UiB through CIH, and UKZN Department of Paediatrics to foster the institutional capacity to develop, initiate and sustain a nutritional epidemiological education programme and build and strengthen research capacity at the KSPH. An application was successfully submitted to Norwegian Programme for Capacity Development in Higher Education and Research for Development (NORHED) for funding. On receipt of 5 years of funding from NORHED the new project called GROWNUT was initiated in 2014. The CRH joined the collaboration as the UKZN representative after the first two years of the funding period.

Aims and objectives of GROWNUT

The primary aim of the GROWNUT project was to develop and implement a Masters' and PhD programme in nutritional epidemiology at KSPH. The vision was to develop a cadre of African nutrition scholars and researchers to provide context relevant nutrition research, and expedite the translation of research findings into nutrition policy. Furthermore, it was envisioned that this project would promote sustainability and create institutional capacity through providing opportunities for professional development for staff members at the KSPH, as well as prospects for research collaborations between the participating universities. Institutional development was seen as key to success and sustainability, and therefore skills development for teaching and research staff at KSPH was an essential component of the project. Included in the vision for the post-graduate nutritional epidemiology programme was the establishment of a residential rural research site where students could gain experiences of a variety of nutrition conditions and work with local communities.

The main objectives of the GROWNUT project were:

- To establish of a 2-year Master and 3-year PhD programme in nutritional epidemiology for students in the DRC.
- To train staff members at the KSPH to PhD level and support development of teaching and research skills among KSPH staff members.
- To conduct high-level relevant research in the rural research site and in other areas in DRC, for practical training and research.
- To inform nutrition policy.

DEVELOPMENT OF THE MASTER'S PROGRAMME IN NUTRITIONAL EPIDEMIOLOGY

The nutritional epidemiology master's programme was based on a number of educational principles as follows:

Duration of the programme: A two-year master's programme in nutritional epidemiology was developed consisting of one full year of theory- based modules and one year of field work and research.

Entrance requirements: Students applying for the Master in Nutritional Epidemiology had to be less than 40 years old, hold a bachelor degree and provide three letters of recommendation from a supervisor. Applicants also had to have previously worked in a health-related field. Women were given preference and eligibility criteria were relaxed in an effort to ensure equitable representation of women. All applicants had to pass an admission test including an English proficiency test.

Provision of bursaries: Five scholarships were provided annually for master's students, one of which was allocated for a permanent KSPH staff member and four allocated for applicants from vulnerable groups. Selection for bursaries was based on the student having fulfilled the admission criteria, proof of belonging to a vulnerable group and performance in the admission test. Vulnerable groups included female gender, applying from an outlying district, or from a war affected area in DRC.

Use of English as a medium of instruction: Researchers from the three partner institutions in the GROWNUT project had a variety of home languages, while English was the common language for most participants. The administrative language and medium of instruction in educational institutions in DRC, including UNIKIN, is French. However, this is not the home language for most students as the DRC has over 200 indigenous languages. When deciding the language to be used as the medium of instruction for the nutritional epidemiology programme, partners weighed the concerns of using English, which is not currently a medium of instruction in DRC, with the benefits of English learning. These benefits included providing students with improved access to nutrition literature, improved ability to contribute meaningfully to the international discourse on nutrition, and the ability of graduates to network with international researchers and publish their research. On this basis, and at the specific request of the DRC partner, English was adopted as the medium of instruction for the nutritional epidemiology programme, which had the additional benefit of allowing researchers from all partner institutions to participate in teaching and learning and supervision activities.

Curriculum content and teaching methods

A constructive authentic learning approach characterized by encouraging students to engage in their own learning experience through problem solving, critical thinking, self-directed learning, and real-world problems formed the basis on which the curriculum and the 17 compulsory modules were developed (see Table 1). The use of adult learning principles was applied throughout the programme along with a variety of other teaching methods.

TABLE 1: THEORY MODULES AND TEACHING METHODS

Module	Name	Teaching methods used
1	Scientific English	Adult learning teaching approach Groups work with presentations Case studies
2	Biostatistics I	Active participation Group work and data analysis Individual presentations
3	Applied computing	Group work and presentations Wrap-up plenary with expert Case studies
4	Principles of nutrition	Lectures from experts Group work with plenary presentations Field visits and field reports
5	Nutritional problems	Face to face lectures. Adult learning principles Group work with plenary presentations Case studies
6	Research and ethical considerations	Face to face lectures. Adult learning principles Group work with plenary presentations Case studies
7	Measurements of nutritional status	Active participation Self-learning Group work Field work Audio-visual presentations
8	Epidemiology I	Lectures by experts Group work with presentations Individual work
9	Food security and nutrition	Lectures Audio visual presentations and discussions Field work Practical work
10	Nutrition and major global issues	Presentations by experts Group work Report back in groups Field work
11	Food hygiene	Presentation by experts Group work and presentations
12	Management principles	Adult learning Case studies within groups and presentation Lecture the working in groups and presentation Expert summary of principles
13	Biostatistics II	Theory Practical exercises Tutorials Readings Group work
14	Epidemiology II	Lectures by experts Computer laboratory practical Group work with presentations
15	Research methods	Active participation Experienced facilitators lead students through process Audio visuals
16	Climate change and nutrition	Use of specific climate change presentations and software Practical exercises in laboratory using software
17	Gender and nutrition	Adult learning Groups to prepare subjects then present Expert facilitator summarizes subject Case studies in groups

Fundamental to the teaching and learning approach was the participation from the three collaborating GROWNUT universities, PRONANUT and other stakeholders involved in nutrition in the DRC. As a result, all partners contributed to project activities. Joint sessions empowered and strengthened KSPH faculty members' abilities to facilitate the programme, including those faculty members registered for PhDs or who had completed PhDs. This was an essential component of the GROWNUT approach and aimed to ensure sustainability of the programme.

At the end of the first year of study, students were required to pass an examination to proceed to the second year of study which consisted of a rural-based internship and a research project.

Rural internship

The deployment of students to the rural site was fundamental to the of the authentic learning approach, as it provided students the opportunity to learn and acquire practical skills in nutrition and research, by being exposed to real-life problems in rural communities in the DRC. All students were required to undertake a three-month internship at the rural site. Through the rural internship students were able to better understand the impacts of nutrition, malnutrition, food insecurity, agricultural practices and other nutritional problems on rural communities.

Bwamanda in Sud-Ubangi province was initially identified to serve as the rural research site, but due to logistical challenges, this was changed to Popokabaka Health Zone in Kwango province (see Figure 1). Malnutrition in Kwango, particularly in the health zones of Kenge, Popokabaka, and Kitenda had reached crisis proportions (COOPI Cooperazione Internatazione, 2020) thus making Popokabaka suitable for training.

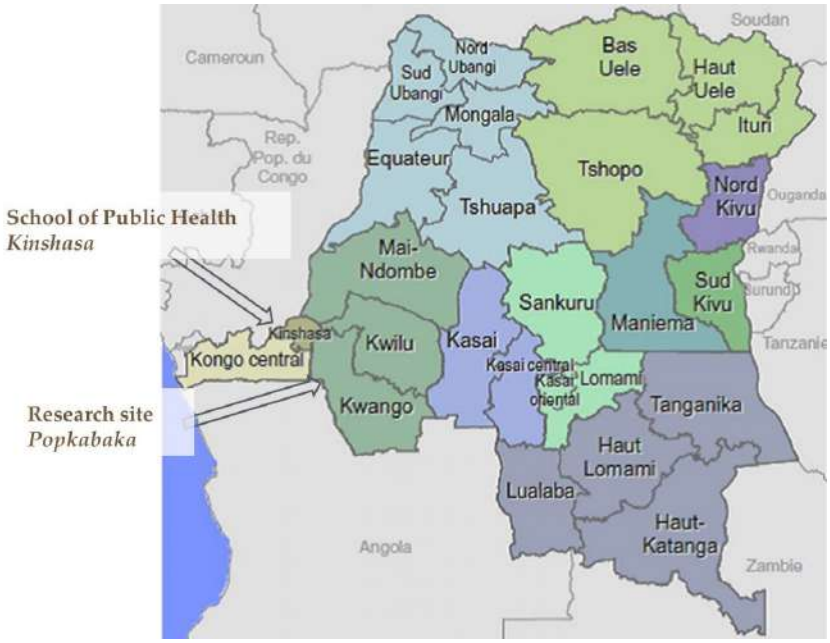


FIGURE 1: MAP OF DRC WITH RURAL SITE INDICATED

Due to political unrest in the DRC, the second and third cohort of students undertook the first part of their internship at a health center in Kinshasa and went to Popokabaka for the second part of their internship and data collection.

During the rural internship students developed skills in assessing nutritional status using anthropometry, biochemical tests, clinical assessment for nutritional status and assessment of food security and intake. A set programme of teaching, facilitation and support was developed and implemented during the rural internship by KSPH faculty members and their supporting partner PRONANUT (Table 2). In addition, PhD students were available at the rural site to support master's degree students.

TABLE 2: PROGRAMME OF TEACHING IN THE RURAL SITE

Type of measurement	Conditions targeted and instruments or techniques used
Clinical assessment	Kwashiorkor: identifying the presence of oedema Marasmus: observation of signs of wasting Konzo: observation, palpation, testing neurological reflexes Anaemia: iron deficiency Goiter: iodine deficiency Vitamin A: deficiency Using a pedometer
Anthropometry	Measuring weight Measuring height Measuring cranial circumference Measuring thoracic circumference Measuring skin fold Measuring Bio-impedence Measuring mid upper arm circumference Measuring abdominal circumference
Biochemical tests	Glycaemia Hemoglobin Urine or serum tests for vitamin A, zinc and iodine
Food intake	24 hour food recall Food frequency Food weighing
Food security	Production of food / purchase of food / food aid Accessibility of food Utilization of food Stability of the agricultural system

At the end of the rural internship, students spent a further month in Popokabaka to collect data for their individual research projects.

FIGURE 2: MEASURING THE HEIGHT OF CHILDREN IN POPOKABAKA

Research project

During the rural internship, students were required to identify a real-life nutrition related research question as the topic for their research study. Each student then developed a full research proposal to investigate the research question, collected and analysed the data, and wrote a thesis/dissertation to complete the requirements for the Master in Nutritional Epidemiology. All research was undertaken at the rural research site, except for a small number of students who gained special permission to conduct their research elsewhere. Students at the rural site used tablet computers and open access software for data collection.

Students were allocated two supervisors for the research component, the main supervisor being from KSPH and a co-supervisor from a collaborating university. Having two supervisors brought a different perspective on the students' research. Students were required to defend their dissertation in a venue where key leaders and role-players from collaborating universities and PRONANUT were present, prior to the completion of their degree.

DEVELOPMENT OF THE PHD PROGRAMME IN NUTRITIONAL EPIDEMIOLOGY

Entry requirements for the PhD programme

Students who were less than 45 years of age with a masters' level qualification were eligible to apply for the PhD programme. Students applying for the PhD had to provide three recommendations, work in a health-related field, and have a good working knowledge of English. In addition, students had to demonstrate good performance in previous academic programmes.

Top performing students who had successfully completed the master's programme in nutritional epidemiology were eligible for the PhD programme if they met the above requirements, preference was given to female applicants.

Curriculum content and teaching methods

All three collaborating universities participated in teaching of PhD students. A full programme of formal teaching was planned for the first year of PhD studies consisting of 13 modules but this plan was never implemented. As the number of students who registered for a PhD was small, a specially designed programme tailor-made for their research topic was developed for each student and all PhD students had the opportunity to attend courses in South Africa, Norway and one student spent time studying in Germany.

All PhD students were able to spend periods of time at UiB or UKZN to undertake some of their required modules, and have an opportunity to improve their English skills.

Research for PhD students

The research component was the major component of the PhD programme. PhD students were supervised by senior researchers at KSPH, UIB and UKZN.

