BACHELOR OF SCIENCE ENVIRONMENTAL HEALTH GRADUATES' ACADEMIC COMPETENCIES AND PUBLIC HEALTH WORK EXPECTATIONS IN KENYA: GRADUATE AND EMPLOYER PERSPECTIVES

BY

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DECLARATION

Declaration by Candidate

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DEDICATION

This work is dedicated to my family; husband Japheth Chebii Kipkulei and my children Kiptoo, Aengwo, Yatich and Jepkong'a for their love, patience and support. It is further dedicated to my parents; mother Rael Chemugun Keny and my late father Cornelius (Barnandi) Kipkorir arap Keny for their encouragement and support.

ABSTRACT

Background: Public Health workforce faces varied challenges ranging from personnel shortages to debates on relevance and adequacy of the training provided to graduates undertaking degree in Bachelor of Science in Environmental Health. There are also concerns of the mismatch between the academic training and the market demands which raises concerns on the preparedness of these graduates to handle public health activities and responsibilities.

Objectives: The objectives were to: assess how educational competencies relate to the graduates' current working role, evaluate employer assessment of graduate work skills and competency; establish the perception of graduates' preparedness to handle emerging public health challenges and explore professional development needs and available employer support options for public health graduates.

Methods: A cross-sectional, mixed methods employing concurrent triangulation methods was done at the Moi University, School of Public Health, Eldoret. The graduates of 1999 to 2015 were stratified by year of graduation and gender then randomly select to attain a sample of 227. For graduate employers, a total of 45 were purposely selected. Data was collected using a pretested semi-structured questionnaire and an interview guide for in-depth interviews. Data was analysed using SPSS® version 20 and NVivo® software. Quantitative data was summarized using proportions and median while inferential statistics was carried out using Mann Whitney U test, Kruskal Wallis and logistic regression. Statistical significance was considered for $p < 0.05$. Qualitative data was analysed thematically.

Results: Out of 227 graduates sampled, 188 responded and out of 45 employers sampled, 39 responded giving a response rate of 82.1% and 86.7% respectively. Among the 188 graduates, 79 (42%) were aged 25-34 years and 111 (59%) were male. Among the employers, 27 (69.2%) were males and 12 (30.8%) were females. Graduates were distributed among 12 public health career areas with the highest 33 (17.6%) being in the field of disaster management. Only 72 (38.3%) of the graduates reported competency challenges and 142 (75.5%) reported that their training formed the basis of their current jobs. However, 131(69.7%) graduates reported not to have acquired adequate skills to match their work performance with 39 (20.7%) self-rating poor and 64(34.0%) self-rating fair.

The overall graduate median competency score was 3 with employers rating graduates highly on timely task completion and teamwork. Majority of the graduates 123 (65.4%) perceived that they were prepared to handle emerging public health challenges and on Mann Whitney U test, those that felt that they were adequately prepared had a higher median competency score compared to those who did not (2.93vs2.79, Z=2.472, p=0.013 while binary logistic regression indicated that a unit increase in the competency score increases the likelihood of being prepared by 10.6% (OR; 95% CI: 1.106; 1.042-1.174, p=0.001).

Further qualitative findings showed that Community Based Education and Service (COBES) activities came in handy especially on communicable disease control while the scope on disaster management and preparedness was wanting.

Most of the employers 27 (69.2%) recommended the need for professional training to boost graduates' competencies at their place of work with 21 (53.8%) providing support in form of reducing workload and 11(28.2%) granting study leave.

Conclusion: The education competencies did not entirely conform to the graduates' practice and work expectations. Although the majority of the graduates perceived to be prepared to handle emerging public health challenges and concerns, there were an overwhelming proportion of graduates who lacked adequate skills to match work expectations. Most employers recommended further professional training for the graduates.

Recommendation: There is need to forge and strengthen collaborations between the training institutions and the practitioner organizations to tailor graduate training to industry requirements.

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LIST OF ABBREVIATIONS, ACRONYMS AND SYMBOLS

AMPATH	Academic Model Providing Access to Health Care
AASPH	American Association of Schools of Public Health
ASPHER	Association of Schools of Public Health in the European Regions
AMREF	African Medical Research Foundation
APHRC	African Population and Health Research Centre
B.Sc.	Bachelor of Science
B.Sc. EVH	Bachelor of Science in Environmental Health
BMC	BioMed Central
BQ	Bill of Quantities
CARTA	Consortium for Advanced Research Training in Africa
CBE	Competency Based Education
CHS	College of Health Sciences
COBES	Community Based Education and Service
CI	Confidence Interval
CPD	Continuous Professional Development
CPE	Continuous Professional Education
CBE	Competency Based Education
CUE	Commission for University Education
CLTS	Community Led Total Sanitation
D	The statistical significance set
Df	Degrees of freedom
Dr.	Doctor
EVH	Environmental Health
EIA	Environmental Impact assessment
GWSP	Global Water Security and Sanitation Partnership
IDI	In depth Interviews
IREC	Institutional Research and Ethics Committee
IME	Institute of Medical Education
IOM	Institute of Medicine
MTRH	Moi Teaching and Referral Hospital
MACH	Miner, Alperin, Cioffi and Hunt
MHM	Menstrual Hygiene Management

NGO	Non-Governmental Organization
NVIVO	Qualitative data analysis software
OR	Odds Ratio
P.I	Principal Investigator
PBL	Problem Based Learning
PHAST	Participatory Hygiene and Sanitation Transformation
PhD ME	Doctor of Philosophy in Medical Education
PDN	Public Health, Dentistry and Nursing
PHOTC	Public Health Officers and Technicians Council
SBCC	Social and Behaviour Change Communication
SOM	School of Medicine
SPSS	Statistical Package for Social Sciences
UN	United Nations
UNICEF	United Nations Children Fund
WFME	World Federation of Medical Education
WASH	Water, Sanitation and Hygiene
PAHO	Pan American Health Organization
SPICES	Student centered, Problem based learning, Integrated learning, Community based, Electives oriented and Systematic or Self-directed learning

OPERATIONAL DEFINITION OF TERMS

Educational outcomes – are desired learning objectives and educational results that schools and teachers want students to achieve

Competency - The unique set of applied knowledge, skills and other attributes grounded in theory and evidence for the broad practice of public health.

Core competencies for public health professionals - are set of skills desirable for the broad practice of public health

Competency based education - Framework for designing and implementing education that focuses on the desired performance characteristics of a health care professional

Preparedness - This is a state of readiness and it involves actions taken as precautionary measures in the face of potential disasters. These actions could be both physical preparation and trainings for emergency action

Professional Development - Encompasses all types of facilitated learning opportunities including credentials such as academic degrees to formal coursework, conferences and informal learning opportunities situated in a practice.

Practitioner organizations - The health and community based organizations involved in the actual delivery of public health practice, interventions and programs

Academic performance - The outcome of a teaching process in a measurable way demonstrated by what students can do when they have finished the course of study

Organizational performance - Comprises the actual output or results as measured against intended outputs.

Workforce competency - The labour pool in employment able to undertake assigned tasks functions

Instructional competency - Refers to the teachers' mastery of the subject field, teaching skills, classroom management and evaluation skills

Public Health - Is the science and art of preventing diseases, promoting human health through organized efforts of health education, health promotion and other strategies that create conditions within which populations can remain healthy.

Health - A state of complete physical, mental and social well-being and not merely the absence of disease and infirmity

Environmental Health - Refers to the theory and practice of assessing, correcting and preventing those factors in the environment that can potentially adversely affect the health of present and future generations.

Perception – The way something is regarded, understood or interpreted

Tier – Career stage of a public health professional

CHAPTER ONE

INTRODUCTION

1.0 Background

Environmental health is a rapidly evolving field and professionals working in this discipline have to deal with increasingly complex situations in their work stations. Today's public health challenges are much broader and diverse hence the need for well-trained public health practitioners who are well prepared to handle the challenges (Lichtveld and Cioffi, 2003), (Guvenen *et al.*, 2020) . These challenges range from demographic transition, natural disasters, and epidemics and ill-health that is worsened by poverty levels particularly in resource constrained countries (Grimm *et al.*, 2015). Globally, there are also emerging issues affecting public health due to an increased threat to health as a result of terrorism, public health emergencies and emerging and re-emerging infectious diseases (Fauci, 2005; Markenson *et al.*, 2005). In critical situations of public health emergency, specialized knowledge and effectiveness is required of the public health professionals though studies have showed that there are professionals that may lack the requisite skills despite being fully trained (Ogwueleka & Aniche, 2017; Walsh *et al.*, 2012). This has raised a heated debate across the globe on the quality of graduates being trained and released into the job market .A study by the Inter - university Council of East Africa revealed that more than 50% of the graduates are poorly prepared for the job market, with Kenyan graduates ranging highest at 67% (Knight, 2014). This raises the concerns of whether the training done in academic settings   relate to the demands of workforce competencies. This indeed is an aspect of quality assurance and competency training,

which is advocated for by the Kenyan Commission for University Education (CUE) established in 2012 under the Universities Act No 42 of 2012 (Act, 2012) as a successor to the Commission for Higher Education in Kenya (Odhiambo, 2011). This commission is mandated to regulate university education to ascertain quality education for national, regional and global competitiveness (Abagi *et al.*, 2005; Kinyajui, 2007, McCowan, 2018) The Kenyan CUE has endeavoured to tackle the quality crisis seen in Kenyan universities by undertaking reviews, crackdowns and other forms of quality audits. Despite all these measures, a host of questionable malpractices like academic cheating and corruption which affect the quality of the Kenya's rapidly expanding higher education sector and that of its graduates still exist (Munene, 2016; Odhiambo, 2011; Owuor, 2012).

The development of a fully competent public health workforce is a key component of the nation's public health policy and indeed the improvement of population health globally. The council on linkages between academic and public health practice developed public health competencies designed for the broad practice of public Health (Practice, 2010) (Appendix VIII). These competencies reflect the characteristics that staffs of public health organizations possess as they work to protect and promote public health. Indeed over 50% of state and local health departments and over 90% public health academic institutions use them (Harrison *et al.*, 2005). The competencies are organized into eight domains reflecting skill areas within public health and three tiers representing career stages of public health professionals (Britten *et al.*, 2014; Practice, 2010). Despite the development of these competencies, public Health workforce is still faced with varied challenges ranging from public workforce shortages to debates on their relevance, adequacy of their training and

preparedness to handle public health challenges (Lichtveld and Cioffi, 2003; Petrakova & Sadana, 2007) . There is therefore need for a transformation in health education so as to meet the varied challenges in public health. This need has indeed been acknowledged by a variety of health-related organizations notably the American Association of Schools of Public Health (AASPH) (Syed Muslim Abbas *et al.*, 2014), the Social and Behavior Change Communication (SBCC) programs in the Global South (Christofides *et al.*, 2013), The African Health Strategy 2007 – 2015 and the Institute of Medicine (IOM)(Hernandez *et al.*, 2003).

In fact, the IOM report of 2003 presents vast evidence on the current threats and weaknesses of public health infrastructure, in that the system that protect and promote the public health was already challenged by problems like health disparities, poverty, toxic environment as well un insured population (May, 2003). Additionally, the 2003 report of the committee on educating Public Health Professionals for the twenty –first century anticipated that developing broad undergraduate public health education would result in a cadre of trained individuals ready to enter the public health workforce in an effort towards alleviating the many public health challenges like health disparities, inaccessibility of health care services (Hernandez *et al.*, 2003). This was subsequently reinforced by the International Institute of Medical Education and the World Federation for Medical Education (IME & WFME) on global standards for quality improvement. These global standards prescribed radical changes and innovations that included Primary Health Care, community and rural components in the structure and process of medical education at all levels (Tackett *et al.*, 2015). This was followed closely by the training of public health

workforce at the bachelor's degree level not only to reduce the projected shortage of public health practitioners, but also to address the complexities of public health challenges. Even though Environmental Health training is done globally, not enough is known about how these Public Health practitioners are trained or whether the training they receive prepares them adequately for the market (Beaglehole & Dal Poz, 2003).

There has been integration of modern science into the public health curricula at the universities and other institutions of higher learning but despite this, fresh health challenges that threaten the health of the public still loom (Frenk *et al.*, 2010). Public Health occurrences such as disasters and disease outbreaks coupled with political changes clearly indicate that the challenges faced are not static, but can change considerably in a short time. This, therefore, calls for adequate training in competencies required for Environmental health practitioners so as to handle all possible scenarios in public health and research. Despite this lacuna, competency training framework has not been adequately developed to fit the African settings

 (B. Parker & Walters, 2008). Comparatively, the more developed countries have organizations regulating competencies for example the Pan American Association of Public Health (PAHO) (Britten *et al.*, 2014). Additionally, (Whittaker *et al.*, 2010) reported that the association of Schools of Public Health in the European regions (ASPHER) were in the process of initiating a public health competency framework by organizing brainstorming workshops on professional public health competencies. Curriculum development and training in Environmental Health education ought to form part of the public health competency framework that can be used to identify needs for Environmental Health capacity building worldwide in preparation for the new priorities and challenges

(J. Bell *et al.*, 2014; Czabanowska *et al.*, 2014), (Fineberg *et al.*, 1994). It is true that countries worldwide ranging from United States, United Kingdom, and Nigeria and indeed world over experience public health incidents that change considerably over a short time hence the need for public health practitioners to be ready and be equipped to meet the demands and challenges (Uzochukwu *et al.*, 2009). This notwithstanding, public health workforce research has focussed more on categorical issues like individual care rather than crosscutting issues like interfacing public health infrastructure with the health care delivery system to shift focus to population based care. Evidently, the need for competent work force infrastructure to compliment other public health structures for a better focus on public health challenges is paramount for the future of public health (Australia, 2010; Giloth, 2000). Subsequently, calls have been made to shift focus from individual to population based research, policy and community engagement (South & Phillips, 2014).

Similarly professional education and training needs to be transformed to meet the new priorities and challenges as they arise (Fineberg *et al.*, 1994). This is because, in an ideal situation the training and education of public health practitioners should address the requirements of the roles to be undertaken and one approach to this is to adopt a competency-based approach to education and training (Wright *et al.*, 2000). If industries and or employers are encouraged to continuously give feedback to academic institutions on graduate trainee's performance, a key aspect of targeted training would be institutionalized which could eventually revolutionize graduate outcomes (Ho, 2015; Tóth-Téglás *et al.*, 2016).

The matching of training skills to real life working experience is a challenge not limited to developed communities but also to the third world countries as evidenced by studies done in sub Saharan Africa notably by Western Cape University in South Africa with regard to public Health competencies which indicated dire need for broadening and deepening public health competency training (Beaglehole *et al.*, 2003; Meeus & Dovlo, 2009, Mukhwana, 2017) Several other studies and annual reviews on outcome based workforce development in public health have placed high hopes on a successful academic – industry partnership for the improvement of public health outcomes (Koo & Miner, 2010; Hoge, Paris*, et al.*, 2005). In studies by (Pearson *et al*, 2005), industries are encouraged to continuously give feedback to academic institutions on their assessment of graduate trainees. In a study done in Kenya, Uganda, Rwanda and Southern Sudan on availability of emergency obstetrics services revealed personnel related obstacles with competency in skills being the major one (Pearson & Shoo, 2005) (Luboga *et al.*, 2009), hence the need to upgrade the competencies and skills of healthcare workers.