OVERALL ACHIEVEMENTS OF GROWNUT PROJECT

Master in Nutritional Epidemiology: achievements

Four cohorts of students were enrolled in the master's programme between 2014-2018, which comprised 41 students in total. Of whom, 40 students completed the degree, and one student failed during the first year.

All students completed a research project. Thirty-four students wrote their thesis in English and six wrote in French. Thirty five students collected data in the rural research site at Popokabaka. Research topics included a variety of important nutrition challenges in DRC. Examples of research topics are shown in Table 3.

TABLE 3: EXAMPLES OF RESEARCH UNDERTAKEN BY NUTRITIONAL EPIDEMIOLOGY STUDENTS

Double burden of malnutrition among adolescents in Popokabaka
Positive deviance as an approach for preventing acute malnutrition in rural context of Popokabaka
Evaluation of the Double Burden of Malnutrition: Under nutrition & overweight / obesity in children under five years in the city of Popokabaka in Kwango (DRC)
Breastfeeding practices among lactating women living in the Health Area of Popokabaka, Kwango Province, DRC
Dietary knowledge and practices during pregnancy among pregnant women and key informants in the rural area of Popokabaka
Exploration of nutrition counselling provided to pulmonary TB patients in Popokabaka Health Zone
Exploration of nutritional counselling for people living with HIV followed up at Popokabaka hospital.
Relationship between women's education level and infant feeding practices in Popokabaka health district
Exploring the perception of the Popokabaka population about the choice of sources of drinking water.
Barriers to exclusive breastfeeding practices among mothers with children aged 0-6 months in Popokabaka, Kwango Province, DRC
Care-seeking behaviors of mothers/caregivers about acute malnutrition in children under 5 years of age in Popokabaka
Food insecurity as a barrier to antiretroviral therapy in Popokabaka
Knowledge and feeding practices during pregnancy among mothers who delivered a low birth weight infant in the Popokabaka Health Zone.
The relationship between breakfast consumption and school performance among school aged children in Lemba "Commune"
Exploration of knowledge and practice of nutrition education on diabetes among type 2 diabetics patients in Popokabaka hospital, 2018: A qualitative study
The prevalence and determinants of household food insecurity in the Popokabaka Health Area, March 2016
Prevalence and predictors of anaemia among women of childbearing age in Popokabaka city

Effectiveness of plumpy sup compared to corn-soya-blend in the management of acute moderate malnutrition of 6-59 months children in Pweto, Haut Katanga province, DRCongo
Nutrition and food security among adult inmates in the prison facilities of Kinshasa. Case of the penitentiary and rehabilitation center of Kinshasa and the military prison of N'Dolo
Cassava processing in six villages affected by Konzo in the Democratic Republic of Congo: a qualitative knowledge, attitude and practice approach regarding soaking and wetting methods.
Mothers' knowledge, complementary feeding practices and nutritional status of children 6-23 months in Mbanza-Lemba, Kinshasa, Democratic Republic of Congo

FIGURE 3: SUPERVISOR AND STUDENT WORKING TOGETHER IN POPOKABAKA

Seven master's students presented their research findings at the 8th annual African Nutrition Epidemiology Conference in Addis Ababa in 2018 which provided an excellent opportunity to showcase the wide range of nutrition research conducted by students (Table 4). Four master's students, of whom one has since registered for a GROWNUT PhD, were accepted to present at the World Public Health Nutrition Conference in Brisbane Australia, which was cancelled due to the Covid-19 pandemic.

TABLE 4: AFRICAN NUTRITION EPIDEMIOLOGY CONFERENCE (2018): STUDENT PRESENTATIONS

Students	Title of presentation
ORAL Presentations	
Kazenza BM, Muyer MC, Bosonkie M, Mbunga B, Mapatano MA, Akilimali P, Horwood C, Haskins L, Mutombo P.	The dietary knowledge and practices of pregnant women in Popokabaka health area, Kwango province, DRC: a qualitative study
Konshi J, Horwood C, Lusamba P, Mutombo P.	Positive deviance approach, a tool for exploring infant and your children feeding in rural Popokabaka.
*Mbunga BK, Bangelesa FF, Mapatano MA, Akilimali P.	The role of spatial modelisation in the exploration of household predictors of stunting: Case of Popokabaka, DR Congo.
*Mbunga BK, Mapatano MA, Mutombo PB	Barriers and facilitators to infant and young child feeding practices in Popokabaka, DRC: a thematic analysis.
Mpoyi JL, Mbunga BK, Mutombo PB, Mapatano MA	Determinants of household food insecurity in Popokabaka DRC: A cross sectional study. Oral presentation second cohort student.

POSTER Presentations	
Badila D, Mutombo PB, Hatløy A, Kayembe PK	Nutrition and coping strategies among adult inmates in the prison facilities of Kinshasa: Case of Makal Central prison and N'Dolo Military prison.
Ngoy EB, Mbunga BK, Moleko J, Mutombo PB.	Complementary feeding practices and nutritional status of children 6-23 months in Lualaba Province, Democratic Republic of Congo.
Baloji A, Lusamba P, Engebretsen IMS, Mutumbo P.	Predictors of Anaemia among children aged 6-56 months in Popokabaka City, Democratic Republic of Congo.
**Originally a Master Degree student, now registered for a PhD*	

FIGURE 4: MASTER AND PHD STUDENTS WITH THEIR FACILITATOR PRESENTING RESEARCH AT THE 8TH AFRICAN NUTRITION CONFERENCE IN ADDIS ABABA

Currently one masters student has published two articles based on research undertaken in the GROWNUT project (Table 5) and five Masters students are preparing manuscripts from their research for publication in peer reviewed journals (Table 6).

TABLE 5: GROWNUT MASTER'S STUDENT PUBLICATIONS

Author	Title	Journal
Ngoy Bulaya, Emmanuel; Malamba Wa Malamba, Sylvain; Mulungulungu N. Ho, Ali; Luboya Numbi, Oscar (2020).	Nutritional value of MASO31 recipe and complementary feeding according to the WHO recommendations in Katanga, DR Congo.	Journal of Food Science & Technology. DOI: 10.25177/ JFST.5.4.RA.10657.
Ngoy Bulaya, Emmanuel; Horwood, Christiane; Mapatano, Mala Ali; Muyer Telo, Marie-Claire; Ntiba Assumpta, Ruth; Mutombo Beya, Paulin (2020).	Complementary Feeding Practices Associated with Wasting of Children 6 - 23 Months Old in Dilala, Lualaba Province, Democratic Republic of the Congo, 2017.	Acta Scientific NUTRITIONAL HEALTH (ISSN:2582-1423),4 (8):67-76.

TABLE 6: MANUSCRIPTS IN PROGRESS

Student	Manuscript being drafted
Kazenza MB, Horwood C, Haskins L, Mapatano MA, Mbunga BK, Bosonkie M, Hatloy A, John V, Mutombo P.	A qualitative study to explore dietary knowledge, beliefs and practices among pregnant women in a rural health zone in Democratic Republic of Congo
Bokundabi G, Haskins L, Horwood C, Kuwa N, Mutombo P, John V, Thorkild T, Banea JP, Hatløy A, Mapatano MA	Barriers to recommended cassava processing in resource-constrained Kwango, DRC
*Mbunga B, Connolly C, Horwood C, Ali MM.	Micronutrient-rich food consumption in the rural context of Democratic Republic of Congo: a cross sectional study.
Bosonkie M, Hatløy A, Mapatano MA, Mbunga BK, Muyer MT, Babakazo P.	Food intake was not the major predictor of anemia in rural women of childbearing age, Democratic Republic of Congo: A cross sectional study
Badila D	Coping strategies among inmates in the prison facilities, DRC
**Originally a Master Degree student, now registered for a PhD*	

Career pathing for master's graduates

On completion of their degree, master's graduates have been employed in a variety of nutrition specific fields such as PRONANUT (4), WHO (1), UNICEF (2) and other non-governmental organisations (5), where they are able to represent the DRC in the international arena. Others are employed in teaching capacities, not only at the University of Kinshasa (3), but also other universities and training colleges (2). Two graduates have returned to work in Popokabaka, while others work in hospitals, and rural health zones. One student registered for a PhD at UNIKIN and two students have registered for PhDs at other universities.

Achievements from the PhD students in Nutritional Epidemiology

Six students registered for the Nutritional Epidemiology PhD course through the KSPH. Two students completed and were awarded their Doctoral degrees, one of whom was a KSPH staff member. A further two students aim to submit their PhD theses in 2020, one of whom is a KSPH staff member. Two students dropped out. Titles of PhD students research are shown in Table 7.

TABLE 7: PHD STUDENT RESEARCH

PHD student	Title
Pierre Akilimali	Outcomes among HIV patients on Antiretroviral Therapy in a (post- conflict setting of Goma in the Democratic Republic of Congo)
Denis Bungu	Situation and valuation of African Yam Bean (Sphenostylis stenocarpa Hochst ex. A Rich) Harms in Democratic Republic of Congo.
Branly Mbunga	Micronutrient deficiencies in under five Children. The Case of Popokabaka, RD Congo
Freddy Bangelesa	Climate change and variability related to food security in Central Africa: Evidence from the Democratic Republic of the Congo.

One PhD students presented two posters from his research at the World Public Health Nutrition Conference in Cape Town, South Africa in 2016 (Table 8). In addition, one PhD student (initially from the Masters cohort – see Table 5) presented at the 8th annual African Nutrition Epidemiology Conference in Addis Ababa during 2018. This same PhD student (initially from the Masters cohort) was accepted to present at the World Public Health Nutrition Conference in Brisbane Australia, which was cancelled due to the Covid-19 pandemic.

FIGURE 5: DR DENIS BUNGU (TO THE LEFT) AND DR PIERRE AKILIMALI (TO THE RIGHT) AT GRADUATION

TABLE 8: WORLD PUBLIC HEALTH NUTRITION CONFERENCE, CAPE TOWN 2016: PHD PARTICIPATION

Poster Presentations	Title of presentation
Akilimali PZ, Musumari PM, Kashala-Abotnes E, Tugirimana PL, Mutombo PB, Veldman FJ, Kayembe PK, Tylleskar T, Mapatano MA	Food insecurity and undernutrition in treated HIV patients in a (post-) conflict setting: A cross sectional study from Goma, Eastern Democratic Republic of Congo. Depressive Symptoms, Loss of Appetite and Undernutrition among Treated HIV Patients: A Cross Sectional Study in Goma, the Democratic Republic of Congo.