Health disparities still persist despite evolutional development and the major advancement in medicine and public health (C. S. Jackson & Gracia, 2014). In an effort to address health care disparities, Mitchel Dennis and Shana Lassiter identified elements addressing healthcare disparities aimed at increasing diversity of health care workers with emphasis on balancing training to the work challenges and demands. This study determined that the proportion of public health professionals was quite small with only 7.36% being public health practitioners of the total workforce under study (Mitchell & Lassiter, 2006). Other studies done elsewhere (Beach *et al.*, 2005; C. L. Parker *et al.*, 2005) have settings not

feasible in the Kenyan situation for instance the study in Canada found that professional development and continuing education trainings done online equipped the public health professionals with core competency skills to address public health challenges (M. Bell & MacDougall, 2013). Whereas the findings of this study were quite encouraging and could provide solutions to the public health challenges being faced globally and particularly in the less developed countries, the settings and the methodology makes it not practical in various parts of the world more so in Africa therefore the gap still exists.

1.2 Statement of the Problem

The lack of congruence between what is taught and what is required could result in public health practitioners being ill-prepared for the demands of the real world public health practice. (S. M. Abbas *et al.*, 2014). It could also result in lack of confidence on public health practitioners from our institutions by the prospective employers despite the many years of training at the institutions of higher learning.

As the global university enrolment rates soars, graduates from Kenyan universities have increased from 25, 523 in 2012 to 49,020 in 2015 (Wiesmann *et al.*, 2014). This rapid increase is however not corresponding to their abilities to undertake work requirements. Recent reports indicates a growing rate of unemployment among university graduates yet employers are lamenting on their inability to get skilled workforce to hire (Tóth-Téglás *et al.*, 2016, Ponge, 2013) One of the factors singled out for graduate unemployment in Kenya is an increasing mismatch between education skills, practice and the domains of the job market (Nyerere, 2009; Altbach *et al.*, 2009). This raises serious concerns for the various academic institutions in their continued journey of training and generating graduates into

the labour market. It is well known that these institutions of higher learning use varying curricula as well as varying implementation strategies. Whereas the curriculum vary for the different academic institutions, what is less clear is whether what is taught matches the competency requirements for the real world work requirements (Whittaker *et al.*, 2010).

Evidently, public health has evolved over decades and workforce development has been evolving too. The Institute of Medicine report of 2000 records some success on building stronger public health workforce competency for the future, but a lot of work still remains (McDonald *et al.*, 2000). Evidently, workforce development has been a much needed discourse and indeed great changes have been reported though with greater emphasis being on strengthening the health systems (Frenk *et al.*, 2010). Even with this, there are frequent occurrences of public health challenges and concerns which have been recurrent despite health professional being continually trained and released to the labour market. This raises the question on the adequacy and preparedness of the public health professionals churned out of training institutions. Furthermore, the workforce faces a crisis in the face of changing training demands evidenced by mismatch in education skills, practices and the domains of job market as experienced by graduates of the existing training programs.(Jogerst *et al.*, 2015) There is therefore need to identify these training needs for public health professionals which will then be ploughed back into the curriculum to equip future graduates for better outcomes (Jacobs & Dougherty, 2006; Union, 2007; Wamai, 2009). Thus this study sought to assess the perceptions of B.Sc. Environmental health graduates' competencies in relation to public health work expectations in Kenya.

1.3 Justification of the study

There is a crucial need for a competent public health workforce that is responsive to the ever changing public health complexities (Conejero *et al.*, 2013) . A wide range of both general and topical competencies have been identified and applied to workforce development initiatives. The Institute of Medicine (IOM) report of 2003 calls for the development of additional competencies to set the standards for both undergraduate education in public health and continuing education for the public health workforce. (Hernandez *et al.*, 2003). Improvements in global health can only be realized through the development of a workforce that has been educated to promote health and to care for those with disease (Frenk *et al.*, 2010). In an ideal situation, the training and education of public health practitioners should address the requirements of the roles to be undertaken with particular attention to competency-based approach to education and training (Scharff *et al.*, 2008) thus a call for public health action (DeSalvo *et al.*, 2017)In the United States, there has been a call for transformation in public Health though, the full realization of this transformation into Competency Based Education (CBE) for potentially enhancing educational practices across the professions remains in the earliest stages of adoption and curricular integration (Finnegan Jr, 2011). In Africa, this far, it is very clear that public health transformation to ascertain whether what graduates learn measures to real life workforce demands and expectation is necessary for better outcomes. This calls for a resounding reform in health professions education, training, and professional development programs that are made in relation to curricula content, outcomes, and process review. In Kenya for instance, there are universities offering public health degree programs such as in B.Sc. Environmental Health which have been generating graduates to the labour market.

However, there is no documented information as to how these graduates perform their assigned duties in relation to their education competencies. In addition, previous researches on public health workforce have focused on categorical issues rather than cross cutting issues. Consequently, little research has been carried out on the infrastructural support on public health programs even when there are glaring functional system deficits of public Health. Institute of Medicine reports of 2003 for example reveals health professionals inadequately prepared to provide high quality care and recommends restructuring of public health training (Baker Jr *et al.*, 2005; Hernandez *et al.*, 2003) thus, this research built on infrastructure on public health workforce with intentions of strengthening and sustaining it for the health of future populations by assessing the perceptions of the B.Sc. Environmental Health graduates' education competencies, preparedness and professional development needs.

1.4 Purpose of the Study

The purpose of this study was to assess the perceptions of B.Sc. Environmental Health graduates' competencies, preparedness and professional development needs by the graduates and employers.

1.5 Objectives of the study

The objectives of this study were to assess the graduates' work competencies from their perspectives and those of their employers. These were;

i) To assess how the perceptions of B.Sc. Environmental Health graduates' education competencies relate to their current working roles.

ii) To evaluate employer assessment of B.Sc. Environmental Health graduates' work skills and competency

iii) To establish the perceptions of B.Sc. Environmental Health graduates' preparedness to handle emerging public health challenges

iv) To explore the professional development needs and available support options for a public health graduate.

1.6 Research Question

Do education competencies gained in formal academic training conform to graduates' current working role?

1.7 Scope and limitations of the study

The scope of the study assessed how formal academic training in Bachelor of Science in Environmental Health conformed to the graduates' current working roles. Responses from the study were dependent on the employer's assessment as well as self-assessment from selected graduates. The dependent variables involved the education outcomes/competencies and workforce performance/competencies. The individual attributes and curriculum processes including the curriculum content and the implementation strategy formed the independent variable. The competency of the graduates is a pointer to the success of the training as well as the curriculum processes. However, this could have been limited by self-assessment by graduates in that the graduates' responses could have been influenced by the graduates' emotional commitment to the institution and for having received their professional degrees.

On geographical coverage, the scope was wide by virtue of the distribution of the graduates and the organizations where they work in as evidence in Appendix IX and X.

1.8 Significance of the Study

This study assessed the graduates' roles and capabilities, while identifying the instructional competencies relevant to individuals' job responsibilities and levels of their ability. Consideration of both responsibilities and abilities is essential, as it provides educators with an understanding of how important different skills are to individual workers, as well as the capacity to perform them. This assessment process is beneficial in having the adult learners' voice their education process and more so graduates on their needs to educators or discover training needs that may have been unrecognized previously. The identified development needs will be made known to the educators for development, improvement and training programs. This will lead to curriculum review in the interest of the professional development needs. Furthermore, the findings of this study will be useful to public health practitioner institutions in designing their continuing professional development programs. This is envisioned the channeling of resources to domains that are either relevant to the needs of workers, or in which competence is not well established. It is hoped that the findings of this study shall be used by the institutions of higher learning as well as the Public Health Officers and Technicians Council (PHOTC) in designing policies and guidelines for training public health care providers to market needs.

1.9 Assumptions of the Study

The study was based on the following assumptions:

    i)   Employers gave an honest assessment of the graduates' performance on their

               functional roles at the organization level

    ii)   The graduates gave their honest feedback on the program

1.10 Philosophical Paradigm understanding for the study.

Research philosophy is the development of research assumption, its knowledge and nature (Žukauskas *et al.*, 2018). According to (Mertens, 2010) research philosophy is a system of the researchers' thought while paradigm of scientific research consist of ontology, epistemology and methodology which should be related to the philosophical position of the researcher and the analysed social science phenomenon. Scientific research paradigm help to define research philosophy. When scientific research philosophy is applied, it allows scientists to generate ideas into knowledge in the context of research which reflects the author's important assumptions.

In the field of research, several philosophical approaches are possible, but more extreme approaches can be delimiting and only intermediary philosophical approach allows the researcher to reconcile philosophy, methodology, and the research problem (Žukauskas *et al.*, 2018). Subsequently , according to (Creswell & Clark., 2017), the major philosophical approaches includes positivist, interpretivist, pragmatism and realistic research philosophy (J. W. Creswell & Clark, 2017)

1.10.1 The positivism research philosophy

Positivism is based on the idea that science is the only way to learn about the truth and positivists claims that the social world can be understood in an objective way. In this

research philosophy, the scientist is an objective analyst and, on the basis of it, dissociates himself from personal values and works independently. People who hold this view approach research with an already determined mind set (Schwartz *et al.*, 2004). In positivism data collection method involve large samples

1.10.2 Interpretivism (Interpretivist) research philosophy

Interpretivist research philosophy says that the social world can be interpreted in a subjective manner and the greatest attention here is given to understanding of the ways through which people experience the social world. Interpretivist research philosophy is based on the principle which states that the researcher performs a specific role in observing the social world (Leitch *et al.*, 2010) According to this research philosophy, the research is based and depends on what the researcher's interests are (K. Petersen & Gencel, 2013).

1.10.3 The Realistic research philosophy

Realism research philosophy relies on the idea of independence of reality from the human mind. This philosophy is based on the assumption of a scientific approach to the development of knowledge (Mingers, 2004)

1.10.4 The Pragmatism research philosophy

Pragmatist research philosophy deals with the facts. It claims that the choice of research philosophy is mostly determined by the research problem and the holders of this view claim that the choice of research philosophy is mostly determined by the research problem and that the practical results are considered important (Alghamdi & Li, 2013)

The present research adopted a pragmatic view. Holders of this view approach research with a research problem, then seek for a solution to it. In conducting research, this view allows for a mixed methods approach to benefit both quantitative and qualitative to enable the researcher secure an in depth answers to the problem (Cohen *et al.*, 2013).

In the spirit of pragmatism, using both quantitative and qualitative methods of data collection simultaneously was the best suited method for this study to explore the more complex aspects of the human and social world in terms of the workforce development, public health practice and its related work deficiencies, challenges and barriers.

1.11 Conclusion

This chapter has presented the background of the study, the statement of the problem, the objectives and the research question. It has also stated the justification of the study, the significance of the study and the assumptions that were considered for the study. These sections of the study were key concepts which introduced the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section reviewed literature on public health academic competencies in relation to real life public health demands and practice. Guided by the question on whether educational competencies used in formal academic setting correspond to workforce competencies. The key terms for review were education competencies, curriculum process, public health graduates, academic competencies, public health work force demands and public health practices. The literature review examined existing knowledge locally, regionally and internationally on aspects of academic competency vis a vis workforce competencies.

2.2 Domains of Public Health   Competencies

The public Health Core Competencies are a consensus set of skills for the broad practice of public health, developed by the council of linkages between Academia and public Health Practice (Practice, 2010; Sorensen & Bialek, 1991). The Core Competencies reflect foundational skills desirable for professionals engaging in the practice, education, and research of public health.(K. E. Stewart *et al.*, 2010) and are summarized into eight domain areas representing skill areas as follows;

Analytical/Assessment Skills. This focuses on identifying and understanding data, including information gathering and processing, legislative research, needs assessment, Participatory action research, political analysis, population forecasting and social indicator analysis (Hardina, 2002)

Policy Development/Program Planning Skills. This focuses on determining needed policies and programs; advocating for policies and programs; planning, implementing, and evaluating policies and programs; developing and implementing strategies for continuous quality improvement; and developing and implementing community health improvement plans and strategic plans (McKenney & Kiesecker, 2010). http://www.phf.org/resourcestools/Pages/Core_Public_Health_Competencies.aspx

Communication Skills. Communication Skills focus on assessing and addressing population literacy; soliciting and using community input; communicating data and information; facilitating communications; and communicating the roles of government, health care, and others (Kurtz *et al.*, 2017; Maguire & Pitceathly, 2002)

Cultural Competency Skills. Cultural Competency Skills focus on understanding and responding to diverse needs, assessing organizational cultural diversity and competence, assessing effects of policies and programs on different populations, and taking action to support a diverse public health workforce (Kamaka, 2001).

Community Dimensions of Practice Skills. Community Dimensions of Practice Skills focus on evaluating and developing linkages and relationships within the community, maintaining and advancing partnerships and community involvement, negotiating for use of community assets, defending public health policies and programs, and evaluating effectiveness and improving community engagement (Freedman *et al.*, 2009).

Public Health Sciences Skills. Public Health Sciences Skills focus on understanding the foundation and prominent events of public health, applying public sciences to practice,

critiquing and developing research, using evidence when developing policies and programs, and establishing academic partnerships (Koplan *et al.*, 2009).

Financial Planning and Management Skills. Financial Planning and Management Skills focus on engaging other government agencies that can address community health needs, leveraging public health and health care funding mechanisms, developing and defending budgets, motivating personnel, evaluating and improving program and organization performance, and establishing and using performance management systems to improve organization performance (Akin *et al.*, 1987).

Leadership and Systems Thinking Skills. Leadership and Systems thinking skills focus on incorporating ethical standards into the organization; creating opportunities for collaboration among public health, health care, and other organizations; mentoring personnel; adjusting practice to address changing needs and environment; ensuring continuous quality improvement; managing organizational change; and advocating for the role of governmental public health (Skaržauskienė, 2008).

2.3 Academic Competencies for Environmental Health Professionals

Academic competency is the multidimensional characteristic of a learner that is factored into the academic success and it includes the capability to apply and use a set of related knowledge skills and abilities required to successfully perform critical work functions (Levy *et al.*, 2015; Parry, 1996). Academic competency therefore is a topic of discussion because out of the individual graduate performance shall the graduate employers tell of their competency and stakeholders and individual graduates can recommend additional professional training needed.

Curriculum process is a cyclic process that encompasses the design and development of integrated plans for learning, implementation, the evaluation and the outcomes of the learning experience (Kelly, 2009).   The focus of this research was to understand the limits of academic competency and the relationship that exists between the academic competencies and the societal expectations of public health professionals. With this, it is anticipated that it will be possible to discern whether academic competencies translate to operational competencies (Barnett, 1994; Brett *et al.*, 2013). The study design builds on the model developed and used at Rollins School of Public Health in Atlanta Georgia.(Miner *et al.*, 2005). The literature has been reviewed with the goal of identifying gaps in structural competencies for the purposes of improving public health training programs.