PhD students were also able to contribute to the body of knowledge through a number of publications in peer reviewed journals about their research (Table 9). Dr Akilimali has gone on to publish widely with a further nine publications around issues of contraception and provision of health services

TABLE 9: PHD STUDENTS' RESEARCH PUBLICATIONS

Akilimali PZ, Mutombo PB, Kayembe PK, Kaba DK, Mapatano MA. (2014)	Determinants of survival in HIV patients receiving antiretroviral therapy in Goma, Democratic Republic of Congo]. Rev EpidemiolSantePublique; Jun; 62(3):20106.
Akilimali PZ, Kashala-Abotnes E, Musumari PM, Kayembe PK, Tylleskar T, Mapatano MA (2015)	Predictors of Persistent Anaemia in the First Year of Antiretroviral Therapy: A Retrospective Cohort Study from Goma, the Democratic Republic of Congo. PLoS One; Oct 16;10(10):e0140240.
Babakazo P, Donnen P, Akilimali P, Mapatano MA, Okitolonda E.	Predictors of discontinuing exclusive breastfeeding before six months among mothers in Kinshasa: a prospective study. Epidemiol Sante Publique. Oct;63(5):285-92. (2015)
Bungu Denis, Katanga Joseph, Mungele Tresor; Kimema Sebastien.	Effet du billonnage et du tuteurage sur le rendement en tubercules chez le haricot igname d'Afrique (Sphenostylis stenocarpa): cas de deux écotypes de la R.D Congo. Congo Sciences volume 4 (2): 162 - 168.
Kafuti C., Bolaluembe P., Belesi, H; Ifuta, S; Bangelesa, Freddy. (2016)	Impact of industrial logging on specific diversity and floristic composition of a tropical rainforest, case of Cotrefor-Alibuku concession forest in DRC. Revue Scientifique et Technique Forêt et Environnement du Bassin du Congo Volume 7. P. 18-27.
Malumba Paul, Bungu Denis, Katanga Joseph; Doran Lynn; Danthine Sabine; Béra François.	Structural and physicochemical characterization of Sphenostylis stenocarpa (Hochst Ex. A. Rich) Harms tuber starch. Food Chemistry volu 212: 305 - 312 (2016).
Akilimali PZ, Musumari PM, Kashala-Abotnes E, Tugirimana PL, Mutombo PB, Veldman FJ, Kayembe PK, Tylleskar T, Mapatano MA	Food insecurity and undernutrition in treated HIV patients a (post-) conflict setting: A cross sectional study from Goma, Eastern Democratic Republic of Congo. 2016. Nutrition Health Food Sci 4(2): 1-9 (2016)
Akilimali PZ, Musumari PM, Tugirimana PL, Mutombo PB, Veldman FJ, Patrick Kayembe PK, Mapatano MA, Tylleskar T, Kashala-Abotnes E. (2016)	Depressive Symptoms, Loss of Appetite and Under Nutrition among Treated HIV Patients: A Cross Sectional Study in Goma, the Democratic Republic of Congo. 2016. Nutrition Health Food Sci 4(2): 1-10.
Akilimali, Pierre, Musumari, Patou Masika, Kashala-Abotnes, Espérance; Kayembe, Patrick; Lepira, François; Mutombo, Paulin; Tylleskar, Thorkild; Mapatano, Mapatano MA	Disclosure of HIV status and its impact on the loss in the follow-up of HIV-infected patients on potent anti-retroviral therapy programs in a (post-) conflict setting: A retrospective cohort study from Goma, Democratic Republic of Congo. PLoS ONE. 2017 Feb 7: 12(2)
Bungu Denis, Katanga Joseph, Mungele Tresor; Kimema Sebastien.	Production et potentiel de rendement en tubercules chez les écotypes du haricot igname d'Afrique (Sphenostylis stenocarpa) Hochst de la République Démocratique du Congo. Scientifique et Technique Forêt et Environnement du Bassin du Congo Volume 8. P. 28-35, Avril (2017).
Katanga Joseph, Bungu Denis, Mungele Tresor; Kimema Sebastien.	Situation du haricot igname d'Afrique (Sphenostylis stenocarpa) en République Démocratique du Congo: culture, consommation, et qualités gustatives. Scientifique et Technique Forêt et Environnement du Bassin du Congo Volume 8. P. 57-64, Avril (2017).
Bangelesa, Freddy; Elhadi Adam; Knight, Jasper; Dhau, Inos; Marubini Ramudzuli; et al. (2020)	Predicting soil organic carbon content using hyperspectral remote sensing in a degraded mountain landscape in lesotho. Applied and Environmental Soil Science, 2020, 11.

BENEFITS OF GROWNUT PROJECT AMONG COLLABORATING PARTNERS

Collaborating partners benefitted from GROWNUT in a number of different ways.

Resource benefits for the KSPH

The GROWNUT project was directly responsible for providing many essential resources needed in the KSPH as well as at the rural research site in Popokabaka. Staff and students alike benefited from these resources.

Library facilities were upgraded with a large number of books purchased that were available to both students and staff. In addition, from 2015 all GROWNUT students and staff were able to access the library at UiB using their own registered username and password. Unfortunately this turned out to be complicated and was not used very much, either by the staff nor by the students. Attempts were made to purchase online text-books with very limited success. The most convenient way for the KSPH staff and students to get access to literature, was through HINARI, a WHO developed program intended to improve scientific access for health sector institutions.

In the early stages of the project a high-speed internet line was installed at KSPH to ensure all KSPH staff and GROWNUT students had access to reliable internet connections. Computers, printers, laptops and a video-projector were purchased for KSPH use in the GROWNUT project. Office equipment, furniture and air conditioning was installed to provide a comfortable work environment at KSPH. As UNIKIN has moved towards a more e-learning platform, the GROWNUT project provided materials/equipment such as web-cam video, mounted retro projector, projector screen, USB ports, internet 6 mega, e-learning package and training of staff. These resources will improve KSPH staff ability to access other UNIKIN equipment and improve sustainability of the project. The e-learning resources have been widely used for teaching and even for organizing thesis defences at KSPH and more recently have also been extensively used by the Ministry of Health for training medical health zones, anaesthesiologists, etc on COVID 19 when traveling was restricted. In addition, at the onset of the Covid-19 pandemic, the project purchased a number of portable modems to allow for remote teaching and collaboration.

Equipment purchased for student use during their nutritional studies included biostat-machines, tape recorders and dietary assessment software. In addition, all students were provided with a personal Android Tablets to be used for literature searches and during data collection at the rural research site.

The GROWNUT project upgraded the living conditions at the house provided for students at the rural research site in Popokabaka through the provision of solar panels, and other basic furnishings and equipment. Satellite internet installation in Popokabaka enabled students and supervisors to stay in contact during the research internship periods. In addition, motorbikes were purchased which allowed students to move around the rural area more easily.

Skills development and opportunities among all partners

KSPH has benefitted through improving the academic qualifications of three members of staff who graduated with a Master in Nutritional Epidemiology. A further staff member has graduated with a PhD and a second staff member will graduate in 2020. In addition, one staff member from Department of Agriculture at UNIKIN has graduated with PhD in nutritional epidemiology. He is now teaching at KSPH, and this has increased the inter-departmental collaboration at the University of Kinshasa. This represents a substantial increase in skilled nutrition researchers at KSPH, at the University and in DRC.

Additionally, all KSPH staff have been exposed to many learning experiences, extending their knowledge and skills through interaction with GROWNUT partners, many of whom are experts in the fields of nutrition and research. In the early stages of the project, GROWNUT partners travelled to Kinshasa for teaching and facilitation, sharing their expertise with students and KSPH facilitators. Co-teaching modules provided opportunities for both partners to learn from each other. Co-supervision of student research provided partners opportunities to support and value the contribution each partner brought to the research, especially where junior partners were co-supervising with more experienced partners.

Learning opportunities

There was regular contact between all partners through on-line Skype meetings every two weeks. However, face-to-face meetings provided opportunities to connect in a physical space and when all the partners were together, it was an ideal time for capacity building in identified topics. Workshops conducted with all partners were especially useful to develop a shared understanding of research supervision for PhD and master's students. Annual meetings also provided administrative staff with learning opportunities through interaction with grant administrators and financial managers from all three sites.

FIGURE 6: SUPERVISORS AND FACILITATORS ATTENDING PHD SUPERVISION WORKSHOP IN NORWAY

Opportunities to travel to each others countries not only to inspired partners but facilitated the building of networks which have the potential to positively impact individuals in the future, an important GROWNUT achievement which cannot be quantitatively measured. Cohesion, friendship and trust among partners were forged during face-to-face meetings, workshops and informal gatherings.

FIGURE 7: VISITING BONOBO SANCTUARY DURING A WRITING WORKSHOP IN DRC

Joint publications

Publications are an important output of all universities and also for the GROWNUT project. While GROWNUT partners have authored a large number of manuscripts there are some publications which directly relate to the GROWNUT project (Table 10).

TABLE 10: PUBLICATIONS DIRECTLY RELATED TO GROWNUT PROJECT

Authors	Title
Schwinger C, Markussen Lunde T, Andersen P, Kismul H, van den Broeck J.	Seasonal and spatial factors related to longitudinal patterns of child growth in Bwamanda, DR Congo. Earth Perspectives: 1:26. doi: http://dx.doi.org/10.1186/s40322-014-0026-8 (based on fieldwork done in the preparatory phase of GROWNUT.) (2014)
Kismul H, Schwinger C, Chhagan M, Mapatano MA, van den Broeck J	Incidence and course of child malnutrition according to clinical or anthropometrical assessment: a longitudinal study from rural DR Congo. BMC Pediatrics; 14:22. doi:10.1186/1471-2431-14-22 (direct result of GROWNUT collaboration, with authors from all the three institutions). (2014)
Kismul H, Hatløy A, Andersen P, Mapatano MA, Van den Broeck J, Moland KM.	The social context of severe child malnutrition: a qualitative household case study from a rural area of the Democratic Republic of Congo. Int J Equity Health; 19;14(1):47. DOI: 10.1186/s12939-015-0175-x.(2015)

Bumbangi F, Muma J, Choongo K, Mukanga M, Velu R, Veldman F, Hatloy A, Mapatano MA	Occurrence and factors associated with aflatoxin contamination of raw peanuts from Lusaka district's markets, Zambia.. Food Control. Volume 68, April 2016, Pages 291–296. http://dx.doi.org/10.1016/j.foodcont.2016.04.004.(2016)
Acharya P, Kismul H, Mapatano MA, Hatløy A.	Individual- and community-level determinants of child immunization in the Democratic Republic of Congo: A multilevel analysis. PLoS ONE 13(8): e0202742. https://doi.org/10.1371/journal.pone.0202742 (2018)
Kismul H, Acharya P, Mapatano MA, Hatloy A.	Determinants of childhood stunting in the Democratic Republic of Congo: further analysis of Demographic and Health Survey 2013–14. BMC Public Health, 2018, Volume 18:74.
Kismul H, Mapatano MA, Banea JP	Diet and Kwashiorkor in the Democratic Republic of Congo. in Preedy V, Patel VB. Handbook of Famine, Starvation, and Nutrient Deprivation. DOI:10.1007/978-3-319-40007-5_38-1. (2017)
Mapatano MA, Hatløy A, Horwood C. (2019) (Peer-reviewed book chapter)	Building a new master's and PhD programme in nutritional epidemiology in Kinshasa: How to face obstacles beyond the control of the project. I: Sharing Knowledge, Transforming Societies: The Norhed Programme 2013-2020. African Minds 2019 ISBN 978-1-928502-00-5. pp. 542-554

A further 3 manuscripts detailing the findings from the GROWNUT internal evaluation have been submitted and are under review (Table 11).

TABLE 11: MANUSCRIPTS FROM EVALUATION UNDER REVIEW

Authors	Title
Horwood C, Mapumulo S, Haskins L, John V, Luthuli S, Tylleskär T, Mutombo P, Engebretsen IMS, Mapatano MA, Hatløy A.	A North-South-South partnership in higher education to develop research capacity in nutritional epidemiology in the Democratic Republic of Congo: the challenge of finding a common language
Mapatano MA, Haskins L, John V, Hatløy A, Luthuli S, Maphumulo S, Engebretsen IMS, Tylleskär T, Mutombo P, Horwood C.	Establishing a postgraduate programme in Nutritional Epidemiology to strengthen resource capacity, academic leadership and research in the Democratic Republish of Congo.
Hatløy A, Luthuli S, John V, Haskins L, Maphumulo S, Mutombo P, Tylleskär T, Engebretsen IMS, Horwood C.	'I am not only beneficial to the community but to the entire country, I am trained as a researcher now'. Developing research skills in low-income countries: the power of a North-South-South partnership. I wish to appear on the list, if you don't mind

Challenges experienced during implementation of the GROWNUT project

There were a number of challenges experienced during the GROWNUT project which resulted in changes to how the project was delivered. The principal investigators (PIs) at UKZN and at UIB both sadly died in 2014, early in the project implementation, leading to considerable unexpected disruption. New PIs were identified at UIB and UKZN, however the UKZN replacement PI subsequently resigned and was unable to continue in the role as a result. CRH came on board from UKZN in 2016. These changes disrupted the leadership and vision of the project in the early years, however the project team was able to overcome this challenge and build new relationships and trust, and develop a strong partnership with a common vision for the project.

A further important challenge was that political unrest in the DRC in 2017 meant that partners were unable to travel to the DRC for over two years during the programme for the third and fourth cohort of master's students. As a result, only the first two cohorts of students were exposed to external facilitators from collaborating universities teaching with KSPH colleagues in the classroom settings in Kinshasa. KSPH facilitators had to undertake most of the teaching from this point onwards. To alleviate the burden of teaching and provide students with access to facilitators from collaborating universities, the two-week research proposal development module for the third and fourth cohort was delivered by collaborating partners at UKZN in Durban. This not only provided the students the opportunity of interacting with external international facilitators, but also provided students with the opportunity to travel outside the DRC, many of whom had never travelled before.

To ensure cohesion among collaborating universities, team meetings and management meetings were undertaken on-line during the period of unrest and resumed in the DRC once the travel restrictions were lifted.

Other challenges included internet access which was frequently slow or unavailable in DRC, particularly during periods of unrest where electricity outages were frequent, limiting communication and student access to online resources. Further investment in IT systems later in the project has succeeded in improving this challenge, which is a frequent constraint when working with partners in low-income settings.

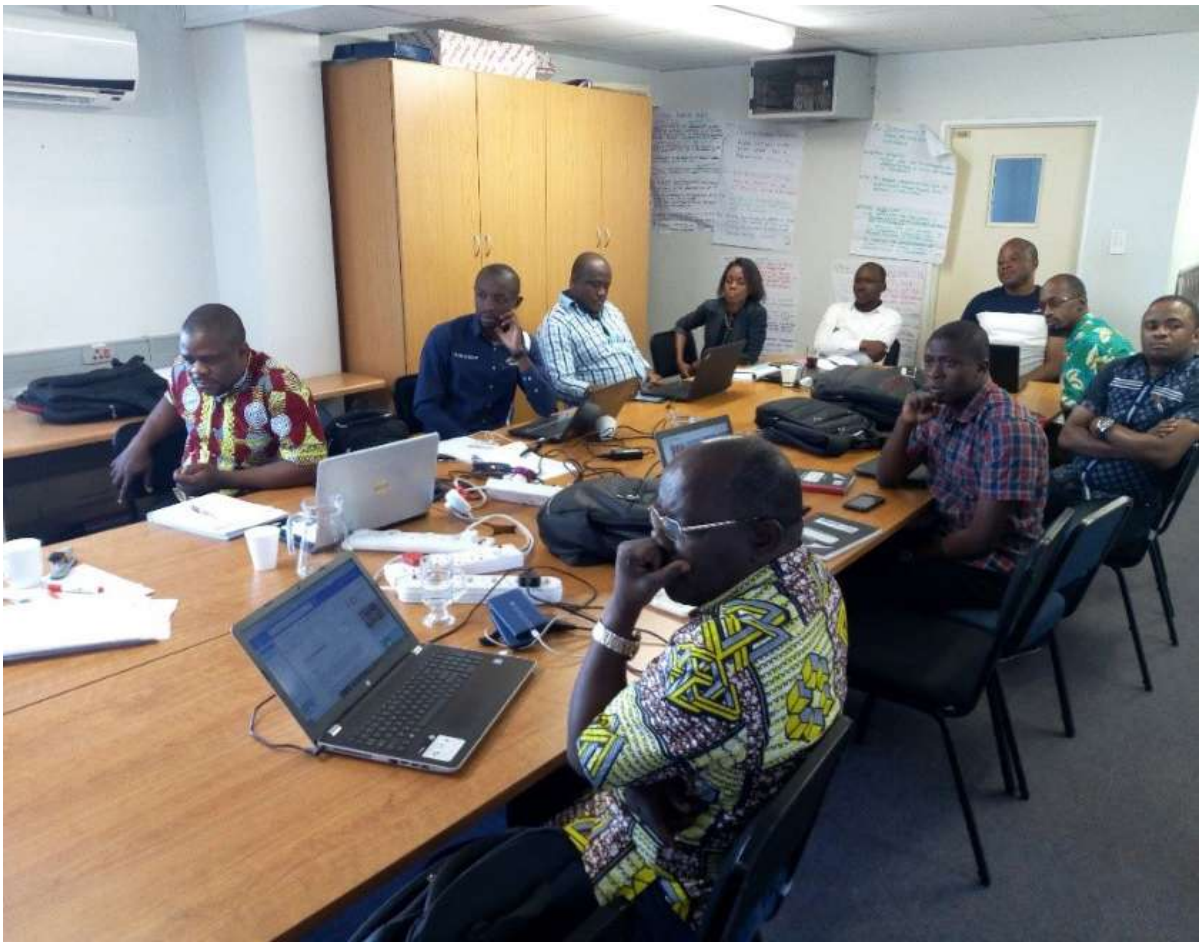


FIGURE 8: STUDENTS FROM THE FOURTH COHORT IN DURBAN SOUTH AFRICA DURING A RESEARCH WORKSHOP

FIGURE 9: MANUSCRIPT WRITING WORKSHOP IN DRC

PART TWO: GROWNUT EVALUATION

To evaluate the effectiveness of the GROWNUT project in developing teaching and research capacity in nutritional epidemiology in three partner universities a self-evaluation was undertaken in 2019/2020.

Objectives of the evaluation

The objectives for the evaluation were:

1. To explore perceptions of the functioning of the partnership between the three Universities (University of Kinshasa, University of Bergen & University of KwaZulu-Natal)

2. To evaluate the effectiveness of the GROWNUT project to develop institutional capacity in KSPH and other partner universities.

3. To explore experiences of students enrolled in the GROWNUT programme of the curriculum and pedagogy employed in teaching and research activities.

4. To explore the experiences of multi-site supervision between the three partnering Universities in supporting students to complete master's and PhD studies.

5. To explore the perceptions of using the English language as medium of communication and teaching within the GROWNUT programme

6. To explore the experiences of establishing and using a rural site to conduct practical training and nutritional epidemiological research.

7. To explore career pathing among GROWNUT students after degree completion.

Methods

A mixed methods study was undertaken to evaluate the GROWNUT project. The aim of the study was to evaluate the effectiveness of the GROWNUT project in developing teaching and research capacity in nutritional epidemiology in three partner universities.

Study setting

The study was conducted at all three universities who collaborated on the GROWNUT project, namely the University of Kinshasa, the University of Bergen and the University of KwaZulu-Natal.

Research methodology

The evaluation consisted of a mixed method design, using both a **quantitative** and **qualitative** approaches.

QUANTITATIVE STUDY

A cross-sectional descriptive study was conducted to evaluate the master's programme in Nutritional Epidemiology from the student's perspectives.

Participants

All master's degree students who enrolled on the programme between 2014-2018 and had completed all the learning components of the programme (theory, internship and research) were invited to participate in the quantitative survey. This included 32 students who had graduated with a Master in Nutritional Epidemiology and eight students who were about to graduate. One student who failed the examinations in the first year was excluded from the evaluation.

Data collection tools

A quantitative questionnaire was developed to assess all three components of the degree programme (theory, internship and research) using both closed and open-ended questions. Students were invited to rate the quality of the master's programme using Likert-type scales in relation to the teaching and learning provided during the master's programme. In addition, students were asked to agree or disagree with a series of statements relating to how they experienced participating in the programme. Questionnaires were available in both English and French and students were requested to respond in whichever language they felt most comfortable.

Data collection and management

Questionnaires were emailed to all 40 master's students. Questionnaires used an online platform which students downloaded, completed and returned vial email. Reminders were sent via email to non-responders on five different occasions over a four-month period.

One CRH staff member who had not previously been involved in the GROWNUT project received the student responses and anonymised these by allocating a study number and removing all identifiable information before capturing them.

Data analysis

Quantitative data was captured and validated in Microsoft Excel 2019 and converted into SPSS v26 for analysis.

Descriptive statistics are presented. Simple frequencies were calculated and demographic data is presented in tables.

Frequencies for rating of the master's programme and the levels of agreement and disagreement with specific statements are presented in aggregated stacked bars. Where students reported a question as not applicable, the denominator was changed to reflect this.

Open ended questions were categorised into themes and verbatim quotes used to highlight specific points.

QUALITATIVE STUDY

Using in-depth interviews, a qualitative cross-sectional study was conducted using a combination of purposive and convenience sampling.

Participants

Participants consisted of 1) stakeholders from the three collaborating institutions and from the funding body, 2) facilitators or supervisors who participated in the GROWNUT project, and 3) master's and PhD students in the nutritional epidemiology postgraduate programme.

Project leaders identified stakeholders who were involved in the inception of the project or had undertaken an oversight or management role. This included managers from UNIKIN, KSPH, UKZN, UiB and representatives from Norad, the funding organisation.

All staff from the three institutions who had participated in either teaching, or supervision of nutritional epidemiology students or both, were invited to participate in the study.

Master's students who had graduated or were about to graduate on the nutritional epidemiology programme were purposively selected to participate in the qualitative study. Three students were identified from each of the four cohorts based on their willingness and ability to be interviewed at KSPH. This included at least one female student from each cohort.

Three PhD students were invited to participate, two of whom had already graduated and one who will graduate in 2020. The latter PhD student had previously graduated from the master's programme.

Data collection

Data was collected using in-depth interviews by qualified qualitative researchers from UKZN who had not previously participated in the GROWNUT project. A semi-structured interview guide was developed to guide a discussion about pertinent aspects of the GROWNUT project, which allowed researchers the opportunity to prompt and further explore what was said by participants. Face-to-face, telephone and Skype interviews were undertaken depending on the participants' location.

Interviews were conducted in English or in French through a language interpreter, depending on the language preference of the participant. All interviews were audio recorded.

Data analysis

All interviews were transcribed verbatim and, where necessary, translated into English. A selection of the transcripts were quality controlled by researchers who simultaneously listening to the audio-recording and read the transcript. All transcripts were anonymised through allocation of study numbers and all identifying information was removed from the transcripts.

Data was analysed using an inductive thematic approach with the aid of Nvivo12 software. After a thorough reading of all transcripts, researchers identified an initial coding framework based on the research questions and emerging themes. Coding was undertaken by the two researchers working independently. Meetings were frequently held between the two researchers to monitor progress until no new themes emerged.

Ethics

Ethical approval for this evaluation was obtained from University of KwaZulu-Natal Humanities and Social Sciences Research Ethics Committee (HSS/0258/019), University of Kinshasa School of Public Health Ethics Committee (ESP/CE/247/2019), and Norwegian Centre for Research Data (Ref 466503).

As the quantitative data consisted of a self-administered questionnaire, informed consent was assumed by return of the completed questionnaire. Participants were assured of anonymity and this was ensured by allocation of participant codes. All data that could be linked to individuals was deleted from the transcripts.

All participants in the qualitative study provided written informed consent for in-depth interviews. Where interviews were conducted telephonically participants signed consent ahead of the interview and forwarded the consent form this by email to the researcher.

RESULTS

Demographic characteristics are presented for participants as well as participants in the in-depth interviews. Results are then presented corresponding to significant themes identified in the project. The quantitative experiences of the GROWNUT project from the master's students perspectives are presented first. This is followed by the following qualitative themes: development of the GROWNUT progamme; functioning of the GROWNUT partnership; teaching and learning in the GROWNUT programme; research and supervision experiences; use of English as a medium of instruction and supervision; internship in Popokabaka; and dissemination of findings.

Demographic characteristics

Quantitative data were collected from master's students between November 2019 and February 2020. In total 35/40 (88%) students responded to the questionnaire. Students representing all four master's cohorts participated in the quantitative evaluation.