Several studies done on academic competency vis a vis operational competency reveals mixed results. A study done on higher education levels by Reason and team revealed that only two thirds of the gains students make in knowledge and cognitive skill development occurs in the first two years of college life (Reason *et al.*, 2006). Aging academic workforce emphasizes on shaping the students competency by anticipating future needs of the prospective professional (Hugo & Morriss, 2010). In response to anticipating evolution and changes in competencies, certain researches have focused on model curricula to address specific needs (Botchwey *et al.*, 2009). Rychem and Salganik in their book on key competencies for successful and well-functioning society describes academic competency as a consequence of policy and politics that requires a multiple approach (Rychen & Salganik, 2003). Also, workforce diversity is dynamic and therefore requires changes in

academic competency just the same way that public health challenges are ever dynamic (Mujtaba, 2007)

Consequently, due to the ever changing public health complexities, redesigning professional education for the public health workers is necessary and timely so that the public health workforce is equipped about these issues and well trained to respond effectively. (Chauvin *et al.*, 2001). Since public health challenges are not static, they therefore demand for change in educational practices across the health professions to meet the ever changing public health challenges. In particular, environmental health practitioners need to develop new professional practices and update their competencies continuously in order to adapt to the new realities in the field (Karkee *et al.*, 2015). There are dire implications for lack of redesigning health education among the professionals such as lack of preparedness and response to epidemics, outbreaks, terrorism, emerging and re-emerging public health challenges (J. Stewart & Bourn, 2013). In fact, the marked improved life span in the 20th Century was due to the integration of modern science into the curricula of the University based schools for public health education which were coupled with the reforms that equipped health professional with vast knowledge on how to manage health conditions among the populations (Frenk *et al.*, 2010). The lacking aspect therefore is to ascertain that the integrated modern science and the reforms provide skills to the graduate that meet the demands of the existing labour market.

2.4 Curriculum Process for Environmental Health professionals

Curriculum development is a process that involves interaction among five components: assessment, planning, development, delivery, and evaluation (Miner *et al.*, 2005; Swales

et al., 2004). Literature further indicates that competency based instructions can be applied in an academic program through curriculum development to produce performance based learning outcomes (Iobst *et al.*, 2010; Litzelman & Cottingham, 2007). These have been supported by the findings of a research done on curriculum architecture to educate the 21st century, in which it is posited that curriculum is an ongoing process that requires repeating the steps of analyzing the alumni, industry needs, reviewing relevant professional standards and re-examining departmental goals (Chyung *et al.*, 2006). Indeed, to understand the public health graduates competencies and answer our research question, it was important to interview the B.Sc. Environmental Health alumni and their employers.

Reports on curriculum process have indicated that assessment is the first step in the curriculum process (McEvoy *et al.*, 2005), covering worker's roles, capabilities, identification of instructional competencies relevant to individual job responsibilities and individual levels of ability. Consideration of both responsibilities and abilities is essential as it provides educators with an understanding of how important different skills and their execution are to individual workers. In addition, systematic decision making is crucial in curriculum development process where the adult learners have a voice in the education process and they can use the process to directly communicate their needs to educators or discover training needs that may have been unrecognized previously (Finch & Crunkilton, 1999; Knowles, 1996). Many authors have coined the essence of meaningful interdisciplinary learning and found that learning is characterized by the integration of multidisciplinary knowledge across a central program them. Additionally, with focus and repeated exposure to interdisciplinary thought, learners develop more advanced

epistemological beliefs, enhance critical thinking ability and metacognitive skills, and an understanding of the relations among perspectives derived from different disciplines thereby enhancing the various learners' patterns of intellectual functioning (Holley, 2017; Ivanitskaya *et al.*, 2002). These studies points to the essence of the role of various disciplines and their critical roles played in emphasizing relationships and connections.

According to Blooms taxonomy (Huitt, 2004), information collected through the assessment process serves as the foundation for the planning stage of curriculum design. This process incorporates the needs assessment information into a plan for meeting the educational requirements of the workers. Essentially, a blueprint is created that outlines the learning objectives, topic areas, delivery mechanisms, and evaluation criteria for the training curriculum. Learners should be key participants in the process to ensure that the plan and the whole process of evaluation meets their educational needs (Huitt, 2004). The aspect of learners being key participants in curriculum development and through involvement, graduates will contribute on any additional professional development needs which are then ploughed back to the curriculum development process.

Curriculum delivery calls for collaborative and multidisciplinary teaching practices and requires an inclusive approach to education as well as pressure to review curriculum delivery for better outcomes (Gislason, 2009; Smith, 2002). As for curriculum evaluation, much impact depends on its audience and the purpose. Evaluation is essential for understanding the relevance, coherence and progression. This however seems to deviate from the findings of researches done by Barss and Gurpinar who found out that curriculum evaluation depended majorly on life style factors (Barss *et al.*, 2008; Gurpinar

et al., 2005). It also depend on the earlier curriculum planning, as confirmed by a study team lead by Merriam (Merriam *et al.*, 2012). Further research confirms that indeed curriculum process is a continuous process and that faculty instructors must use performance based methods to determine if students have attained   the requisite competence (Jungnickel *et al.*, 2009). This is without doubt in that after evaluation, any deficit in the knowledge is factored in for future planning and inclusion in the subsequent curriculum process (Jungnickel *et al.*, 2009)

2. 3   Environmental Health Workforce Development

Workforce   development   in   public   health   is   aimed   at   improving   health outcomes by enhancing the training, skills, and the performance of public health workers (Wright *et al.*, 2000). In economic perspectives, workforce implies more than employment because it expands to employment engagement, career advancement and contextual and industry driven education and training (Giloth, 2000). It is paramount to look at the economic aspect of healthcare workforce because, lack of it leads to economic turmoil that upsets the development standards of a country and in turn reverses the trends gained in health milestones (Chuma *et al.*, 2012; Dodd & Cassels, 2006; Oyaya & Rifkin, 2003). In addition, it expands it to include the skills of the workforce directly involved in the delivery of patient care and population-based programs aimed at improving health (Honore, 2014). Given the central role that public health plays in protecting the health of our communities, it is incumbent upon leaders in practice and academics to ensure that the current and future workforce is well prepared to face new and existing challenges (Amde *et al.*, 2014).

The heterogeneous nature of the public health workforce presents both opportunities and challenges. The skills and knowledge of the workforce provide opportunities to build on existing individual workers and in the organization as a whole. Challenges arise from the gaps in worker capabilities in terms of skills expected for current performance or needed to address emerging issues. The ability to identify priorities and implement comprehensive approaches to public health workforce development is critical (Fineberg *et al.*, 1994; Neiworth *et al.*, 2014). Therefore needs assessment of public health human resources as well as need for international institutions to join hands in boosting public health expenditure areas some of the priority areas that need to be addressed to overcome the human resource crisis (Potter *et al.*, 2000 ; L. Chen *et al.*, 2004)

Studies indicate that innovation in skills is required for a better match with diversity when addressing public health challenges as evidenced by a study done in northern Canada which found that professional development and continuing education equipped the public health professionals with core competency skill to address public health challenges (M. Bell & MacDougall, 2013). The settings of the above study and the methodology it used makes it not practical in various parts of the world. The use of online professional education with videos and videoconference makes it realistically difficult to be done in resource scarce settings such as Africa. The glaring gaps justifies the need for a more practical and innovative way of addressing the mismatch between the academic competencies and workforce demands.

2.4 Competency Driven Workforce Development for Environmental Health Professionals

Competency is a measurable pattern of knowledge, skill, abilities and behaviors that an individual needs to perform work roles or occupational functions successfully (Donna Rodriguez *et al.*, 2002, Hoge *et al*., 2005) avers that much is being directed to the competency of healthcare workers which is converse to the work by (Koslov *et al*.,2009) who observes that much attention has been on the behavioural aspects of health (Hoge, Tondora*, et al.*, 2005; Kaslow *et al.*, 2009; Lie *et al.*, 2011). However, what stands out is that health challenges generally cut across all aspects of health necessitating competency based training to be implemented across all aspects of health with emphasis on public health. (Noe *et al*., 2006) asserts that competency based training leads to professionals who are sustainable with low turnover rates, higher productivity and better consumer services (Noe *et al.*, 2006). Whereas these researchers focussed on global challenges where business companies compete for international markets and economies, health care systems and related personnel ought to have an upper hand in handling public health challenges requiring international emergency responses (Cutter *et al.*, 2010).

Furthermore, studies have revealed that in a competency-based system, both the employer and the employee benefit as a result of establishing a transparent blueprint for recruitment, job expectations, performance evaluation and advancement paths. By so doing, personal judgment and subjectivity are minimized hence creating a more positive work environment with a stronger employee and employer relationship. In recent years, the practice of competency-driven workforce development has become increasingly prevalent in the field of public health (Syed Muslim Abbas *et al.*, 2014) and it has been proposed as the present

and future of public health education by programs adopting competencies though actual implantation and curriculum design (Bennett & Walston, 2015).

In the context of training and educational programs, competencies represent small, targeted components of skills and knowledge by breaking essentially larger skill sets down to sequential levels of cognition or mastery. Competencies are functionally related; they progress from basic to advanced and reinforce one another as learning occurs (Miner *et al.*, 2005). These observations have been supported by other researchers who confirm that when competencies are in line with the workers views and responsibilities, they are predictors of success in fulfilling workers' duties (Bennett & Walston, 2015). However, (Rezaian et *al.,* 2013) differs with this findings who proponents that there is need for accreditation standards and processes for quality assurance (Rezaeian *et al.*, 2013) over and above competencies. Other studies elsewhere have done among government public health officers possessing a formal public health degree revealed some competency gaps in budgeting and systems thinking (Taylor & Yeager, 2019). Consequently, there is therefore need of identifying competency gaps between what is learnt and what is applied in the assigned duties among the graduates compounded by accreditation and credentialing standards so as to reduce the gaps within the public health systems.

2.5 Demands of Public and Environmental Practice

Public health refers to the science and art of preventing disease, prolonging life and promoting human and environmental health through organized efforts and informed choices of society, public and private, organizations communities and individuals (Organization, 2002, Koplan *et al.*, 2009). Public health practice on the other hand refers

to actions and decisions that protect and improve health for all people in all places (Baum, 2003). It is a concerted effort between the public health professionals, partners, and individuals to protect and improve the health of people and communities. Other scientist have defined public health practice as the art and science of action to improve health for populations of individuals and families in their respective settings (Sørensen *et al.*, 2012). The world federation of public health associations indicates huge risks for the public health if opportunities to design an environment that supports health choices are not fully exploited (Cueto, 2004, Wanless, 2004). The only challenge is the high demand for public health services, disparities in their distribution and the concern on training adequacies, which may have geographical undertones (Dussault & Franceschini, 2006). This health workforce imbalance in times of globalization raises concerns and therefore to equip the new graduates with skills and knowledge relevant to their real life working conditions is a valid reality (Marchal & Kegels, 2003).

2.6 Environmental Health Graduate Competencies

The Core Competencies for Public Health Professionals are a set of skills desirables for the broad practice of public health. They reflect the characteristics that staff of public health organizations collectively possesses as they work to protect and promote health of populations. The core competencies are in three tiers (Tiers 1, 2 and 3) which reflect the Core Competencies that public health professionals at different stages of their career have. Specifically, Tier 1 Core Competencies apply to entry level public health professionals whereby the individuals that have limited experience of working in the public health field and are not in management positions; Tier 2 Core Competencies apply to individuals with

management and/or supervisory responsibilities; and Tier 3 Core Competencies apply to senior managers and/or leaders of public health organizations.

 In this current study, the core competencies were used in general with no reference to any tier. This was guided by the mission of the department training these graduates, which is "to produce professionals who will approach environmental health issues with a holistic perspective". Assessing competencies in general approach was also supported by various researchers who recommended general competencies for collaborative practice in handling public health challenges and emergencies (Betancourt *et al.*, 2016; Markenson *et al.*, 2005; Batalden *et al.*, 2002).

2.7 Challenges faced by Environmental Health Practitioners

Environmental health aims to create environments supportive of good health and to minimize disease. This is by addressing all environmental (physical, chemical and biological) factors external to a person, and all the related factors impacting behaviors (P. E. Petersen, 2003; Pruss-Ustun *et al.*, 2006). This encompasses the assessment and control of those environmental factors that can potentially affect health and is targeted towards preventing diseases and creating health-supportive environments (Pruss-Ustun *et al.*, 2006). Environmental Health professional are responsible for delivery of essential environmental public health services. Due to their wide scope of their roles, the challenges faced by these professionals are diverse and dynamic in nature.

The current major challenge facing public Health and humanity as a whole in this century is the spread of infections due to emerging and re –emerging diseases associated with

climatically related changes. In addition to climatically changes, the five pillars of environmental health in terms of disease control, water, sanitation and hygiene, food safety hygiene, pollution control, occupational health and safety as well as built environment and reportedly the major factors leading to ill health (Kumwenda *et al.*, 2014, Morse *et al.*, 2020). Evidently, the interlink between the pillars of Environmental health and climate change has led to un ending environmental challenges that are not limited to the human population , but extends to the animals and the ecosystem in general. These global health problems facing the Environmental Health Practitioners, that are mostly related to climate change, environmental sustainability, zoonotic and infections and are either emerging or re –emerging (Ribeiro *et al.*, 2019) requires innovative strategies to curb them. One health strategy has been coined to mitigate these challenges resulting from interlink and interface of the human, animal and environmental ecosystems. This one health approach is a worldwide strategy for expanding interdisciplinary collaboration and communication in all aspects of health care for humans and animals (Monath *et al.*, 2010). This One Health, though still evolving is quite promising. However, it has faced a lot of challenges, thus compounding further the challenges faced by Environmental Health Practitioners presently.

Additionally, there has been debates on the relevance and the training of the Environmental Health professionals, coupled with high demands for skilled workforce in public Health. In fact, public health agencies have had workforce shortages not only in Environmental Health, but across all carders of public Health (Yeager *et al.*, 2016). These shortages strain the existing workforce while limiting their chances of professional development to boost their competency skills (Allais, 2012). This work overload coupled with skill mismatch

aggravate professional competency for the workforce lack specialization as well as time to further skill development thereby contributing immensely to competency challenges experienced at the workplace by these professionals. This situation is further exacerbated the more experienced and highly valued health care work force due to retire. This has led to chronic healthcare workforce shortages and pending worker retirement. In relation to this persistent problem, various researchers have hypothesized and ascertained the fact that skill mismatch could be the potential cause of the paradoxical supply and demand chain of public health practitioners, (Desjardins & Rubenson, 2011, Yeager *et al.*, 2016, Bjegovic-Mikanovic *et al.*, 2015). However, more research is necessary to understand the dynamics of persistent health care workforce shortages despite the substantially higher numbers of graduates being released from the various institutions of higher learning.

2.8 Theoretical framework

The study utilized a MACH (Miner, Alperin, Cioffi, & Hunt, 2005) Model, developed at the Rollins School of Public Health (Miner *et al.*, 2005). The model serves as a logic map that describes the association between the workforce competencies and its components which reinforce each other. The model places into context the organizational and instructional theories that underpin workforce preparation and practice, which makes it suitable for use in the present study.

2.8.1 MACH (Miner, Alperin, Cioffi and Hunt) Model and its application

The Model contains components arranged in a multi-part structure and many of the processes are cyclical and reinforce one another, as follows:

Figure 2. 1: MACH Model Adopted from Competencies to instruction and performance

of Public Health Workforce (2005)
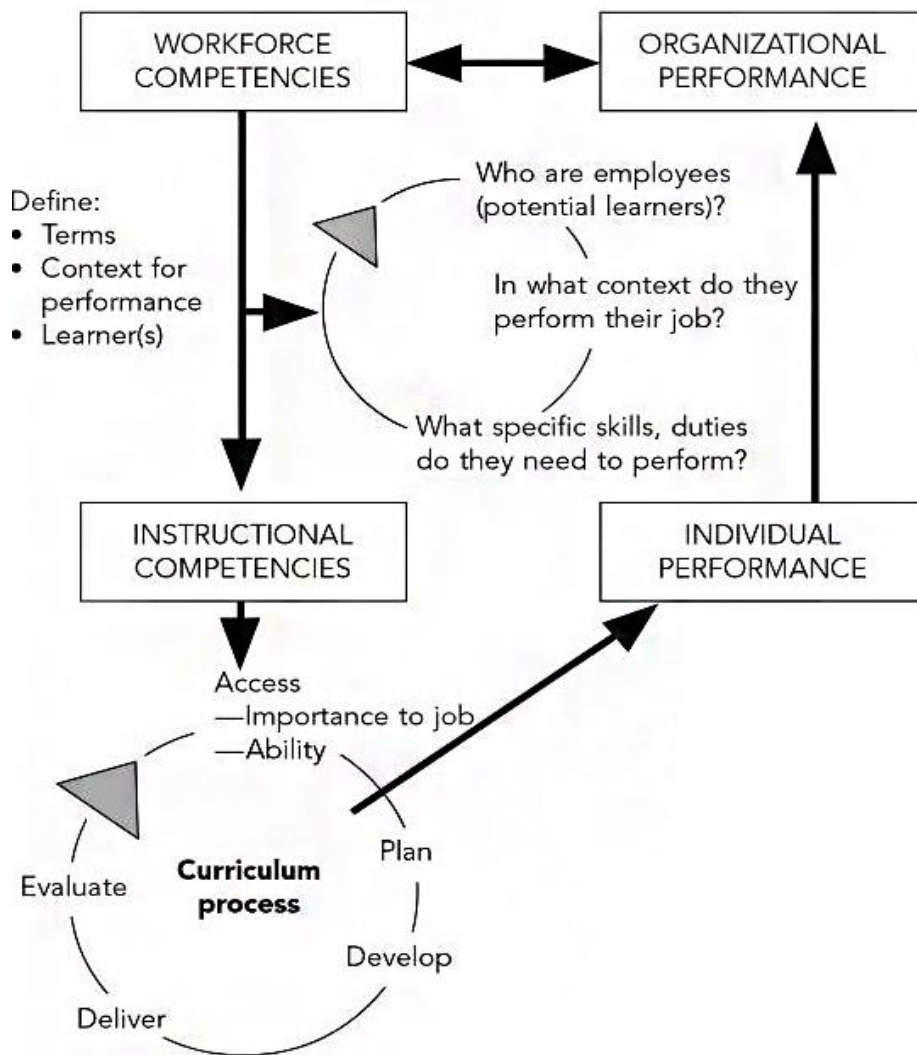
2.8.2 Components of the MACH Model

The Model serves as a logic map that describes the associations between the workforce competencies; defining elements; instructional competencies; curriculum process; individual performance and organizational performance. The Model also accounts for the general types of needs within public health and in particular the needs of those employees with skill deficits for specific tasks, which can be met through training or other expert systems. Through the MACH Model, competencies can be used to fulfil both instructional and workforce needs, with the primary outcome being organizational performance, achieved through a system that targets the needs of individual workers. Its components are described as follows:

2.8.3 Curriculum Process

Once instructional competencies have been identified, educators use them as a guide for developing and administering training programs. Instructional competencies influence the content, while the curriculum process provides a structure for designing and conducting the training programs, which then determines an individual's performance.

2.8.4 Individual Performance

The success of any training or educational efforts relies on individual performance. Even the best designed curriculum cannot stand on its own without evidence that learners can demonstrate new or developed competencies. The overarching goal of workforce development is that individuals apply what they have learned during training or education to their work. Appropriate training can provide individuals with hands-on skills that can be

applied immediately to their job responsibilities, while other experiences can contribute to general knowledge that may be applied under a variety of circumstances (G. Chen *et al.*, 2004). Appropriate training can provide individuals with hands-on skills that can be applied immediately to their job responsibilities, while other experiences can contribute to general knowledge that may be applied under a variety of circumstances.

2.8.5 Organizational Performance

There is a reciprocal relationship between organizational performance and the performance of individuals in the organization (Melville *et al.*, 2004). The underlying assumption that drives the demand for public health workforce development is that once enhanced individual performance is achieved; there is a logical extension to improved organizational performance.

2.8.6 Workforce Competencies

Workforce competencies generally combine a series of different skills into one broad statement. These statements which may be explicit or implicit are meant to define a wide scope of work, and generally include multiple actions, responsibilities, and content areas (Gerber & Lankshear, 2002). In practice, workforce competencies are often used to create and define job descriptions. When explicit, they are generally presented in a summary format to allow workers to appreciate the full extent of their positions, while at the same time condensing the content to facilitate understanding (Betancourt *et al.*, 2016).

2.8.7 Instructional Competencies

Once an understanding about the specifics of a workforce is achieved, instructional competencies can be developed. Instructional competencies are modeled after the sequential stages of learning illustrated in Bloom's taxonomy.

2.9 Conceptual Framework

The aim of the conceptual framework assists in thinking and planning for complete investigation of a successful study (Berman, 2013). The research assessed academic competencies as it relates to graduates' current work requirements. The dependent variables involved the education outcomes/competencies and workforce performance/competencies. The individual attributes and curriculum processes including the curriculum content and the implementation strategy formed the independent variable. The competency of the graduates is a pointer to the success of the training as well as the curriculum processes. Appropriate training is expected to provide hands on skills that can be applied immediately, which subsequently affect the organizational performance. Any training needs and gaps identified by the employers and the graduates ought to be communicated to the training institutions as curriculum inputs to be incorporated into the curriculum.

Independent variables   **Dependent variables**
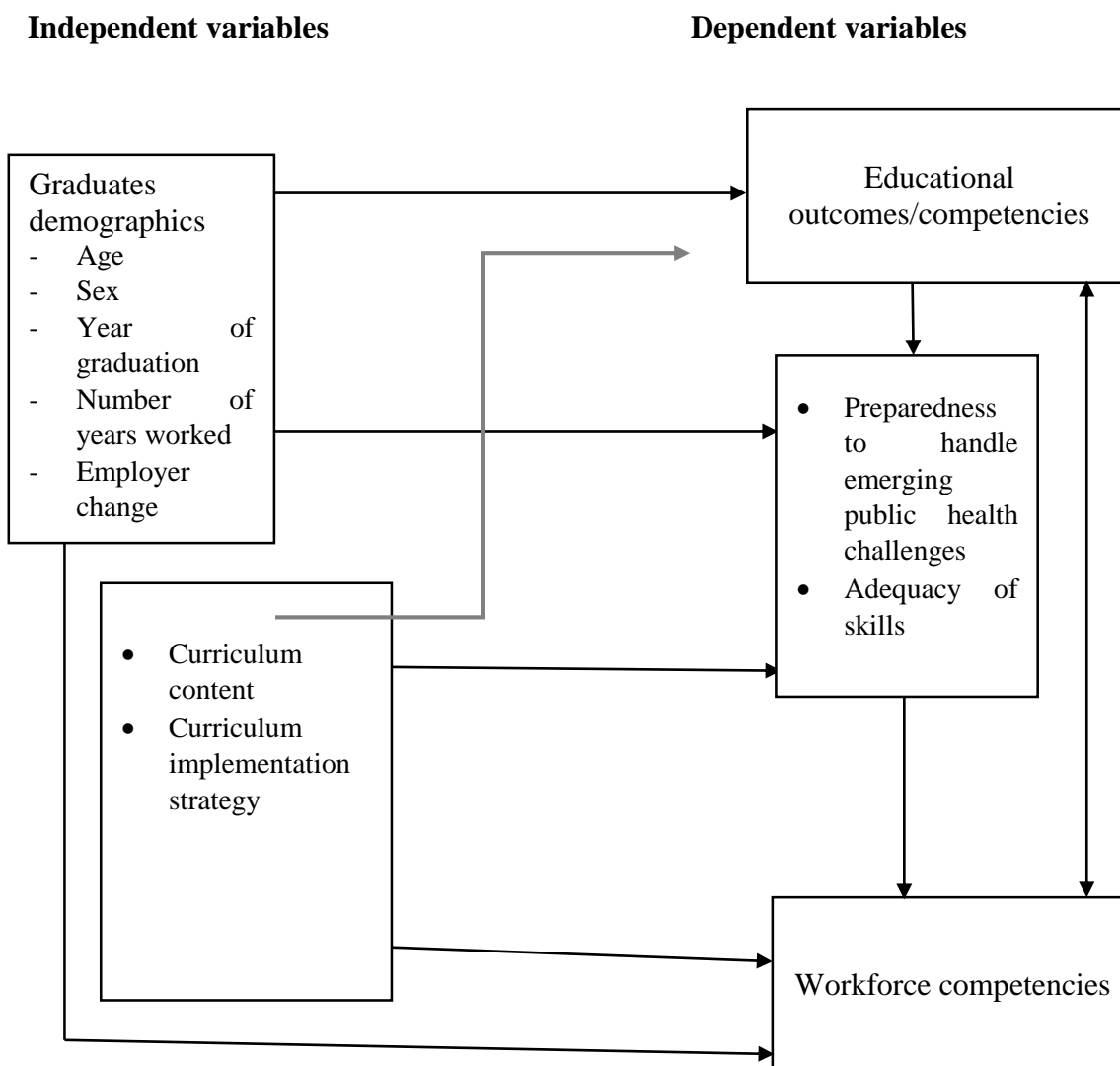
Figure 2. 2: Conceptual framework

Source: Modified from Competencies to instruction and performance of Public Health

Workforce, MACH, 2005

2.10 Conclusion

This chapter has highlighted in detail the relevant and recent literature on academic
competencies of B.Sc. Environmental Health graduates. The review was done in regards
to the domains of public health competencies, curriculum process, workforce development,
work demands for Environmental professionals as well as the challenges that these
professionals face at their workplace.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter discusses the   procedures that were used in conducting the study. These include the description of the research design, study site, study population, sampling procedures, the instruments used to collect the data, data collection procedures, data analysis and ethical considerations.

3.1 Location of the study

The study was based at Moi University, College of Health Sciences at the Department of Environmental Health in the School of Public Health. College of Health Sciences is part of the larger Moi University established in 1984 by the Kenyan Government. It is located in Eldoret, Kenya's fifth largest city approximately 200 miles northwest of Nairobi in the Rift Valley Province. College of Health Sciences constitutes the schools of Medicine, Public Health, Nursing and Dentistry. The School of Public Health was established in July 2006 to train high level manpower in Public Health. At the College of Health Sciences, an innovative approach, the SPICES (Student centered learning, Problem based learning, Integrated learning, Community based, Electives oriented and Systematic/Self-directed learning) model is used in the training of health care professionals. The curricula in all the schools at the College of Health Sciences are based on the SPICES model.

3.2 Research Design

The research design used for this study is mixed methods that employed a cross-sectional approach. A mixed methods design involves both quantitative and qualitative methods (J. W. Creswell *et al.*, 2004). According to (Johnson & Onwuegbuzie, 2004), mixed methods research is defined as a research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, or concepts into a single study. Mixed methods design, is more than simply collecting both qualitative and quantitative data; but the data are integrated, related, or mixed at some stage of the research process (J. Creswell & Plano Clark, 2007). The rationale for carrying out a mixed method research is that when qualitative and quantitative methods are combined they capture the trends and details of the situation and they complement each other and yield a more complete analysis. According to (Greene *et al.*, 1989) as cited by (Schoonenboom & Johnson, 2017), the purpose of mixing in mixed methods research include triangulation, complementarity, development, initiation and expansion

- Triangulation seeks convergence, corroboration, correspondence of results from different methods.

- Complementarity seeks elaboration, enhancement, illustration, clarification of the results from one method with the results from the other method;

- Development seeks to use the results from one method to help develop or inform the other method, where development is broadly construed to include sampling and implementation, as well as measurement decisions;

- Initiation seeks the discovery of paradox and contradiction, new perspectives of frameworks, the recasting of questions or results from one method with questions or results from the other method;

- Expansion seeks to extend the breadth and range of inquiry by using different methods for different inquiry components methods

There are different models of mixed methods design, according to (Creswell & Clark, 2011), and include triangulation design, the embedded design, the explanatory design, and the exploratory design. Triangulation is the most common and well-known approach to mixing methods. This design is used when a researcher wants to directly compare and contrast quantitative statistical results with qualitative findings or to validate or expand quantitative results with qualitative data. The purpose of using this model to bring together the differing strengths and weaknesses of quantitative methods with those of qualitative methods. According to (Creswell & Plano Clark, 2007) as cited by (Creswell & Clark, 2011), the triangulation design is a one phase procedure where the quantitative and qualitative methods are implemented during the same timeframe and with equal weight. The model generally involves the concurrent, but separate, collection and analysis of quantitative and qualitative data so that the researcher may best understand the research problem. The researcher attempts to merge the two data sets, typically by bringing the separate results together in the interpretation or by transforming data to facilitate integrating the two data types during the analysis. This study employed the triangulation design where quantitative qualitative data were collected concurrently, the results analyzed separately and the different results were interpreted by comparing and contrasting the results as depicted in figure 3.1

```
┌──────────────┐     ┌──────────────┐     ┌──────────────┐
│ Quantitative │     │ Quantitative │     │ Quantitative │
│ data         │ ──▶ │ data analysis│ ──▶ │ results      │
│ collection   │     │              │     │              │
└──────────────┘     └──────────────┘     └──────────────┘
```

                                          ┌──────────────┐   ┌──────────────┐
                                          │ Comparison   │   │ Interpretation│
                                          │ and contrast │ ──▶ │ of results   │
                                          │ of results   │   │   │
                                          └──────────────┘   └──────────────┘

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┌──────────────┐     ┌──────────────┐     ┌──────────────┐
│ Qualitative  │     │ Qualitative  │     │ Qualitative  │
│ data         │ ──▶ │ data analysis│ ──▶ │ results      │
│ collection   │     │              │     │              │
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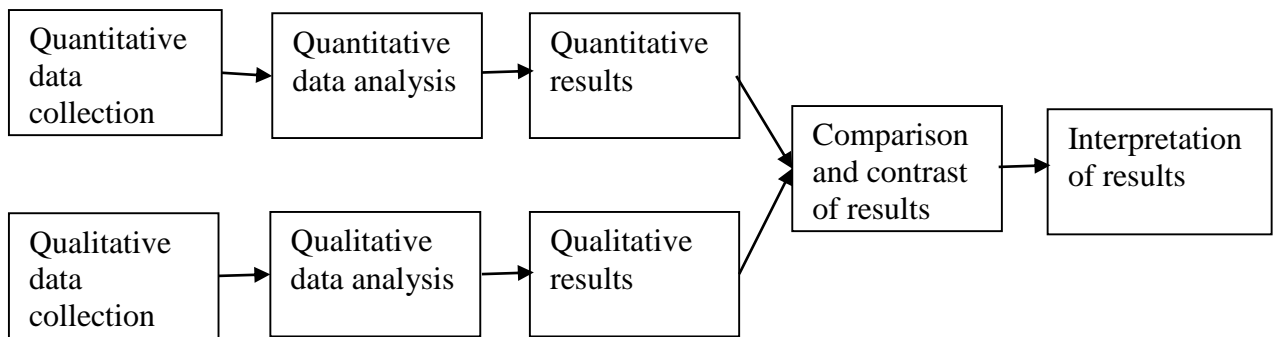
Figure 3. 1: Triangulation design with convergence approach (Adopted from Creswell & Clark, 2011).

3.3 Study Population

The study population is the subset of the population with the condition or characteristics of interest defined by the eligibility criteria (Friedman et al., 2015). The objective for clearly defining population is to form the basis for generalizing the research results to other relevant populations. Clearly defining a study population early in the research process also helps assure the overall validity of the study results (Eldredge et al., 2014).