Participants: quantitative survey

The median age of students participating in the quantitative evaluation was 39 years (IQR 32-44 years, and most were medical doctors. Student participation throughout the GROWNUT project as well as other demographic characteristics of students are shown in Table 12.

TABLE 12: CHARACTERISTICS OF PARTICIPANTS QUANTITATIVE SURVEY

	n n
Gender	
Male	23
Female	12
Profession / Basic degree	
Doctor	24
Nutritionist	3
Other	2
Missing data	6
Cohort of GROWNUT students	
1st cohort	7
2nd cohort	9
3rd cohort	9
4th cohort	8
Missing data	2
Student participated in an internship in the rural research site	30
Student collected data for thesis in the rural research site	26
Master's degree completed	32

Student received a GROWNUT bursary	
Yes	15
No	12
Missing data	8
Language in which thesis was written	
English	29
French	6

Participants: qualitative interviews

In-depth interviews were conducted with 31 participants, comprising eight stakeholders, 11 facilitators/supervisors, as well as 9 master's students and three PhD students, one of whom had previously graduated from the master's programme.

Four of the participants selected were unavailable to participate during the study period. These were one master's student, one facilitator from KSPH and one from UKZN, and a stakeholder from Bergen. The master's student was replaced by another student from the same cohort. One KSPH facilitator was replaced by a staff member from KSPH who had participated in teaching one module. One UKZN facilitator had left the university and could not be reached and was excluded. Overall, 13 interviews were conducted in French and 18 in English. A total of 25 interviews were conducted in Kinshasa, two in Durban, and four interviews were done remotely (telephone or skype).

Demographic characteristics of all participants from the in-depth interviews are shown in Table 13. A number of stakeholders and facilitators occupied high level management positions in different universities. There was an overlap between the role of stakeholder and facilitator as five facilitators also had a management role in the project.

TABLE 13: DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS OF THE IN-DEPTH INTERVIEWS

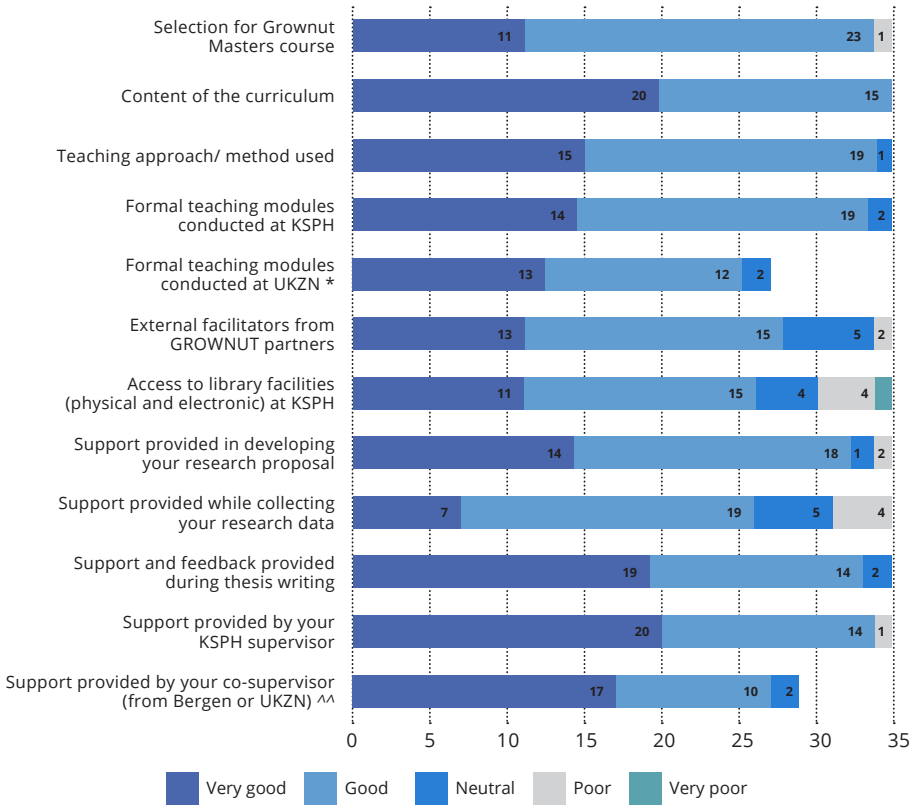
Students n=12	
Age (median)	39 (IQR=11.5)
Gender	
Male	8
Female	4
Occupation	
Physician / medical doctor	9
Academic assistant	3
Level of academic of study	
PhD / Doctoral degree	3
Master's Degree	9
Partner university who co-supervised the degree	
UKZN	5
University of Bergen	6
No co-supervisor	1
Attended training at partner universities	
Attended training at UKZN	9
Attended training at UIB	3
Facilitators, supervisors, stakeholders n=19	
Age (median)	54 (IQR 12)
Gender	
Male	9
Female	10
Role in the project	
Stakeholder (includes managers at KSPH/UIB/ UKZN and at Norad, and community leader from Rural site)	9
Facilitator/supervisor on the GROWNUT programme	10
Current position	
Professor/academic staff	14
Project manager	2
Director of nutrition (PRONANUT)	1
Community leader rural research site	1
Institution in which based	
University of Kinshasa	11
University of KwaZulu-Natal	3
University of Bergen	4

RESULTS FROM QUANTITATIVE STUDY

Experiences of the Nutritional Epidemiology programme from the Master's students perspectives.

Selection, pedagogy and support for students

Selection, teaching and support for students registered on the master's Programme in Nutrition Epidemiology was evaluated through Likert scale rating. Most students were positive about the programme which they rated as either good, or very good (Figure 8). There were, however, a few aspects that were given a poor or very poor rating by a small minority of the students and these were: the selection process for admission to the programme; library access at KSPH; and external facilitators from GROWNUT partners. A small number of students also gave a poor or very poor rating to research related activities such as support provided in developing their research proposal, support provided while collecting research data and support provided by the KSPH supervisor (Figure 8).



* *8 Students did not receive any teaching at UKZN;*
^^ *6 Students did not have a co-supervisor from Bergen or UKZN.*

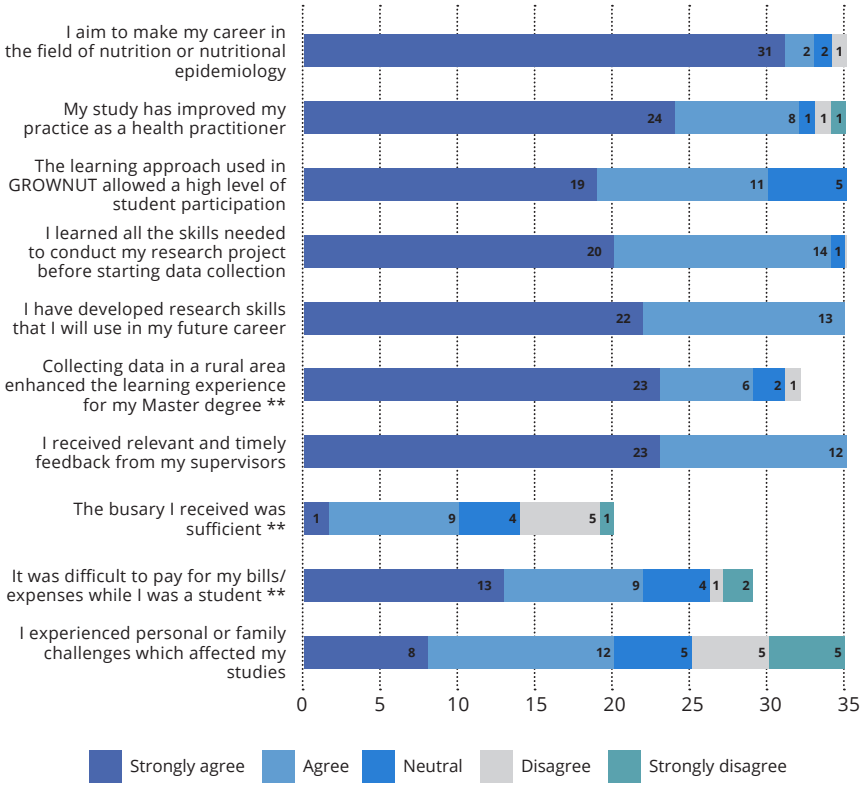
FIGURE 8: MASTER'S STUDENTS RATING OF CURRICULUM, PEDAGOGY AND RESEARCH ACTIVITIES

Master's student impressions and perceptions of the programme

How students participating in the masters programme personally perceived the programme was explored through statements with which students could ascribe their level of agreement or disagreement as seen in Figure 9.

Twenty two of the 35 students indicated they had encountered difficulties paying their bills or expenses while they were a student. Among 20 students who had received a bursary only 10 felt the bursary was sufficient for their needs. Most students (20/35) experienced personal challenges during their two years of study.

Collecting data in the rural research site was described as contributing towards a positive learning experience by most students (29/35). While all 35 students reported they had developed research skills that would benefit their future, and that feedback from supervisors provided timely feedback (35/35).

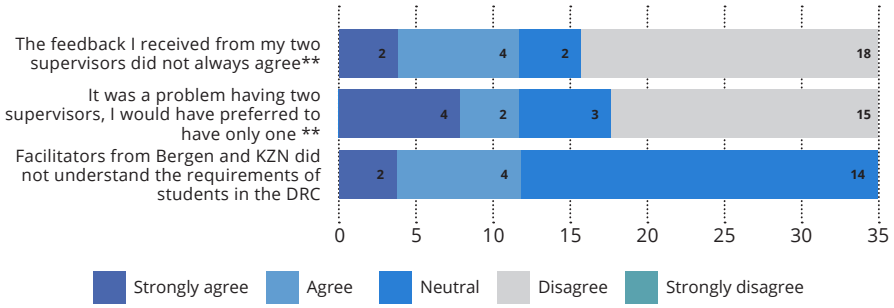


** *data were reported as not applicable*

FIGURE 9: STUDENTS EXPERIENCES OF THE PROGRAMME EXPRESSED AS AGREEMENT OR DISAGREEMENT WITH STATEMENTS

Master's students experiences of research supervision from collaborating partners

Multi-site supervision involving collaborating partners as co-supervisors for the research component was well received by students who rated external facilitators very good (13/35); good (15/35): neutral (5/35) and poor (2/35), this was similar to the responses in the open-ended questions. Some students reported problems relating to two supervisors when the feedback they received did not always agree and they would have preferred to only have one supervisor. A few students felt the facilitators from Bergen and KZN did not understand the requirements of the students in the DRC (Figure 10).

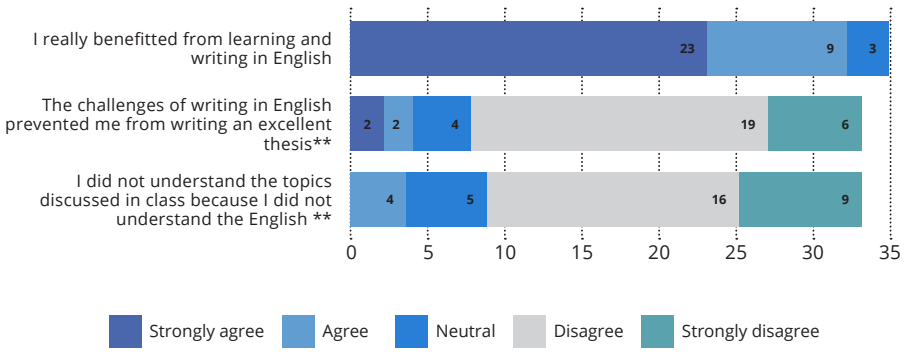


** *data were reported as not applicable*

FIGURE 10: STUDENTS EXPERIENCES WITH MULTI-SITE SUPERVISION.