The study population encompassed B.Sc. Environmental Health graduates who graduated between the years 1999 and 2015 and their respective employers in various practitioner organizations.

3.3.1 Study site

The study was based at the department of Environmental Health. The department was established in 1995 in order to train public health officers at B.Sc. level after recommendation by the Central Board of Heath in the Ministry of Health. This Department is housed in the College of Health Sciences, School of Public Health. It currently has a total of seven (7) teaching staff and one technical staff directly involved with curriculum implementation. Additionally, there are courses, including common courses, which are serviced by other departments within the college. Therefore, curriculum implementation is depended not only on the departmental staff, but also on the entire college staff. The professional profile of the environmental Health practitioners is made up of a number of competencies as outlined in the curriculum's core objectives/outcomes located in Appendix VII

3.3.2 Target population

 Since the inception of the Department of Environmental Health in 1995 to 2015, a total of 600 students have graduated and are serving in various capacities within and outside the country. The first curriculum was operationalized in 1995 with the first cohort of students graduating in 1999 and the distribution of graduates per year and gender is outlined in table 1.1 below;

Table 3. 1: B.SC. Environmental Health graduates from 1999 to 2015

Year	Males	Females	Yearly totals	Cumulative Total
1999	10	4	14	14
2000	19	12	31	45
2001	13	10	24	69
2002	14	7	21	90
2003	18	7	25	115
2004	11	8	20	135
2005	23	10	33	168
2006	19	16	36	204
2007	14	8	20	224
2008	10	12	22	246
2009	17	18	35	281
2010	20	28	48	329
2011	29	16	45	374
2012	32	26	58	432
2013	30	23	53	485
2014	26	31	57	542
2015	21	37	58	600
Subtotals	326	274	600	600

Source: Moi University, College of Health Sciences Registry 2015

3.3.3 Practitioner organizations

These are organizations employing B. Sc. EVH graduates. The immediate graduates' supervisors in the practitioner organization were targeted to participate in the study.

3.4 Eligibility Criteria

These are guidelines that outline who can or cannot participate in the study

3.4.1   Inclusion Criteria

These are predetermined characteristics used to identify subjects who will be included in the study

3.4.1.1 Graduates

The participant must have graduated between the years 1999 and 2015, both years inclusive and have ever worked for at least six months after qualifying from the university.

3.4.1.2 Practitioner Organization

For the practitioner organizations, the graduate must have worked for at least six months in the present organization. The respondent representing the organization must be an immediate supervisor   to the graduate.

3.4.2   Exclusion Criteria

These are characteristics that disqualify prospective subjects from inclusion into a study

3.4.2.1 Graduates

Graduates working outside Kenya and those working within Kenya with specialized training outside the scope of public health

3.4.2.2 Practitioner organizations

Practitioner organizations with graduates whose duration in employment was less than six months and those Practitioner institutions that employed B.Sc. graduates previously, but the graduates have since left the institution.

3.5 Sample Size Determination

3.5.1 Graduates

To get the graduates desired sample size, the Fisher's formula was used as follows;

$$n = z^2pq/d^2$$

Where:

n = the desired sample size

z = the corresponding value confidence level of 95% in the normal distribution table.

p = the proportion in the target population whose training matches the work requirement. (used 60% as per the healthcare competency research done by Quality assurance project in Kenya (Mutungi *et al.*, 2008).

q = 1 – p (Proportion of the graduates whose workforce demands does not match the training received (40%

d = the amount of discrepancy to correlate in z. It was set at 0.05

$$n = 1.96^2 \times 0.6 \times 0.4/0.05^2 = 368.$$

Since the population under study was less than 10,000, then the sample size of the B.Sc. graduates was adjusted using Fischer Exact formula used for calculating sample sizes for population sizes less than 10,000 as below;

$n = n_0 / (1 + ((n_0 - 1)$ and $/ N))$

Where:

n- the adjusted sample size

n_0- the calculated sample size from the Cochran's formula (368)

N- The population size (600)

$n = 368/ (1+367/600)$

$= 227$

To get a representative sample of the graduates in terms of the gender and year of qualification, proportionate stratification was done using the formula

$$n_h = (N_h / N) * n$$

Where n_h was the sample size for stratum *h*, N_h was the population size for stratum *h*, N was the total population size, and n was the total sample size. To arrive at the total sample size, the cumulative roll of graduates since inception of the department to 2015 was used and the proportionate sample size is as indicated in table 3.1 below.

Table 3. 2: B.SC. Environmental Health graduates from 1999 to 2015

Year	Males	Females	Yearly totals	Cumulative Total	Proportionate sample
1999	10	4	14	14	5
2000	19	12	31	45	11
2001	13	10	24	69	9
2002	14	7	21	90	7
2003	18	7	25	115	9
2004	11	8	20	135	7
2005	23	10	33	168	12
2006	19	16	36	204	14
2007	14	8	20	224	7

2008	10	12	22	246	8
2009	17	18	35	281	14
2010	20	28	48	329	18
2011	29	16	45	374	17
2012	32	26	58	432	22
2013	30	23	53	485	20
2014	26	31	57	542	22
2015	21	37	58	600	22
Subtotals	326	274	600	600	227

Source: Moi University, College of Health Sciences Registry 2015

3.5.2 Practitioner organizations

Mapping of these organizations was done using the existing EVH Alumni register versus their placement to establish the greatest absorber of the graduates. A total of 45 practitioner organizations were targeted.

3.6 Sampling Techniques

This refers to how members of a population are selected to participate in a particular study.

3.6.1 Graduates (Quantitative)

Stratified random sampling technique was used. The graduates were first stratified by year of graduation into 17 strata. Each stratum was then further stratified into two strata by sex. Using the Alumni list as a sampling frame, simple random sampling was applied to select the desired sample size from each stratum.

3.6.2 Graduates (Qualitative).

Purposive sampling was used to recruit graduates to participate in the in-depth interviews. Graduates working in various organizations were recruited and interviewed until saturation level was attained. This was achieved at graduate number 22.

3.6.3 Practitioner organizations

Practitioner organizations, after mapping them out, were purposively sampled based on the eligibility criteria. A total of 49 organizations were selected.

3.7 Data collection tools

These refers to the devices that were used to gather data relating to the set objectives

3.7.1 Data Collection Instruments

The instruments used for data collection were structured self-administered questionnaire and interview guide/schedule for in-depth interviews. The curriculum was used to identify the program objectives and or the program outcomes. The questionnaire was then developed using the validated competencies list developed by the council on linkages between academic and public health practice (Practice, 2010) The questionnaires were in two sets, that is for graduates and practitioner organizations. The graduate questionnaires rated graduates' competency levels as per the programs expected outcomes/competencies while the practitioners' questionnaire rated graduates' performance. The questionnaire used in this study was a modification of the tool used by (Grimm *et al*., 2015) to assess the Education and Training Needs of Nebraska's Public Health Workforce.

3.7.2 Validity of the Instruments

The questionnaires were used to generate data in line with the objectives. In this study, content validity was measured by providing all possible items on the questionnaire. The supervisors and experts of medical education were asked to determine whether the items in the Likert scale accurately represent the concepts in assessing competency of public health graduates. Their suggestions and recommendations were incorporated to produce a final draft.

3.7.3 Reliability of the data collection tool

The reliability of the items included in the questionnaires was ascertained by use of the Cronbach alpha. The internal consistency reliability based on the Cronbach's alpha was calculated for the items on graduates' education competencies and the coefficient was 0.7. The reliability coefficient was within the acceptable range of 0.70 - 0.95 (Tavakol & Dennick, 2011) and the items were therefore found to be reliable.

3.7.4 Pilot study

Pilot testing of the study instruments was undertaken using 10% sample size as recommended by (Mugenda & Mugenda 2003). Twenty respondents were randomly selected from Mt. Kenya University, Eldoret campus and four employer respondents were purposively sampled from National Environment Management Authority, African Institute of Research and Development, Hospital Insurance Fund and Reale Hospital, all within Eldoret town to participate in the pilot study. Results obtained from the pilot were used to improve on the data collection instruments.

3.8 Implementation of the study

This is the process of putting a plan into effect through execution process.

3.8.1 Data collection procedure

This is the operational pattern that stipulates what information is to be gathered from what sources with which procedures

3.8.2 Graduate Questionnaire

The items in the questionnaire were arranged according to the study objectives. Data was collected through an online survey. An electronic survey has been defined in the research literature as "one in which a computer plays a major role in both the delivery of a survey to potential respondents and the collection of survey data from actual respondents"(Bakla *et al.*, 2013) This type of data collection has been deemed "effective, reliable, and safe"(D'Agruma & Zollet, 2007) and it allows convenient access to graduates who are geographically dispersed and more convenient for those who decide to participate (Evans & Mathur, 2005)

With the help of a research assistant experienced in online surveys, contacts were made both though the mobile telephone numbers and email addresses. A link containing the survey questions was then sent to the respondents.

3.8.3 Employers Questionnaire

Employers were contacted and appointment booked for each of those that were sampled to participate in the study and thereafter, data was collected using a self-administered questionnaire

3.8.4 In - depth interviews

In-depth interviews were used to collect additional data from the graduates to triangulate response from the questionnaire. This involved oral questioning where open ended questions were used with the guide of an interview checklist. The interviewees were subjected to the same questions until saturation level was achieved. An audio recorder was used during the interviews and the data collected was later transcribed.

3.9. Training of research Assistants

The researcher trained three research assistants for two days on the use of research instruments, data collection technique and ethical issues before the commencement of the study. One research assistant was a specialist in Information Technology and was trained to work closely with the principal researcher on the online platform. All were trained on interviews as well audiotape recording.

3.10 Roles and Responsibilities of the Research Team

The research team consisted of four members including the principal researcher and three research assistants. The research assistants participated in data collection while the lead researcher mapped out the graduate distribution and practitioner organizations. Apart from directing the entire research process, the principal investigator lead the team to plan and book employers' survey as well scheduling and conducting in-depth interviews.

3.11 Data management and Analysis

3.11.1 Data Entry

Data was checked for completeness, coded and entered into excel spreadsheet then

exported to SPSS® version 20 (IBM Corporation, New York, USA) for analysis.

3.11.2 Quantitative data analysis

Descriptive statistics by means of frequency, proportions and median were used to

summarize the data. Inferential statistics was done to test the association between the

dependent and independent variables. The normality of the data was determined using

Kolmogorov Smirnov and Shipiro Wilk tests (Razali & Wah, 2011) and was found not

to be normally distributed. Analysis was carried out using Mann-Whitney, Kruskal-Wallis,

Chi-square and logistic regression. Statistical significance was considered for $p < 0.05$.

The individual's responses to the Likert scale items were aggregated and weighted median

computed as composite scores. These transformed statistics were then used to carry out

descriptive and inferential statistics. This approach is supported by several authors. For

example (Kerlinger 1966) described a Likert scale as a summated rating scale whereby an

individual's score on the scale is a sum, or average, of the individual's responses to the

multiple items on the instrument (Kerlinger, 1966) whereas (Oppenheim 1992, Kline

(1998, & Babbie 1999) emphasized that the score an individual receives on a Likert scale

is the sum of an individual's responses to all items comprising the scale or subscale

(Oppenheim, 2000 Kline, 1998, Babbie, 1999). In addition, according to (Rushton *et al.*,

1983) the principle of aggregation – the sum of the responses to a set of multiple items is

a more stable, unbiased and reliable estimate than are responses to any single item in the set.

3.11.3 Qualitative data analysis

The qualitative data generated from in-depth interviews contained narrative from graduates on the various aspects of the study. The data was organized, cleaned and coded using the hybrid model of coding where both pre-determined and the emergent themes were used to create a story line. This data was managed using N Vivo® 10 (QSR International, Melbourne Australia) software.

3.12 Ethical Considerations.

The autonomy of the research participant had to be considered in recruiting research participants. The Principle of natural justice dictates that the participant should be given adequate information then requested to join the study voluntarily. In this regard, any risks involved and any anticipated benefits, either to the participant or the community had to be made clear to the potential participant to allow them to make informed choices (Vanclay *et al.*, 2013) .

3.12.1 Clearance by the Ethics committee

The proposal to conduct this research was approved by the Institutional Research and Ethics Committee (IREC) based at the Moi Teaching and Referral Hospital and Moi University, College of Health Sciences. The proposal was granted Formal approval Number: **0001701** (**Appendix VI)**

3.12.2 Respect for Autonomy

The identified participants who met the eligibility criteria were given a full explanation about the purpose of the study. For the online survey respondents, those who choose "yes" to participate were directed to a link that had the consent form, where they got more details about the nature of the study. After reading the consent form, they were again given an option to choose to participate or not. Those who consented got a link to the questionnaire and were able to answer them consecutively. They were informed about their freedom to withdraw from the study any time at their own will.

For the respondents representing the employers who physically filled the questionnaires, they were taken through the full details of the study. Those who consented were given a consent form to fill and were informed of their free will to withdraw from the study at any time.

3.12.3 Confidentiality

Confidentiality of the participants was assured by ensuring that none of the research documents had their names on. All the questionnaires and in-depth interview notes were kept under lock and key. All computerised data were password protected.

3.13. Dissemination of study findings

The findings of this study will be of benefit to the Universities, Policy makers, Public Health Officers and Technicians Council (PHOTC), Ministry of Health, Ministry of Education, B.Sc. EVH graduates, NGOs and other practitioner organizations.

The findings will be shared through conference presentations, poster presentations and publications in peer-reviewed journals. So far two research articles from the study have

been published in refereed journals (appendix XI and appendix XII) and a poster presentation has been done at an international conference. A poster presentation was also done during a virtual oral presentation at the Towards Unity for Health (TUFH) 2020 conference done in September 2020 in Mexico (appendix XIII).

3.14. Study Limitations

1. The practitioner organizations were widely distributed within the country, thus widening the coverage of the study.
2. Scheduling and actualizing in depth interviews with graduates was resource consuming.

3.15 Conclusion

This chapter has described the procedure that was used in conducting the study. It has given a description of the research design, study site, study population and sampling procedures and the research instruments that were used in collecting data. It has also presented the procedures that were used in data collection, data analysis methods as well as the ethical considerations and procedures that were followed before commencing the study.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the results of the study which is based on the collected, analyzed and interpreted data from structured questionnaires and in-depth interviews.

4.1 Graduates' characteristics

A total of 227 graduates were sampled for the study but 188 of them responded to the questionnaires corresponding to 82.1% response rate. The graduates' characteristics are indicated in table 4.1 below.

Table 4. 1: Graduates' characteristics

Characteristic	Frequency (n)	Percent (%)
Age-group (years)		
<25	9	4.8
25-34	79	42.0
35-44	71	37.8
>45	29	15.4
Gender		
Male	111	59
Female	77	41
Year of graduation		
On or before 2000	11	5.9
2001-2005	34	18.1
2006-2010	51	27.1
2011-2015	92	48.9
Duration worked		
< 1	32	17.1
1-5	108	57.4
> 5	47	25.2
Worked with any other employer before the current one		
Yes	108	57.4
No	80	42.6

On age group, a higher proportion of the graduates were in the age category of 25 to 34 years (79 (24.0%), while the age category of below 25 years was the least with only 9 graduates translating to 4.8%.

On gender, a total of 111 graduates translating to 59% were male while females were 77 (41 %) ; whereas regarding the year of graduation, a higher proportion 92 (48.9%) graduated between the year category of 2011 and 2015.

On duration worked for the organization, more than 50 % had worked for a range of one year to five years. On whether they had worked for any other organization before the present one, 108 graduates 57.4%) had worked elsewhere before the present organization, while 80 (42.6%) had not.

4.2   Graduates career placement

The graduates were distributed in 12 public health career areas as depicted in figure 4.1 below.
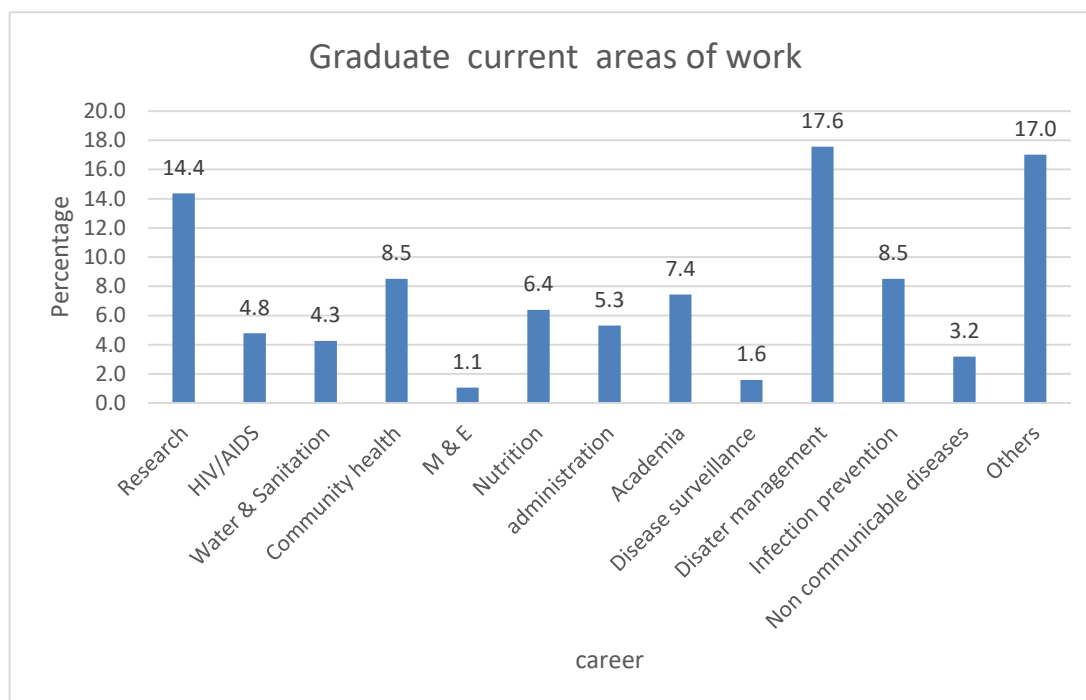
Figure 4. 1: Graduates' Career distribution

About 33 (17.6%) were working in disaster management, 27 (14.4%) were in the research field, 16 (8.5%) were in the field of community health and infection prevention respectively.

4.3 Assessing graduate education competencies in relation to their working roles

4.3.1 Graduate perception of their education competencies

The responses of the 14 items on the graduate educational competencies were analysed and reported in table 4.2. The questions to the responses in appendices II

Table 4. 2: Graduate perception of their competencies as per undergraduate training

Graduate competencies	Frequencies, n (%)				Median	Range
	Poor	Fair	Good	Excellent		
Planning health preventive activities	7 (3.7)	41(21.8)	106(56.4)	34 (18.1)	3	1-4
Planning health promotive activities	8(4.3)	40(21.4)	92(49.2)	47(25.1)	3	1-4
Implementing preventive & promotive activities	13(6.9)	38(20.2)	93(49.5)	44(23.4)	3	1-4
Evidence based decision making	14(7.5)	46(24.6)	76(40.6)	51(27.3)	3	1-4
Design & construct water and sanitation projects	9(4.8)	39(20.7)	100(53.2)	40(21.3)	3	1-4
Surveillance and control of communicable diseases	9(4.8)	35(18.6)	87(46.3)	57(30.3)	3	1-4
Food quality control	9(4.8)	46(24.5)	85(45.2)	48(25.5)	3	1-4
Conducting sanitary inspections	8(4.3)	38(20.2)	91(48.4)	51(27.1)	3	1-4
Occupational health and safety	20(10.6)	51(27.1)	75(39.9)	42(22.3)	3	1-4
Planning and implementing training programs	24(12.8)	45(23.9)	82(43.6)	37(19.7)	3	1-4
Formulation of EVH policies	42(22.3)	41(21.8)	76(40.4)	29(15.4)	3	1-4
Enforcing laws, regulations and public health laws	21(11.2)	66(35.1)	68(36.2)	33(17.6)	3	1-4
Conducting research and suggesting solution to public health problems	15(8.0)	44(23.4)	72(38.3)	57(30.3)	3	1-4
Engaging in Continuing professional development	26(13.8)	44(23.4)	72(38.3)	46(24.5)	3	1-4

Note. N = 188. Scale ranges from 1 = poor to 4= excellent; Cronbach's alpha = 0.70

The overall median competency score was 3 with the highest proportion of graduates

perceiving themselves as being either good or excellent in surveillance and control of

communicable disease (76.6%) followed by conducting research (75.5%). On the other

hand, 44.2 % of the graduates rated themselves as being either poor or fair in formulation

and development of environmental health policies, while 46.2% perceived themselves as either poor or fair in enforcing laws, regulations and public health laws. It is worth noting that 42 (22.3%) rated themselves poor in respect to formulation of Environmental Health policies while with 66 (35.1% rating themselves fair in enforcing public health laws and regulations. The graduate self-rating of the other competencies assessed is detailed in table 4.2.

From the In-depth interviews, there were varying perceptions in regards to the competencies assessed. Regarding research and control of communicable diseases, a theme of proficiency emerged as evidenced by a narration. [*…*] *practical exposure was not good but COBES and ONE health activities came in handy particularly for me in communicable disease control research…* (IDI respondent 19).

While on continuing professional development (CPD), a theme of workload emerged as a challenge to participation in CPD [.....] *attending CPD is a luxury for a few….personally that is the time I struggle to meet timelines so I have to   forego CPD attendance…* (IDI respondent 13)

4.3.2 Graduate characteristics and competency scores

An analysis to determine whether there was any difference in competence scores among the graduates' characteristics is depicted in table 4.3.

Table 4. 3: Competence scores and graduates characteristics

Characteristic	N	Median score	Mean rank	Test statistic	p-value
Age (years)					
<25	9	2.57	73.06	4.010 [a]	0.260
25-34	79	2.86	89.65		
35-44	71	2.93	103.46		
≥45	29	2.86	92.45		
Sex					
Male	111	2.93	100.15	1.714 [b]	0.086
Female	77	2.79	86.85		
Year of graduation					
On or before 2000	11	2.86	83.18	10.663 [a]	**0.014**
2001-2005	34	2.79	81.10		
2006-2010	51	3.00	115.05		
2011-2015	92	2.86	89.41		
Experience					
< 1 year	32	2.71	80.09	0.926 [a]	0.232
1 – 5 years	108	2.93	98.60		
> 5 years	47	2.86	92.89		
Worked elsewhere before joining current organization	109	2.79	86.69	2.328 [a]	**0.020**
Yes	79	3.00	105.23		
No					

a- Kruskal-Wallis; b- Mann-Whitney

The results showed statistically significant difference in competency scores by the graduates' year of graduation ($\chi2$=10.663, p=0.014) and having worked elsewhere before joining the current organization (Z=2.328, p=0.020). However, the Age group and gender had no statistical significance differences in their median score

4.3.3 The extent to which B.SC. EVH curriculum content and implementation conform to graduates practice and work requirements

On education competency in relation to current workforce and practice, 15.4% rated themselves as excellent, 29.8% good, 34% fair and 20.7% poor and a median score of 2 as detailed in table 4.4.

Table 4. 4**:** Rating of educational competency in relation to current work and the B.Sc. EVH curriculum content and implementation

Aspect	Frequency n (%)				Median	Range
	Poor	Fair	Good	Excellent		
Educational competency in relation to the current work and practice	39(20.7)	64(34.0)	56(29.8)	29(15.4)	2	1-4
Content of the BSc. EVH Curriculum you trained in	10(5.3)	45(23.9)	98(52.1)	35(18.6)	3	1-4
Using Problem Based Learning as a strategy for implementing B.Sc. EVH Curriculum	12(6.4)	27(14.4)	80(42.6)	69(36.7)	3	1-4

The aspect on educational competency in relation to the current work and practice was rated lowest with a median score of 2, with 20.7 % of the graduates rating themselves poor and 34% rating themselves as fair.

The curriculum content and curriculum implementation strategy both received a median score rating of 3 each. However, 69 (36.7%) rated the use of problem based learning

strategy to implement curriculum to be excellent while only 35 (18.6%) rated curriculum content as excellent.

On adequacy of skills acquired during undergraduate training, majority of respondents 131 (69.7%) indicated that they had not acquired adequate skills to match their work performance while 57 (30.3%) reported to have acquired adequate skills to match their work requirements.

Similarly, the results from the in-depth interviews on skill adequacy revealed varying themes. The theme of deficiency was quite evident as illustrated by the narration [...] *regrettably nobody mentioned strategies like Participatory Hygiene and Sanitation Transformation (PHAST) and Community Led Total Sanitation (CLTS) which are common Water, Sanitation and Hygiene (WASH) terms, in fact my employer wondered what kind of public health I had done* (IDI respondent 4)

On the other hand, there was a theme of satisfaction particularly emerging from those graduates who seemed to have acquired adequate skills. [.…] *Well for me the program is excellent and I enjoy applying the skills out here the department just needs to improve on the weak areas like practical orientation aspects* (IDI respondent 20)

There were more themes of suggestions and recommendations emerging from the interviews. This was evident among graduates who felt that the curriculum needed review to match market demands. […..] *The department need to review the curriculum to be up to date with the requirements of the job market; personally, I had to learn some aspects on job (*IDI respondent 15)

4.4 Evaluation of Employer assessment of graduate work skills and competency

4.4.1 Characteristics of the employer respondents

Out of the sampled 45 practitioner organizations, 39 responded giving a response rate of 86.7%. A higher proportion of the employer respondents were in the age category of 50 to 59 years with 16 employers constituting 41%. Gender wise, males were the majority with 69.2 %. On the position held at the time of the study, 11 (28.2%) were field officers, 9 (23.1%) were administrators while 6 (15.4%) were heads of departments.

On duration worked for the organization, 11 (28.2%) had worked for between two and five years, 10 (25.6%) had   worked for less than two years, while 9 (23.1%) each had worked for between 5 – 10 years and for more than 10 years respectively. These characteristics are depicted in table 4.5.

Table 4. 5: Characteristics of the employer respondents

Characteristic	Frequency (n)	Percent (%)
Age-group (years)		
30 - 39	8	20.5
40-49	10	25.6
50 - 59	16	41.0
≥ 60	5	12.8
Gender		
Male	27	69.2
Female	12	30.8
Current position in the organization		
Head of department	6	15.4
Human resource manager	2	5.1
Field Supervisor	11	28.2
Program manager	3	7.7
Administrator	9	23.1
Others	8	20.5
Duration worked		
< 2 years	10	25.6
2 - 5 years	11	28.2
5 - 10 years	9	23.1
> 10 years	9	23.1

The category of others included data managers, field director, disaster response coordinator, research associate, communications officer, training coordinator and quality assurance officer.

4.4.2 Employers assessment of graduate skills competencies

The responses from the employer representatives on the 8 items on the graduate skills competencies were analyzed and the results reported in table 4.6.

Table 4. 6: Employer ratings of the graduates' skills competencies

	Frequencies n (%)				Median	Range
	Poor	Fair	Good	Excellent		
Analytic and assessment skills	1 (2.6)	7 (17.9)	19(48.7)	12 (30.8)	3	1-4
Planning and organization skills	0 (0.0)	5 (12.8)	21(53.8)	13 (33.3)	3	2-4
Communication skills	0 (0.0)	13(33.3)	15(38.5)	11 (28.2)	3	2-4
Practical and technical skills	0 (0.0)	6 (15.4)	19(48.7)	14 (35.9)	3	2-4
Quality of work by the graduate	0 (0.0)	4 (10.3)	16(41.0)	19 (48.7)	3	2-4
Completes assigned tasks on time	0 (0.0)	0 (0.0)	19(48.7)	20 (51.3)	4	3-4
Meeting timelines	0 (0.0)	2 (5.1)	17(43.6)	20(51.3)	4	2-4
Team player	0 (0.0)	0(0.0)	19(48.7)	20(51.3)	4	3-4

Note. N = 39. Scale: 1 = poor, 2= fair, 4= excellent

The skills competencies with the highest rating with a median score of 4, were completing assigned tasks on time and team work. In these competencies, all the employer respondents rated the graduates as either good 16 (41.0%) or excellent 20 (51.3%). However, on

analytic and assessment skills, there was a poor rating of 2.6%, fair rating of 17.9% and a good and excellent rating of 48.7% and 30.8% respectively.

Communication skills were rated lowest both in the scale of good (38.5%) and excellent (28.2%) and rated highest on fair (33.3%)

4.4.3 Employer respondent characteristics and graduate skill competency

To assess the relationship between the employer respondent characteristics and graduate skill competencies, an analysis was done using Mann Whitney U test and Kruskal – Wallis as illustrated in table 4.7.

Table 4. 7: Employer respondent characteristics and the assessment of graduate's skills Competencies

Characteristic	N	Median	Mean Rank	Test statistic	p-value
Age (years)					
30 - 39 years	8	3.13	15.25		
40 - 49 years	10	3.31	22.80	2.105 [a]	0.551
50 -59 years	16	3.25	20.53		
$\geq$ 60 years	5	3.13	20.30		
Sex					
Male	26	3.25	19.67	0.258 [b]	0.797
Female	13	3.25	20.65		
Position in the organization					
Head of department	6	3.06	10.00		
Human resource manager	2	3.31	20.75		
Field Supervisor	11	3.36	23.86	12.916 [a]	**0.024**

Program manager	3	3.13	6.67		
Administrator	9	3.25	20.61		
Others	8	3.38	26.31		
Number of years worked					
< 2 years	10	3.31	22.05	1.351 [a]	0.506
2 - 5 years	11	3.25	21.82		
> 5 years	18	3.19	17.35		

a- Kruskal-Wallis; b- Mann Whitney

There was a statistically significant difference in the competency scores between the positions of the employer respondents ($\chi 2$= 12.916; p = 0.024) while the other employer characteristics (Age, Gender and the number of years worked) showed no statistically significant difference in the competency scores.

4.5 Graduates perceptions on their preparedness to handle emerging public health challenges

On graduates' preparedness to handle emerging public health challenges and concerns, more than half, 123 (65.4%) perceived themselves prepared to handle emerging public health challenges.

4.5.1 Level of preparedness and graduate characteristics

Table 4. 8: Relationship between various graduate characteristics and preparedness to handle emerging public health challenges

Characteristic	Preparedness		Test statistic (χ2)	p-value
	Not prepared	Prepared		
Age-group				
<25	2 (22.2)	7 (77.8)		
25-34	29 (36.7)	50 (63.3)	0.940	0.816
35-44	25 (35.2)	46 (64.8)		
$\geq$ 45	9 (31.0)	20 (69)		
Gender				
Male	37 (33.3)	74 (66.7)	0.185	0.667
Female	28 (36.4)	49 (63.6)		
Experience				
< 1	6 (18.8)	26 (81.2)		
1– 5	45 (41.6)	63 (58.4)	6.401	**0.041**
> 5	14 (29.8)	33 (70.2)		
Worked elsewhere before				
Yes	40 (37)	68 (63)	0.680	0.409
No	25(31.2)	55(68.8)		

Analysis to determine the relationship between the level of preparedness and the various categorical variables was carried out and the results revealed an association between the level of preparedness to handle emerging public health challenges and the experience of the graduates as statistically significant (p=0.041) in table 4.8.