Student experiences of using English for teaching and learning

While the use of English for teaching and learning in the master's programme was valued by most master's students, there were a few students who reported that the use of English was challenging. This was shown both in the Likert scale data (Figure 11) as well as using open-ended questions. (Table 15)



** *data were reported as not applicable*

FIGURE 11: STUDENT EXPERIENCES OF USING ENGLISH FOR TEACHING AND LEARNING

Master's students overall best and worst experiences.

Master's students were asked in open-ended questions to describe the best and worst aspects of the nutritional epidemiology master's programme. The main themes which emerged from the open-ended questions were in relation to the curriculum, teaching methods, the use of English in the programme, bursaries, the internship in Popokabaka (rural research site), research experiences.

TABLE 14: STUDENTS PERCEPTIONS OF THE BEST AND WORST ASPECTS OF THE MASTER'S PROGRAMME IN NUTRITIONAL EPIDEMIOLOGY (OPEN QUESTIONS).

What were the BEST things about the master's Programme	What were the WORST things about the master's programme	Students recommendations
Curriculum		
The content of the theoretical courses (GN10) *Epidemiology and Statistics courses were much more advanced, compared to other Master options (GN16)* *Bio statistics and epidemiology (GN23)* *Learning data entry and analysis software (GN24)* *Course contents were well designed. (GN33)* *Richness of the subject matter (GN34)*	*The qualitative research course was botched (GN11)* *Qualitative research module was not well provided (GN17)*	*To add a behavioural communication module into the program, this will help prevent malnutrition at the community level (GN07)* *Deepen the qualitative research course (GN11)* *A health communication course would be of great importance for the contact between the community and the researchers (GN13)* *If we can add the courses in follow-up evaluation, project management and scientific communication (GN23)* *Introduce a communication course in the programme and the development of emergency projects (GN24)*
Teaching methods		
Interactive teaching and to do homework in groups (GN04) *Facilitation of courses by teachers from the universities of Bergen and KZN (GN05)* *Benefit from teaching with rigorous foreign teachers in their supervision. (GN09)* *Communication with certain facilitators from different universities (GN11)* *Experiences of the different local and expatriate professors / facilitators (GN12)* *Being taught by professors from other countries university (GN15)* *Knowledge sharing from Bergen /UKZN/DRC facilitators (GN22)* *Professors from "3 reality of the world" (DRC, South Africa and Bergen /Norway). (GN27)*	*Concentration of [too many] courses in one year. (GN33)* *Studied for 2 years but transcripts are only for one-year Master (GN16)*	*Reduce the training period to 18 months (GN05)* *To create openings within the framework of GROWNUT to continue my doctoral studies in epidemiology (GN08)* *Increase the number of hours of field practice during the 1st year of internship (GN11)* *There are modules that can be given in a conference setting (GN14)* *Respect the time set for training (length of training). Training takes 27 months or more instead of 24 as planned (GN18)* *Recommend that theoretical courses are given in 2 years instead of doing it in one year (GN31)*

The use of English during the programme		
Learning courses and writing a thesis in English (GN03) *The fact of writing my thesis in English (GN09)* *English. I have learnt new technical vocabulary, new words and new expressions (GN16)* *Learning the lessons of the second block which was done entirely in English (GN17)* *Different courses seen in practice and improved my English. (GN21)* *Learning an important part of our study in English (GN26)* *The course of high standards in English (GN27)* *I gave myself a discipline to have extra classes in English. (GN 35)*	*Requirement to write, to be evaluated, to receive such relevant lessons and a thesis in a language that I do not master [English] (GN06)* *Poor English language skills have delayed some things (GN24)*	*Introduce … the English course 6 months before the start of the courses for capacity building (GN24)*
Bursaries		
Obtaining the scholarship, taking charge of my delivery, the payment of the child's nanny. (GN13) *Obtaining my scholarship (GN15)* *Opportunity to get a scholarship. (GN20)*	*Difficult to pay my bills while I was studying (GN20)* *The criteria set up to give the bursary for the PHD degree (GN27)* *Not to have benefited from the scholarship (GN30)* *Difficulties to pay academic fees for both years, without scholarship (GN35)*	*Fair bursary distribution is required (GN04)* *Increase the number of scholarships (GN05)* *provide life insurance / health insurance (GN11)* *Provide pocket money for scholarship learners (GN18)* *include in the bursary [selection] people who are not [resident] in the capital (GN29)* *Feed external students, even with a meal, to increase their attention [span] during lessons (GN33)*
The internship in Popokabaka		
Internship in Popokabaka. (GN01) *Participate in internship in Popokabaka. (GN04)* *Field work (training) in rural environment (GN07)* *Internship spent at Popokabaka, which allowed the learners to contextualize the theoretical lessons in the field. (GN08)* *New experience working in the bush (on the field) (GN15)* *The internship of Popokabaka (GN17)* *Practical course carried out in Popokabaka which refined all the theory learned for 2 years. (GN30)*	*Lack of internship in organizations working on nutrition and food security like UNICEF, Word Food Program, FAO (GN01)* *No internship in research organizations or units specializing in nutrition. (GN10)* *The living conditions at Popokabaka were poor (GN11)* *Trip to Popokababka: a very bad road (GN12)* *The indifference of the administrative team faced with the difficulty encountered especially during internships (GN26)* *After the Popokabaka internship, I had the impression that the department had abandoned us [no communication on the rest of our programme] (GN17)*	*Improve: accessibility to Popokabaka, accommodation and catering conditions (GN05)* *To include internships in organizations interested in nutrition such as WFP, UNICEF, FAO, etc., to enable learners to become familiar with different types of studies and approaches used by these organizations (GN09)* *Diversify internship sites on the last year of internship (GN11)* *I would like learners be trained in rural area and in united nations agencies (those working in nutritional fields) for increasing [the] chance for job[s] (GN19)* *If GROWNUT could contact some partners like WFP, FAO, etc, for some internship time.*

Research experiences		
The workshop on research methodology (GN01) *Mastering scientific research of nutritional problems, and data analysis software. (GN02)* *The [research] workshop in KwaZulu-Natal (GN17)* *Improving my research skills (GN18)* *Competence in research (GN19)* *Learning of research methods (GN23)* *Orientation towards to the research (GN27)* *Acquired the knowledge necessary to conduct research with ease (GN28)* *Improve my knowledge and skills in research (GN29)*	*Having two supervisors was a real challenge to face. (GN03)* *His [supervisor's] support did not live up to my expectations. (GN05)* *Lack of understanding with my Bergen thesis supervisor (GN13)*	*Increase the practical work on research and data analysis with all software (Stata) (GN24)*

FIGURE 10: MAPATANO AND MARIE-CLAIRE

RESULTS FROM QUALITATIVE STUDY

Development of the GROWNUT programme

The main purpose of the GROWNUT programme was to establish of a 2-year master's and 3-year PhD programme in nutritional epidemiology for students in the DRC. Stakeholders, facilitators, supervisors and students discussed the programme during the in-depth interviews.

Several stakeholders mentioned that at the core of the development of the Nutritional epidemiology programme was the aim of improving nutrition and health in the DRC by developing a new cadre of African scholars with research skills to undertake relevant research in nutrition. The well-being of communities was always a priority during the planning process *'the level of malnutrition in the DRC is that high, so we wanted ourselves to build that capacity'* (facilitator 8 Kinshasa). The aim was that robust research would generate evidence-based nutrition policies in the country.

In line with the DRC being central to the nutritional epidemiology programme, participants from the DRC participated actively in all aspects of the development of the programme. DRC stakeholders and facilitators spoke about the value of the programme as a whole.

> *First of all, it brought a new discipline. We did not have nutritional Epidemiology before. So, this (GROWNUT) programme has introduced it. Secondly, what I found is it has built up not only the capacity of training students in Nutritional Epidemiology but also training them in research methods. So, I think that has been a good contribution of the programme to the School (KSPH). (Facilitator 3 Kinshasa)*

Participants from all partner institutions collaborated in the design of the curriculum and the content of the modules for the nutritional epidemiology master's course. Individual participants highlighted their own contributions towards the development of the curriculum, and which modules should be emphasized. For some participants, research was the main focus, while others felt it should be nutrition and epidemiology. This led to a robust debate about how best to structure the modules and what were the key topics to include.

> *We wanted to focus on epidemiology and analysis, we decided by statistics and biology should be second, but then from the Norway side they are very keen to see that the gender is approached and we had a course in climate change. We added those things like climate change, gender issues, but the focus was really on research, conducting research in statistics and biology, we wanted people to do research, collect data, then analyse data and publish data, most courses were important and are still very important for us. (Facilitator 8 Kinshasa)*

> *Well uh, one element was that my colleague was that he was very, the focus was nutrition and that was one of his focuses but he also wanted it to be a focus on epidemiology so that is why it is a Master in Nutritional Epidemiology, not only in nutrition. So, he wanted advanced courses in epidemiology and uh, that was, it was justified in a way that, all the other students at the school are doing epidemiology. (Facilitator 9 Kinshasa)*

The GROWNUT programme was the first postgraduate training in nutritional epidemiology in DRC. The programme included both theory and practical components, including a residential internship at a rural research site. Participants thought highly of the programme

with a number mentioning it was better than other master's programmes offered at the KSPH and was either equal or better than master's programmes at other universities.

> *It does align with most of the universities. For this school, it has been a change, you know to emphasise research in nutrition. I think it has impacted on other programmes as well in the school … I find it is aligned and sometimes I find, when I discuss with others, they say ok you know we are not required to write master's thesis. You can just do a practical, something like that. But here (in GROWNUT) we want them to have both a practical and to write a thesis. So, it puts them at, I think, a little bit higher. That is my opinion. (Facilitator 3 Kinshasa)*

The nutritional epidemiology master's programme was offered over a period of two years where other KSPH master's programmes were one-year programmes. While stakeholders and facilitators understood the rationale for extending the programme to two years, not everyone thought it was beneficial. Students' experiences of the two-year course was also mixed with some students very positive about it and other students challenged. Recommendations about the reconfiguring the structure of the course for the two years was made by one student.

> *There might be changes in the length of the programme. I think that is because students pay quite a high fee for attending the courses at School of Public Health and the Nutrition Programme is the only one which is set through to a two-year programme. So, there might be some, and that might not be a very bad idea to reduce it by for example 6 months, so that the student's fees also go down. I would say, if I should say something in general about the structure of the master's Programme, the first year is very efficient where there are many courses. The second year is very efficient with internship and field work, and then the student goes out ... into the big black books where they can disappear from June, when they should start writing until they deliver the thesis which ideally should have been in October but we have seen it is very often in January or February. They do not need that much time for writing up the thesis. So, I think that period should be shorten down quite dramatically to make it more efficient with a much closer follow-up by the supervisors. (Facilitator 2 Bergen)*

> *It is a well-designed programme but it is crammed up because it packed many courses and delivers them in a short space of time. You start on Monday and end on Saturday and the following start again on Monday and end on Saturday, repeatedly. It would have been better to spread the courses over a period of two years where only a few courses are taken in the second year together with the practical, instead of having all the course work in one year and the second year dedicated to the practical only. (Student 8)*

Functioning of the GROWNUT partnership

A strong partnership was built between collaborating partners based on a common vision for the project, ongoing communication and trust. However, at times it was difficult bringing together partners from institutions with different cultures, different requirements and expectations but the common vision kept the partners together so they were able to address challenges. Communication was important and was maintained throughout the project *'Although we are in three different cities, we talk regularly, we have regular skype meetings and our Bergen colleagues are very good at writing down the action points, following up on the action points, making sure things get done'* (Facilitator 7, UKZN)

The collaborating partners were seen as bringing additional skills and experience to the programme, thus improving the learning opportunities for the staff and students at KSPH, with activities particularly aimed at providing capacity for KSPH academic staff to improve sustainability of the programme.