Table 4. 9**:** Logistic regression analysis of the association between preparedness to handle emerging public health challenges and the number of years worked (Preparedness: yes=1, no=0)

Factor	Preparedness		B	S.E	OR(95% CI)	p-value
	Prepared	Not prepared				
Experience						
< 1 year	26 (81.2)	6 (18.8)	Ref cat.			
1-5 years	63 (58.4)	45 (41.6)	1.130	0.493	3.095(1.577-8.138)	**0.022**
>5 years	33 (70.2)	14 (29.8)	0.609	0.554	1.838(0.621-5.445)	0.272

As indicated in table 4.9, those who had worked for 1-5 years were 3 times more likely to be prepared than those who had worked for less than one year (OR; 95%CI: 3.095; 1.577-8.138, p=0.022).

From the in-depth interviews, the theme of deficiency in course content re-emerged [...] *Very little was taught on disaster preparedness, yet when out here I need to know regulations and litigations which were never mentioned in my entire training period* (IDI respondent 10).

For some graduates, the theme of scope also emerged [….] *the scope on disaster management was misleading. I only heard a little on international disaster used as examples as if there were none within our own setup. It hurts having such a nice course with major units with students gaining very little* (IDI respondent 7*).*

During in-depth interviews, a theme of recommendation re-emerged with graduates pointing out missing units and suggesting unit input into the curriculum […] *at undergraduate, there was no exposure on disaster preparedness and management. A module on it should be factored in the curriculum for it is very key* (IDI respondent 22)

4.5.2 Association between graduates' competencies and preparedness to handle emerging public health challenges

An analysis between preparedness to handle emerging public health challenges and graduate self-reported competencies revealed a significant statistical difference between the competency scores for those who were prepared and those who were not ($p < 0.013$). The median score of those who perceived to be prepared to handle emerging public health challenges was 2.93 and 2.79 for those who perceived unprepared. Further analysis indicated that a unit increase in the competency score increased the likelihood of being prepared by 10.6% (OR; 95% CI: 1.106; 1.042-1.174, p=0.001)

4.5.3. Employers perceptions of the graduates' preparedness to handle emerging public health challenges

The employers' perceptions of the graduates' preparedness to handle emerging public health challenges varied, with 18 (46.2%) rating them as fair, while 14 (35.9%) rating them as good and 7 (17.9%) rated them as excellent.

4.5.4 Comparison of the graduates' and employers' assessment of graduates' preparedness to handle emerging public health challenges

In comparing the perceptions of the graduates and those of the employer respondents, the analysis showed no statistically significant difference in the median between the graduate's and employers on handling of emerging public health issues (Z = 1.003; p = 0.316) as depicted in table 4.10

Table 4. 10**:** Comparison of graduates and employers perception on graduates' preparedness to handle emerging public health emergencies.

Variable	N	Median	Mean Rank	Statistic (Z)	p-value
Graduates	188	3	115.59	1.003	0.316
Employer	39	3	104.88		

4.6 Professional development needs of Public Health Graduates

4.6.1 Training needs

More than half of the employers 27 (69.2%) reported the need for professional training to boost graduates' competencies at their place of work. The graduates and employers identified additional training needs as depicted in table 4.11

Table 4. 11: a) Additional training needs suggested by graduates (multiple responses)

Training needs suggested by graduates (N = 148)	N (%)
Train more on practical applications rather than theory	59 (39.9%)
Climate change and health	27 (18.2%)
Disaster management and preparedness	23 (15.5%)
Health policy and policy making process	21 (14.2%)
More time and practice to understand preparation of bill of quantities (BQs)	11 (7.4%)
Integrated water resource management	7 (4.7%)

Table 4.11: b) Additional training needs suggested by employers (multiple responses)

Training needs suggested by employers (N=11)

Training needs suggested by employers (N=11)	N
Policy lobbying and advocacy	3 (27.2%)
Technical skills in EVH disasters & refugee crisis	2 (18.1%)
Strategic management and leadership	1 (9.1%)
Conducting environmental Impact assessment	3 (27.2%)
Environmental health toxicology	1 (9.1%)
Law prosecution &Nuisance abatement	1 (9.1%)

From the In-depth interviews a theme of training needs emerged as evidenced by a respondent narration. […] *there was a big difference between what I was taught and what I faced in the field. I had to do personal research and on job training to be at per with my employers requirements.* (IDI respondent 2 and 4) These training gaps and needs seemed to emanate from the competency challenges that graduates faced as they performed their duties. However, there was an emergence of graduate determination as a theme, with graduates praising the curriculum implementation strategy for giving them skills to learn on their own. *[....] it was not easy at first, but I thank PBL for the skills gained for I had to learn on my own* (IDI respondent 3).

4.6.2 Challenges at work place

On whether the graduates employed were having any challenges at their work place, 15 (38.5%) of employers noted some challenges among the graduate as they undertake their duties while 24 (61.5%) did not find any difficulty among the graduates.

On graduates self-rating on this aspect, 72 (38.2%) confirmed to have faced challenges while 116 (61.7%) reported not to have faced any challenge at their work stations. Similarly, the theme of challenges emerged during the in - depth interviews as evidence by an excerpt from one of the respondent.....] *My friend, my first job I resigned because of frustrations; my supervisor made me feel like I could not deliver and more so I felt like what I was doing was not what I was trained for* (IDI respondent 6).

 For other graduates, they found themselves in unusual circumstances for they could not understand certain aspects of public health contrary to the expectations of their employer supervisors as depicted by this excerpt. […… *in fact my employer wondered what kind of public health I had done* (IDI respondent 4)

4.7 Forms of Employer support options for professional training for public health graduates

4.7.1 Employer perspectives

More than half of the employers (69.2%) reported that there was a need for professional training to boost graduates' competency. The employer respondents from the various participating organization indicated support to the graduates for professional training. This support included 21 employers (53.8%) pledging to reduce work load to enable graduates

undertake the training, 11 (28.2%) offered to grant study leave and about 6 (15.4%) offered to fund the graduates professional training. However, 3% of the employers gave an option of others, indicating that the graduates would be required to quit employment to pursue their professional development training. The details of the employer support is depicted in figure 4.2
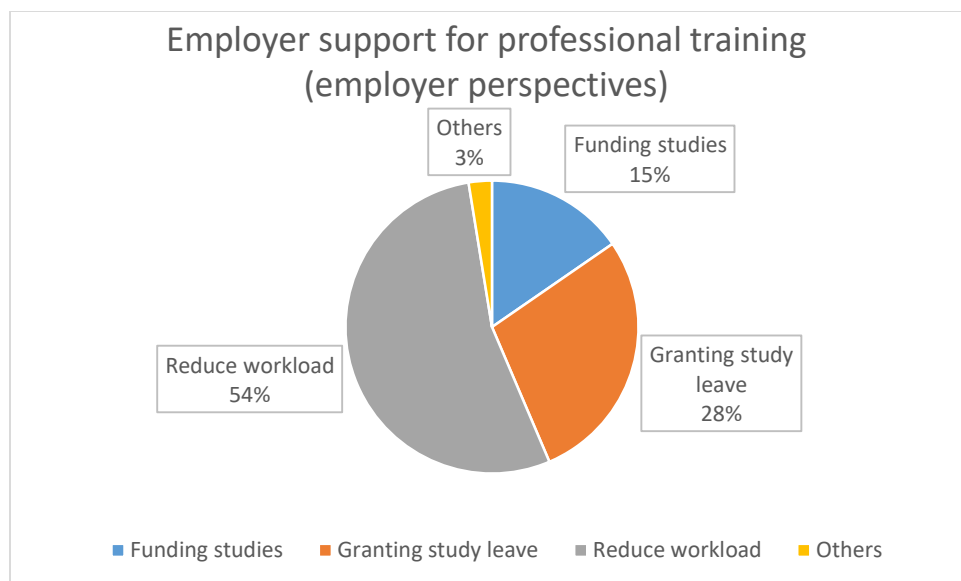
Figure 4. 2: Employer support for professional training (Employer perspectives)

4.7.2 Graduate perspectives

The need for professional training was highlighted as a way of boosting graduates competencies at their work place. Consequently, graduates had their own perceptions on the kind of support they expected from their employers. A higher proportion (86 (45.7%) perceived that their employers would reduce their workload while 19 (10.1%) had a perception of being granted study leave and about 10 (5.3%) had hopes that their studies would be funded. However, 40 (21.3%) reported that they did not expect any form of

support from their employers while 33 (17.6%) thought they would be required to quit their jobs in order to undertake professional training. These findings are as illustrated in figure 4.3
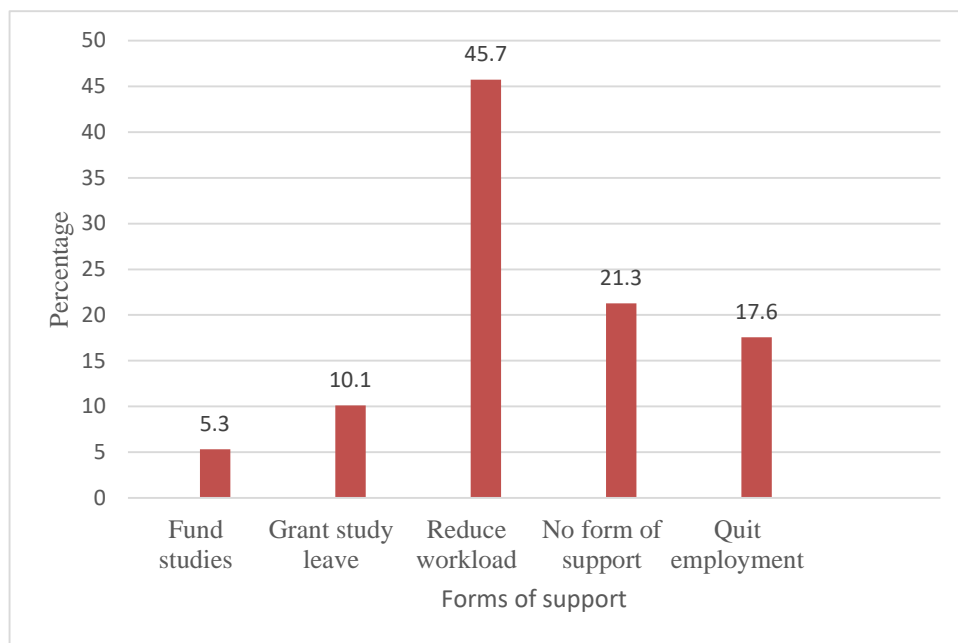
Figure 4. 3: Employer support for professional training (Graduate perspectives)

The findings from in- depth interviews revealed a theme of hope for some graduates who wished that their employers would grant them study leave and fund their professional development training as well. *[….] I believe my employer will grant study leave and offer partial scholarship for I have seen others benefiting* (IDI respondent 1); for some, there was a theme of hopelessness [*…] it is tricky to get any support in this institution […], in the NGO world they expect you to be well trained or else quit and get trained first* (IDI respondent 8).

For some, the theme of hopelessness seemed to emanate from the working relationship with their supervisors *[……] the most recent comment I got was I need to 'grow extra*

wings' to fly up [....] my personal professional development is my own business (IDI respondent 11)

For those institutions that had scheduled professional development training sessions, there seemed to be a deviation between the scheduled CPDs and the needs of the staff. This deviation was revealed through the in-depth interviews where a theme of existent gaps emerged. This gap was between their needs and the scheduled CPDs leading to repetitions as evidenced by some respondent narrations *[……] in my institutions, continuing professional education topics are just pinned on the notice boards most of which are recycled from previous years[...]no consultations on what is priority to workers* (IDI respondent 19). This was however applicable to practitioner organizations that offered routine scheduled CPDs to their employees

4.8 Conclusion

This chapter presented the findings from all the processes and procedures earlier described to generate and collect data relating to the set objectives. This included the demographic characteristics of the respondents and the response rate from the quantitative tool as well as the emergent themes from the qualitative aspect. In addition, the participant own voices featured prominently throughout the chapter in support of theme description.

CHAPTER FIVE

DISCUSSION

5.0 INTRODUCTION

The primary aim of this research was to assess the extent at which educational competencies gained by students in a formal learning environment relate to their current functional roles. This chapter presents discussion of the research findings against literature review as per the study objectives.

5.1 Education competencies and graduates functional roles

Education competencies represent areas of knowledge, skills and abilities for job performance. This study found an overall median competency score of 3, indicating that on average, the graduate's competency was good. This good competency could be attributed to their undergraduate training as well on job training coupled with adaptability skills. This finding compares to other studies done in various countries. It compares well to a study that was done in South Africa where the overall median competency of various specialist trainees on self-assessment was 3.0 (Dufourq *et al.*, 2017) . Additionally, it compares to the findings of a study by Siemon et al., (2018), where the authors assessed the self-reported competence of participants on how they effectively met the Tier 1 Core Competencies for Public Health Professionals, the overall median score was found to be 3.00. (Siemon *et al.*, 2018). In another study done in South Africa the graduates were found to be competent and confident in public health sciences (Tshitangano, 2016), while another one done in Zambia which found students to improve in their perceived competency skills as they progressed in their clinical years (Katowa-Mukwato *et al.*, 2014).

The findings are further corroborated by a study that was done in Netherlands which found a weighted competency score of 74.8 % among graduates of a problem based curriculum (Schmidt & van der Molen, 2001). This study findings therefore highlights a key aspect of education adding value to the students' competencies which is important in the labour market. Besides the importance of formal academic training institutions, the practitioner organizations appear to improve the productivity of graduates by acting as sources of learning and skill formation as well.

Regarding the graduates' functional roles at their place of work, the graduates' self-assessed competency median score was 2, denoting a fair score. This was evidenced by 39 (20.7%) rating their competencies to functional roles as poor, 64 (34%) rating fair, 56 (29.8%) rating good and only 29 (15.4%) rating their competencies to functional roles as excellent. These results are an indication that the graduates were still struggling to competently undertake their functional roles with some facing competency challenges. These results differ from the findings of a study that was done in London where graduates reported higher scores on their perceived learned skills in relation to their job placement (Aslam *et al.*, 2017). The variation in the findings could be related to the settings of the studies, the latter study having been done in a more developed country.