> *It (the partnership) contributed in strengthening the capacity of the staff (at KSPH). At the beginning, we worked in collaboration with professors from KwaZulu-Natal and Bergen, who came here and assisted us with resources. It contributed to the training of our professors. It has contributed to the training of two PhDs and continues currently to train other PhDs. There were also exchange programmes where students here went to KwaZulu-Natal and Bergen. There were other professors here in the School who taught in the programme that means that the project did not operate in isolation. It was a School project and the School was involved in it. It also built the capacity of the financial manager. I think they provided him with new financial management software and he had learnt how to use them. (Facilitator 5 Kinshasa)*

It was important for all partners to participate equally and have equal opportunities, and it was important that benefits accrued to all three institutions. At times this was challenging as the collaborating partners from UKZN and UiB were sometimes perceived as dominant or taking more of a leadership role. However, balance was maintained by collaboration and joint planning, and the structure of the project, where the University of Kinshasa was responsible for awarding degrees and where the research agenda was largely determined at the rural research site by the KSPH team, kept a balance in the overall running of the project.

> *I think it has been an advantage, that it has been a degree given at the University of Kinshasa. It has been a bit more difficult for the external supervisors to understand the system at the University of Kinshasa (Facilitator 2 Bergen)*

Teaching and learning in the GROWNUT programme

As teaching and learning was fundamental to the programme, it was important to explore experiences of teaching and learning from the perspectives of both the facilitators, supervisors and students.

In general, all participants enjoyed the experience of being involved in the GROWNUT project. Most of the participants mentioned that the experience was 'good', 'great', 'interesting', 'positive', and 'enriching' despite the challenges that were encountered during the running of the project. The project allowed opportunity for exchange in knowledge and skills between the three institutions.

> *I can say that it was very good to exchange and share knowledge. It allowed us, for example today when the name University of KwaZulu-Natal is mentioned, it speaks to us because we have already had an opportunity of sharing with that university, because it had allowed our learners through the GROWNUT programme to learn a lot. As such, it was a very good experience. (Facilitator 5 Kinshasa)*

The teaching methodology was based on adult learning principles providing an authentic learning experience for students, and engaging students in real-world problems that they could expect when working in communities. This was well received by students who found it engaging and interactive. Students had access to information at all times which they appreciated.

> *For me I think it is, yes, especially the teaching methodology. This one allowed us to go do our own research and you know in doing so we learned more about the course. Our supervisors were guiding us according to our study findings. We honestly had access to information anytime that we needed it…. Regarding the teaching method, as I said earlier, it is a good method because it pushed us to go to the field ourselves and go extra miles, then supervisors come to guide us and add more to our findings. Actually, this is a perfect teaching methodology for adults. Now regarding the training, it allowed me to get access to the community in specific ways according to what I have learned. Before, I used to go in the community for fieldwork but not in a proper way. After attending this programme, I understood that there are specific ways to gain the population's attention during fieldwork academically; I now know how to get efficient and effective solutions…. Um, yes, it was interesting because the interaction was both ways. Yeah, it was interesting. The lecturer would give the student a chance to explain what they have understood during the lecture then he/she would give clarity or add on what the student had said. The interactions/communication were excellent…. the lecturer allowed us to learn and he later came to add what he thinks that you have left out or correct what we did not understand (Student 10).*

> *The andragogical method was a good method because it allowed for exchange and interaction between the professors and the students. If this was also used for the field work it could have enriched further our GROWNUT experience. Overall it was a good method because there were professors who were teaching while allowing an interaction. If this interaction continues it would be beneficial especially for the field work where we it would have been great to have the professor with us. (Student 6)*

A number of facilitators and supervisors from all three collaborating universities provided teaching on the nutritional epidemiology programme. Class size was small which helped create ideal conditions in which the chosen approach could be implemented.

The number of learners was not that big because there were between ten and twenty for the two years I had taught in the programme. I found that that small number created good conditions for teaching and learning and also to put into practice the teaching content that we were providing. (Facilitator 5 Kinshasa)

Initially teaching was planned so all collaborating partners could participate and when partners visited the DRC, KSPH staff should have co-facilitated with the aim of transferring skills to the KSPH staff who would then continue after completion of GROWNUT. However, there were times when the local facilitators failed to work together with those from collaborating institutions leaving them to teach alone. In some cases, this was because KSPH facilitators lacked English skills to participate in the teaching.

It is true that when the programme started it was understood that the external professors will come to provide some form of coaching, bring his/her international expertise to Kinshasa and ensure that when he goes back Kinshasa will carry on with teaching and learning using the new methodology. I would say that it is what was done because during the first year of the programme each course facilitated had two professors, one from here and one from outside…It was the local facilitators, inspired by the experience of the first year, which had to replicate the teaching and learning approach of the first cohort (Facilitator 4, Kinshasa).

After the second year of the project travel to the DRC was restricted due to violence and political unrest in the country, and DRC facilitators had to continue teaching without support from collaborating facilitators. To relieve some of the teaching burden and to give students the opportunrity to interact with facilitators and their co-supervisors from partner universities, the third and fourth cohort of students undertook their two-week proposal development module in South Africa which was well received.

That has saved us on a number of uh occasions where we were not able to travel to Congo, we could stay with them in Durban. There was no problem for the Congolese to get the visa to travel and we could work. So, definitely it has had also positive aspects. (Facilitator 9 Bergen)

Research and supervision experiences

Research was a fundamental element of the GROWNUT programme and all facilitators, supervisors and students had an opinion about the research component of the programme. Research and research supervision capacity building for all collaborating partners was provided through the GROWNUT programme.

We were building our capacity in teaching and supervision, we attended 2-3 workshops, one in Bergen, two in Durban. For us it was to see how other colleagues from your institution were doing supervision, then it was not just learning from the workshop, but also doing, doing it, practicing together supervision. (Facilitator 8 Kinshasa)

Most students had two research supervisors, a lead supervisor from the DRC and a co-supervisor from a collaborating partner (UKZN or UIB). Students had particular expectations of their supervisors and most often were appreciative of the different skills which co-supervisors provided. However, in some cases, the co-supervisor made it more difficult for the student, especially if the co-supervisor was unable to respond immediately to the student or the feedback contradicted the feedback from the local supervisor.

> *My experience with my main supervisor is, as I said, is just guiding you through your work. He pushed you to work harder. For example, my supervisor always says, 'don't bring half baked work to me because you are looking for something easy, do things correctly' … With the co-supervisor there was a slight challenge regarding the internet connection. Sometimes you send your proposal and had to wait for a month before getting feedback and during that period you have to wait. (Student 6)*

There were challenges, expressed by many students and staff, about the communication between the supervisors, where supervisors were frustrated at times that their feedback was ignored, whereas students reported lack of communication between supervisors led to contradictory comments from the two supervisors. It was difficult to develop good relationships between co-supervisors who had often never met and where communication channels were challenging.

> *So, for instance, when a student was drafting his thesis he or she would submit first to us and then share the feedback with other colleagues from UKZN or Bergen, so but most of the time the main decision was coming from our side, that we accept or do not accept…Sometimes a supervisor from our side will go ahead and not take into account or not wait for the feedback from colleagues from elsewhere, that was frustrating for our colleagues (Facilitator 8, Kinshasa).*

Despite the many challenges experienced by both students and supervisors, the quality of the research was considered by some participants as good because of the collaboration between the partners.

> *In terms of the quality of the research projects that I supervised, the quality was higher than those of the other programmes. Perhaps the advantage of GROWNUT was that supervision was not conducted only locally but internationally. This brought about a level of rigour from both local and international (supervisors) pushing students to be more committed and less lazy than those in the other programmes. The two projects that I supervised were good enough to be published and [name] is writing an article to be published soon. The others did not publish but could have done so. (Facilitator 4 Kinshasa)*

Use of English as a medium of instruction and supervision

One of the biggest problems with research supervision and teaching was the use of English. Although many students and facilitators acknowledged the extremely beneficial value of learning in English, challenges were experienced by facilitators, supervisors and students alike.
This was particularly mentioned when describing using English in relation to research.

> *It is really a challenge especially for us researchers. You can write an article in English, not exactly, but in 'Frenglish', ask someone to proofread for you, have it published and get to be known in the world. But when you will be invited to conferences for that article I would prefer not to go because expressing yourself in English will be a challenge. People say that my English is good but I myself do not accept that I speak it well. It is really a challenge. GROWNUT was good because it helps us to break some of those barriers, because we had to jump in the pool. (Facilitator 4 Kinshasa)*

Collaborating partners were aware of the challenges faced by students in the GROWNUT programme and could empathise with them.

In Kinshasa they faced a lot of challenges, those students, they in particular they were asked to write in English and to learn in English which was like their fourth language, many students struggled with that, making it quite difficult (to know) whether the poor quality of some of the students work was related to poor understanding, maybe poor teaching, or whether it was simply that the language barrier was too great and people were not able to get over that. (Facilitator 7 UKZN)

However, students worked hard at mastering the language through hard work and perseverance. At the end of the programme most students appreciated being pushed to learn in English.

English as a medium language, I have two problems, the first one is the skills to know English, to think in English, after being exposed to English I cannot say that my English is well, but I can today speak and understand. I cannot read the paper in English without any translation, (but) I can be in the GROWNUT program. I now have skills to write something in English, I am not perfect but I know that in my introduction I am able to write the statement of the problem, before it was just in French, now I can do the research in English. Sometimes I need someone to read and write, read it in English, understand what is written in the program in English, in my experiences I think we just say thank you to GROWNUT, it helped me. (Student 2)

Both facilitators and stakeholders agreed that it was beneficial for students to learn in English.

Another very good experience was the use of English as a medium of teaching and learning because the greater body of the scientific literature is written in English. As such, obliging learners to use English as a medium of teaching and learning was a very good experience because it allows them to broaden their scope to consult various sources on nutritional issues. (Facilitator 5 Kinshasa)

There are benefits because more and more people are bilingual. Almost in all organisations and companies, more and more English speakers are required. It is then advantageous for students because if they find a job in those organisations they will be able to cope. Secondly, in the research community it is critical to know English because a major body of the literature is written in English. We do have challenges when we ask students to seek academic articles and they struggle to read and understand good articles published in English. English is then an important asset also because if they succeed to go to international conferences the main language used is English. (Stakeholder 5)

However, there were some major concerns expressed that for some students learning in English was a barrier to active participation and to achieving their maximum potential. It was also challenging for supervisors who sometimes complained that they spent their time as editors and were unable to tell whether the quality of the work was poor or whether it was just that English skills were poor.

… sometimes English becomes a challenge to understand and if one do not know how to ask for an explanation, the professor will assume that everything is clear and will continue. Sometimes you are present but miss some points. (Student 6)

Internship in Popokabaka

The use of a rural site for practical training and research was an important aspect of the teaching methodology employed in the project. Many of the stakeholders and facilitators/ supervisors agreed that a rural site was important for the learning process. It was important for students to have experience of working in a rural community.

> *And Popokabaka is much more similar to most of the country, compared to Kinshasa which is not. So, it was absolutely crucial for the programme to get any understanding from the students on what does it mean to have a malnutrition problem in a countryside (Facilitator 9_Norway).*

However, there were different views on the use of Popokabaka as the rural site for training. Some of the participants liked the idea of Popokabaka as a rural site but mentioned logistical issues about getting to the site. Other participants mentioned that the use of Popokabaka posed a challenge of sustainability when external funding is over.

> *To be honest, I did not like it. I did not appreciate it because even with regard to GROWNUT it will pose a sustainability problem. Because when we were travelling to Popokabaka it was GROWNUT that paid for transport, for renting the house, and for everything. All that cost money. That means the School's Nutritional Epidemiology Programme that the school want to sustain runs the risk to not use the same site because someone has to carry the costs (Facilitator 4_Kinshasa).*

For students, most of them were happy about the experience of being in a rural site and appreciated the practical training,

> *It was positive in Popo because I was in the fieldwork with the supervisors who were training us on the field on how to conduct nutritional research. It was positive because data collection and analysis were done with him on the field under his supervision. So was data analysis. This a very good learning experience. (Student 8).*

The challenges experienced by students were in relation to the time spent in the rural site away from their families, and being in a remote rural environment. The site was many hours drive from Kinshasa so that students were unable to visit home during their internship.

> *You stay there for 4 months there no trip to come back no. So, they send you and you leave everybody your family, your house, and go there. That's too long for me because I remember when we were like free mouse, we were calling in Kinshasa to come and take us back like this. They said no, you have to complete your 4 months training. Yes, because it not like our usual environment (Student 1).*

Dissemination of research findings

The programme provided support for students and facilitators to attend conferences and present their research findings. These experiences were very much appreciated by students and staff, and provided opportunities for interacting with the wider community of researchers in nutrition, and establishing networks. In addition, several PhD students did publish their work in peer reviewed journals.

> *… we started presenting some of the findings of the research, we went to a conference in Addis Ababa which was extremely positive, we saw the students in a different light as they presented their findings (Facilitator 7 UKZN)*

There was also a feedback for the community and stakeholders at the Popokabaka rural research site. Research findings were presented to community members at a mini symposium in the local area, attended by community leaders and local NGOs. Work in Popokabaka provided the GROWNUT team the opportunity to benefit and support a local community.

> *I think that the programme impacted on the community. We first learned that our province of Kwango had one of the highest rates of malnutrition in the country. It was with the students' research that this claim was confirmed. Moreover, it was with their help that we learned the causes of malnutrition and I am convinced that the students explained to women that they met the causes of malnutrition and what can be done to overcome them.*

> *I would like to thank you for your interest in Popokabaka firstly and in me as an individual. I would like to simply state that we pin our hopes on this project of the School of Public Health because the question of malnutrition is a vital problem for us. As such, it is my hope and my wish together with that of the entire population of Popokabaka that one day, the challenges posed by the problem of malnutrition will be taken care of in our community. (Stakeholder 8)*

SUMMARY OF KEY PROJECT FINDINGS

The GROWNUT project objectives, namely to **create a nutritional epidemiology programme in the DRC, to support and strengthen KSPH faculty members, and to conduct robust relevant research in the research site** were successfully achieved on a number of different levels. In particular, GROWNUT benefitted students as individuals, KSPH as an organisation, international partners and strengthened research capacity and academic leadership in the DRC.

Key Findings from the GROWNUT evaluation

The evaluation of the GROWUT project demonstrated key areas of success and a number of challenges from the implementation of this six-year GROWNUT partnership in the DRC, South Africa and Norway.

A strong partnership was established between equal partners who shared a strong vision for the project: Collaborating partners were able to navigate the significant challenges experienced during the project by maintaining open communication and building a strong unified vision for the project. The aims of the project were strongly rooted in the goal of improving health and nutrition for the DRC population. There were benefits for all partners at all levels, opportunities were created and learning was enriched for all participants. However, sustainability remains a concern and the duration of the collaboration is short, given the ambitious aims of the partnership.

The curriculum and teaching methods were well received: Teaching methods employed an adult learning approach focusing more on the learning process, and including interactive participatory learning activities. Students reported that the curriculum was well presented and learning objectives were achieved. However, students and some stakeholders complained about the duration of the master's programme, which was 2-years as opposed to one year for other programmes at KSPH, and this may have led to hardships for some students. Supervision was undertaken by co-supervisors, with a lead supervisor from KSPH and a co-supervisor from an international partner institution. Students and supervisors both reported that communication between supervisors was inadequate and students sometimes received contradictory feedback from the two supervisors.

The rural research site added value to the learning experience: most stakeholders and participants strongly supported the deployment of students to a rural research site to undertake a residential internship. The experience of spending several months in a rural area, working with the community and gaining practical experience, enhanced the learning experience of students and clearly focussed the research agenda on local community needs. Embedding students in a rural research site for practical learning and research differed from other master's programmes at KSPH or UNIKIN. However, there were a number of challenges. Students are vulnerable in an unfamiliar environment and need extra support to establish themselves and benefit from the experience. Some students reported inadequate support during their internship which distracted from their rural experience. The distance to the rural research site prevented students from travelling home, which enhanced their isolation but also allowed them to experience rural life, which some students really appreciated.

English as a medium of instruction was successful but further support is required to overcome challenges: Most stakeholders and students strongly supported learning in English, believing that this would open doors and provide opportunities for students, academic staff and for the school of public health. Use of English allowed students and staff at KSPH to participate fully in this international collaboration, improved access to the research community, and the credibility of research outputs. English learning allowed meaningful participation of collaborating partners and supported the production of a cadre of highly skilled researchers. However, there were many challenges associated with teaching and learning in English, with some students being left behind and struggling to achieve the knowledge required. This led to a few students failing to achieve their academic potential, and some students being unable to write their thesis in English. There was limited participation in the programme at KSPH because non-English speaking staff members at KSPH were excluded.

FIGURE 11: CHILDREN IN POPOKABAKA

Financial challenges for students were a barrier to participation: Many students reported experiencing financial hardships while studying for their master's degree, which is not surprising in a low-income country such as DRC, even among doctors and nutritionists. As professionals, postgraduate students may have extensive financial and family responsibilities, making participation in post-graduate studies without financial support challenging. A number of applicants to the programme withdrew when they did not receive a bursary, and academic performance among many participants is likely to have been suffered because of the need to undertake paid work. Funders may be reluctant to provide bursaries for all students, and usually focus only on students designated as needy, to avoid creating reliance on external funding. However, the need to develop a critical mass of skilled qualified researchers should also be a factor in decision making about awarding bursaries in a setting where participants are unlikely to have other resources to draw on.

A wide range of research was undertaken but a coherent research agenda was lacking: Students undertook research covering many key nutrition challenges in the rural site, and in DRC as a whole. Feedback was given to key stakeholders and partners at the rural research site. However, the research agenda was fragmented and lacked an overall plan. Although some of the research was presented at international conferences, few of the studies were published. In particular, although a small number of master's students are working on manuscripts, no research has been published by master's students so far.

FIGURE 12: STUDENTS IN KINSHASA

Research has had a limited impact on policy development: Despite the involvement of PRONANUT in the planning and implementation of the GROWNUT project, there has not been clear co-ordination between the research required to inform policy and the research agenda of the GROWNUT students. Further, there has been a lack of clear channels of feedback from the research outputs to PRONANUT.

The legacy of the GROWNUT project

The legacy of the GROWNUT project is rooted in the forty students who graduated from the programme, many of whom are employed in key nutrition roles in the DRC and others who are championing nutrition in their everyday work environments. Two students graduated with PhDs with a further two who are nearing completion of their studies, these graduates will provide academic leadership in the field of research and nutrition. Through the GROWNUT project the DRC has benefitted from the significant strengthening of academic leadership in the nutrition field, and the capacity of these researchers to undertake robust, well-respected, context specific research. This has far reaching sustainable advantages not only in the academic environment but also has the potential to address the nutritional challenges in DRC.

KSPH has benefitted extensively in capacity building of staff, with four faculty staff members achieving postgraduate qualifications with support from GROWNUT, including two masters graduates and two PhD candidates, one of whom has graduated and a second will graduate in 2020. Academic staff at KSPH have had the opportunity to be involved GROWNUT activities, both internally within KSPH, as well as through travelling to partner universities, attending conferences, workshops, and annual meetings. Co-supervision of students' research has also provided academic staff with opportunities to interact with researchers from international partner universities. International partners have similarly benefitted with academic staff participating in research supervision, writing articles for publication, and attendance at annual meetings.

Physical resources and infrastructure were provided to support teaching and learning at KSPH, which will not only enhance the learning experience for the current students but will continue to benefit future students. Library facilities have been strengthened, and IT support and infrastructure has been provided to allow students and staff to access literature, participate in meetings, and communicate via emails and other online systems. As e-learning systems were being introduced at the KSPH, GROWNUT strengthened infrastructure required for students to benefit from e-learning. This included the refurbishing classrooms and providing a computer laboratory, desktop computers, video-conferencing ability with screens, cameras and projectors, and connectivity between meeting rooms and video-conferencing rooms. In addition, software for computer use was provided.

An important and unique aspect of the GROWNUT project was the establishment of the rural research site. In order to ensure students are safe and comfortable at the research site, infrastructure at the site was upgraded and resources were provided. These resources are now available to future students who will be undertaking their internship at the research site.

In addition, there are a number of important aspects that will remain in the DRC at the completion of this essential project.

- The core curriculum for a Masters and PhD in Nutritional Epidemiology has been developed and will remain long after the completion of the GROWNUT project. This curriculum can form the groundwork of an extension of the GROWNUT project or for the underpinning of other similar educational endeavours with extra modules being added as necessary.

- Nutritional Epidemiology as a field of study has been firmly established in the KSPH highlighting the vital role nutrition plays in the health and development of communities, focussing particularly on the nutritional challenges of the DRC.

- The foundation for a change to an e-learning platform for nutritional epidemiology and other important academic fields has been established and can be used to extend the nutritional epidemiology into a stand-alone course or separate modules for flexible study for future students.

- A rural research site has been identified and equipped for students undertaking internship. This site will be available for future students.

Recommendations

The GROWNUT partnership provides an evidence-based model for how a North-South-South partnership, based on good communication, trust and a common purpose, can successfully provide the core building blocks for academic teaching and learning. In this project we established a postgraduate training programme in nutritional epidemiology but this approach could be applied to a variety of educational endeavours. The partners in this project have gained extensive experience in the establishment of this academic programme and have built a strong relationships. In addition, infrastructure and resources are already in place for an extension of this project. We therefore recommend that the partnership between KSPH, CIH and CRH be used to build this project into highly acclaimed nutrition and research hub for training nutrition specialists able to undertake robust evidence-based research to inform policy.

Based on the investment GROWNUT has already provided for computers and on-line technologies for the KSPH, we recommend a conscious shift from face-to-face to more flexible training platforms, on-line learning methodologies and blended learning approaches. While the initial costs for setting-up on-line platforms may be high, this process has already started, and, once established, these platforms will provide a range of opportunities to support teaching and learning and promote engagement with the scientific community. In the longer term the use of a blended learning approach may free resources for other important areas of the programme. Developing such technology-based approaches that are supported by robust evidence of their quality and effectiveness is an important process to address, especially in times of conflict, pandemics and climate change disasters.

FIGURE 13: STUDENTS IN KINSHASA

Future projects such as the GROWNUT project must take cognisance of student financial constraints, even among those who received bursaries. Despite the arguments to limit bursaries in an attempt to prevent reliance on external funding, funders may need to weigh the need to develop a critical mass of highly skilled qualified researchers against a reluctance to provide bursaries for a high proportion of students. We recommend a larger number of bursaries in the initial stages of the programme to allow the programme to become well established, bursaries could then be reduced over time as the academic community becomes more able to sustain the process.

We support the use of English in teaching and learning for students in low-income countries because of the wide range of benefits but this decision is a complex one that should not be undertaken lightly. Using English requires considerable and ongoing support for both teachers and learners, to ensure that the educational programme is delivered by teachers who have strong enough language skills to provide interactive teaching in the classroom. Students need support with improving from competent English speakers to become skilled researchers able to speak and write in scientific English.

We feel that this programme produced significant benefits, and many of the challenges highlighted in this study could be mitigated. Investing in wide-ranging supports to develop English proficiency is essential to ensure that challenges do not outweigh the benefits.

Rural internship. The extremely poor roads to the rural research site prevented students from travelling home during their internship, which enhanced their isolation but also allowed them to experience rural life, which some students really appreciated. It is important when choosing a rural site to consider this balance and ensure that it is feasible for students to receive the required support from academic staff.

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