On adequacy of skills gained during undergraduate training, only 57 (30.3%) reported having acquired adequate skills to match job requirements. The study further established that 46 (24.5 %) of the graduates reported that the undergraduate training program did not form the basis for their present job placement. These findings are supported by a study that

was done in Kenya which revealed that university graduates were experiencing difficulties in entering the labour market due to skill mismatch attributed to the nature of courses undertaken (Ponge, 2013). Our study result also agrees with the findings of Abbas, *et al.,* 2014 who reported lack of congruency between what is taught and the work requirements, which, could lead to graduating public health practitioners who may be ill prepared for work requirements. The finding also confirm the criticisms on the workforce training and preparation of public health workforce raised in the Institute of Medicine (IOM) report of 2013 (D. Rodriguez *et al.*, 2013; Walker Jr, 1989), where caution was made on proper training of public health professionals. In fact, the IOM report of 2003 made calls for the development of additional competencies for both undergraduate education in public health and continuing education for the public health workforce. Furthermore, the proportion of graduates 39 (20.7%) who rated themselves poor on their educational competencies in relation to their job requirements is a major concern not only to the institutions of higher learning, but also to the commission for higher education. Some research reports have highlighted high rates of graduates' unemployment in the midst of employers lamentations of their inability to get skilled workforce for hire (Tóth-Téglás *et al.*, 2016). This notwithstanding, the findings of the in-depth interviews yielded a theme of determination by graduates to learn on their own in order to match their job demands. [**….**] *It was not easy at first, but I thank the Problem Based Learning strategy for the skills gained for I had to learn on my own (*IDI respondent 17*).* This narration underscores and emphasizes the importance of the existing curriculum implementation strategy of problem based learning that prepares graduates to direct their own learning for better outcomes. These findings are supported by a published educational review which reiterates that problem

based learning is an instructional approach that offers students flexible understanding and lifelong learning skills (Colliver, 2000; Hmelo-Silver, 2004)

Regarding planning and implementation for preventive and promotive activities, the median competency score was 3 and this competency is perhaps the only one with few graduates rating themselves as poor 7 (3.7%). Studies have shown that competencies on prevention and promotion are aimed at improving the health of a group of people (Wandersman *et al.*, 2008). Additionally, health promotion and prevention are used by graduates as a strategy to change populations' health behaviour patterns for improved quality of life. This educational competency has received a lot of attention and has been echoed and supported by various researchers and book authors (Eldredge *et al.*, 2016; Rosenstock, 1974; Wallerstein, 1992).

On the domain of public health practice, graduates reported to be more competent on conducting research, disease surveillance and control of communicable diseases. In addition, results from the in - depth interviews supported these findings with the recurring theme of being proficient in the control of communicable disease. The graduates reported to be more comfortable with functional roles on disease surveillance and disease control with COBES and ONE health being explicitly mentioned as the programmes with first hand student exposure [...] *practical exposure was not good but COBES and ONE health activities came in handy particularly for me in communicable disease control research (*IDI respondent 19). These findings compares with other studies done on disease surveillance and the role of one health in disease control which found out that One health

holistic approach is aiding immensely in infectious diseases control particularly the emerging zoonosis' (Frenk *et al.*, 2010; Organization, 2006, Gibbs, 2014). The results are further collaborated by studies from Uganda and Zimbabwe which found out that graduates who were more competent in disease surveillance had high retention rates at their work place (Mukanga *et al.*, 2010). Furthermore, the finding compares with that of (Tshitangano, 2016) where 97% (n=71) of the respondents reported that they were competent in research and development activities.

 On formulation and development of environmental health policies, this study revealed that 44.1% of graduates rated their competencies as either poor 42 (22.3%) or fair 41 (21.8%). This could be attributed to the training modalities since many graduates stated it as a competency challenge and recommended the entire policy module as a training need. These findings correspond to the findings found by Grimm and team in their study on assessment of education and training needs of Nebraska's public workforce where they found public health professionals to be less proficient in the area of policy development and implementation (Grimm *et al.*, 2015). In addition, the finding compares with the study by Tshitangano, (2016) where 97% (n=71) of the study participants rated themselves as incompetent in planning and management skills. This calls for the need to strengthen the competency development within undergraduate public health education and more implications for future research and curriculum improvement.

The graduate's self-rating on enforcing laws, regulations and by laws was unsatisfactory with about 87 (45%) of the respondents rating themselves as poor or fair. Similarly, the

law enforcement module was raised as a competency challenge and further recommended as a training need by the graduates. This result concurs with that of studies done in Nebraska, Australia and California which demonstrated low proficiency in policy and law enforcement among public health professionals. (Grimm *et al.*, 2015; D. Jackson, 2010; Jayakumar, 2008). This area of law enforcement evidently requires more emphasis in practical based exposures for improved skill proficiency development.

On graduate engagement in Continuing Professional development, 26 (13.8 %) of the graduates self - rated as poor and 44 (23.4%) as fair. The qualitative aspect of this study revealed a theme of challenges relating to high workload leading to poor attendance and participation in continuing professional education, thus low competency […..] *attending Continuing Professional Development(CPD) is a luxury for a few…. personally that is the time I struggle to meet timelines so I have to forego CPD attendance* (IDI respondent 13).This finding compares with the findings of a study that was done in the Delta state of Nigeria that revealed job workload as one of the factors hindering employees from attending continuing professional development training. (Chukwuma & Ofojebe, 2015). It further compares to the findings of a study done in Transnzoia west district Kenya that found out that high workload was one of the factors deterring workers from attending CPD (David and Bwisa, 2013). The inability of employees to get time for CPD could impact on their job performance and create major gaps in quality in health training institutions (Mumbo & Kinaro, 2015)

5.2 Employers assessment of graduate skills competencies

In this study, the employers rated graduates' competency score to be highest on teamwork and timely completion of assigned tasks, with a median competency score of 4, denoting that the graduates were excellent in these parameters. On these parameters, the employers attributed self-drive and motivation as some of the factors enhancing graduates' excellent performance. These findings compares to the findings of a study done in Uganda where employers were contented with the competencies exhibited by the graduates (Odongo *et al.*, 2017) and a study done at Deakin University, Melbourne, Australia in which despite focussing much on graduate readiness and employability, found team work and meeting timelines to be the key domains that employers rated best and look for when employing graduates (Cabellero & Walker, 2010). These findings are further corroborated by a comparative study done in Poland, united Kingdom and Netherlands that rated highly team work and communication skills (Biesma *et al.*, 2008). However, our findings differ from the results of a study that was done at the University of Nebraska which found that graduates were lagging behind in teamwork and problem solving skills, but were competent in communication skills (Andelt *et al.*, 1997). These variations however could be explained by the nature of the course training offered in that the latter study required graduates to negotiate and market their commodities for high profits. Again, employability is a critical issue currently and with the expansion in higher education and recent economic downturn, there is intense competition for jobs in the graduate employment market (Saunders & Zuzel, 2010)

On the employers' socio-demographic variables, the position of the employer respondent seemed to be associated with employers' rating of graduates' competencies ($\chi 2$= 12.916' p = 0.024). This compares to other studies which have reported strong associations between the employers' age and work experience and their rating of graduates' competencies (Numminen *et al.*, 2014, Lane & Bogue, 2010).

In our study, the employers did not seem to be satisfied with the graduates' communication skills because 13 (33.3%) of them rated the graduates' communication skills to be fair compared to other competencies that received favourable ratings. This could be attributed to graduates self-reported challenges faced during disaster and refugees scenarios in keeping up with communication updates. This result is comparable to the findings of a study done by the Council for industry and higher education in the United Kingdom which found that many graduates hold satisfactory qualifications but were lacking in soft skills notably communication and problem solving skills (Archer & Davison, 2008). This notwithstanding, there is need for a stronger emphasis on teaching that encourages active learning and integration of skills that will include communication skills crucial for enhancing graduate employability as well as fostering an open attitude to multidisciplinary working which is supported by the employers' perspectives and is equally essential in modern health care.

5.3. Graduates perception on preparedness to handle emerging public health challenges

Findings from this study indicate that more than half of the graduates 123 (65.4%) perceived to be prepared to handle emerging public health challenges implying that a

majority of the graduates were in a state of readiness on precautionary measures should any public health challenge arise. This compares to the findings of a study that was done in South Africa where four out of five health care workers were prepared to practice and handle challenges independently (Nkabinde *et al.*, 2013). The findings are further corroborated by the findings of a study done in Texas which established that of the health care workers trained in public health emergency response about 45.8% were prepared to respond to public health emergencies (Hsu *et al.*, 2006). However, our results differ with that of a study done in Columbia University which reported that despite extensive training in public health challenges and emergencies, the health professionals still felt unprepared for the public Health challenges (Markenson *et al.*, 2005). It is unsettling to note that 65 (34.6%) of the graduates in the current study perceived themselves as unprepared yet employers expect better prepared graduates. However, according to (Subbarao *et al.,* 2008) preparedness is a process and competencies must be reviewed over and over. Therefore, continuing professional development of environmental health practitioners is necessary for them to be kept abreast on issues of disease prevention and surveillance and other emerging public health challenges. In fact strengthening the capacity of these professionals will be in keeping in tandem with the world Health Organization's goal which opines that preparedness is an aspect of strengthening institutional and human resource management (Baack & Alfred, 2013; Organization, 2003).

The in-depth interviews revealed deficiencies related to the curriculum content and scope. The training content seemed not to meet the job demands for it was reported to be inadequate and as such graduates were not sufficiently prepared to handle emerging public

health challenges [...]*Very little was taught on emerging challenges preparedness, yet when out here I need to know regulations and litigations which were never mentioned* (IDI respondent 10). These findings compare to a qualitative study done in Kenya at the Aga Khan University that found interns experiencing difficulties in handling clinical challenges (Muthaura *et al.*, 2015) and to a study done in the United States established that population health training required greater depth in both curriculum content and scope (Allan *et al.*, 2005).

On experiences and preparedness, the study revealed a relationship between the number of years worked and preparedness to handle public Health challenges (p=0.041). It also showed that those who had worked for 1 -5 years were 3 times more likely to be prepared than those who had worked for less than one year (OR; 95% CL: 3.095; 1.177-8.138, p=0.022).These findings concur with that of a study done in Texas among nurses which found that those nurses with prior experiences were confident in handling challenges and disasters than those without prior experience (Baack & Alfred, 2013). The results also compare with findings of another study by (Gebbie & Merrill, 2002) where it was established that no two public health challenges or disasters where alike, but in each case effective response depended on the health care workers' experience and competencies acquired. However, our findings differed with those of a study done in Australia which found that the graduates were prepared and confident regardless of their experiences or other social demographics (Manakil *et al.*, 2015). The variations could be attributed to the practical experiences and exposures which graduates reported to be acutely missing in this

current study.

On the association between preparedness and competency scores, our study showed a statistically significant difference in the competency median scores between graduates who were prepared to handle public health challenges and those who were not (p=0.013). On further analysis, a unit increase in the competency score increases the graduates' chances of being prepared by 10.6% (OR; 95%CI: 1.106; 1.042-1.174, p=0.001). Our findings agree with that of a study by Hoge et al., (2005) who avers that there is need to focus and direct attention to the competency boosting of health care workers for better healthcare outcomes. Our research findings are also consistent with those of a study done in China which found significant differences among public health inspectors competency domains as per the adjusted odds regression levels (Ning *et al.*, 2014)

5.4 Graduates Professional Development Needs

Results from this study indicated that more than half of the employers 27 (69.2%) recommended professional training to the graduates to boost their competencies. These findings are consistent with findings from (Frenk *et al*., 2010 & Lanchance *et al.,* 2015) whose findings revealed the need for CPD for health care professionals to meet the changing public health environment. Additionally, our findings compares with that of a study done on the continuing education needs of a public health educators where 25% of the respondents gave topics which they needed more training on (Price *et al.*, 2004). Indeed, continuing professional development for health care workers is critical and particularly for public health practitioners since the challenges they face change considerably within a short period of time.

In this study, 15 (38.5%) of the employers noted some competency challenges among the graduates which they called skill gaps that needed professional training. Among other challenges, these were on policy lobbying, policy advocacy, technical and communication skills in disasters and refugee crisis, Environmental toxicology as well as strategic and leadership management. This compares with the findings of a study that was done in a rural based University in South Africa which revealed some competency challenges facing public health graduates and their professional development needs (Tshitangano, 2016). Our results are further supported by findings from a qualitative study that was done in Malawi, Tanzania and South Africa which found that training gaps and skills were filled according to the need and demand particularly in resource constrained countries (Feldacker *et al.*, 2017). Again, the qualitative findings of this study showed a theme of support for CPD planning and implementation to be guided by workforce and be geared towards the prioritized competency domains. This is with the understanding that CPD seeks to improve the quality of professional competencies on issues with which professionals are faced with certain challenges in their performance; employers also notes as part of investment into the healthcare system (Joyce & Cowman, 2007)

Majority of the employers pointed that provision of professional development is important in improving employee competency and indeed 21 (54.2%) stated that they do provide the support in form of reducing employees' workload while 11 (28.2%) support employees by granting study leave. These options were also mentioned by the graduates as the support they expected from their employers towards CPD activities.

Provision of this support is expected to enhance professional development activities of the graduates as evidenced by a study done in France which reported increased employees' enrolment, uptake and completion of professional development training as a result of employers' support for professional development activities (Castaño Muñoz *et al.*, 2016). In addition, Currant *et al*, 2006 asserted that for better public health outcomes, employer support for Continuing Professional Education (CPE) was key because it allows employees to perform better and this helps to keep their skills relevant in a rapidly changing world. On the other hand, (Murphy *et al.*, 2006) found that lack of employer support and difficulty of balancing home life work to be the major barriers to employees participation in CPD programs.

The findings from in depth interviews revealed some existent gaps between graduates' expectations and the scheduled CPDs by employers. The graduates reported that the schedules were repetitions of subject areas already covered, denoting lack of teamwork between stakeholders when planning for the CPD sessions. These findings differ from other studies done in various parts of Africa that have showed support for the need for continuing professional education to be planned by health care workers as a team (Hongoro & Normand, 2006, Reeves *et al.*, 2013). In Uganda for example, a study found that a needs assessment must be done with the healthcare workers before CPD planning for it to address the existing healthcare workers needs and weaknesses (Giri *et al.*, 2012) while in South Africa, team work in planning CPDs yielded higher outcomes in health as a result of human resource performance (Hongoro & McPake, 2004) whereas in Malawi, continued access to CPD was done in a coordinated manner even at hand over meetings (Muula *et*

al., 2004). This therefore calls for the CPDs to be carefully tailored to meet the contextual needs of the workforce.

5.5 Conclusion

This chapter presented the discussion and interpretation of the research findings against the existing literature review based on the pre-set objectives.

<u>CHAPTER SIX</u>

CONCLUSION AND RECOMMENDATIONS

6.0   Introduction

This chapter presents conclusion and recommendations of the research findings as per objectives.

6.1 Conclusion

The overall self-assessed educational competency score was 3, indicating that the graduates' educational competency was satisfactory. However, there was a higher proportion of graduates rating themselves poor on their educational competencies in relation to their present job requirements. Also, a higher proportion of graduates indicated not to have attained adequate skills to merge the assigned tasks. Consequently, it can be concluded that the educational competencies in formal academic training does not entirely conform to the graduates' current working role. There is therefore need for stakeholders to workout modalities that combine theoretical knowledge with practical skills that merge the needs and market demands. In addition, the graduates require a lot of support for professional training and continuous professional education to boost their competencies rather than relying solely on the educational competencies.

The study has established that the training in Bachelor of Science Environmental Health formed a basis for the graduates' current job placement, and that the basic degree was crucial in their current jobs. Indeed, the theme of public health mastery was dominant during the in-depth interviews with COBES and ONE health programs being explicitly mentioned as boosting their job suitability and adaptability. Those who had ever

encountered competency challenges indicated lack of adequate practical exposure, inadequate industrial placement, inadequate technical skills from the tutors, lack of resource centre for learning demonstration and workmanship as some of their limiting factors. Otherwise, the graduates applauded the curriculum implementation strategy of problem-based learning.

Employers rated highly the graduates' competencies on teamwork and timely completion of assigned tasks whereas the graduates' communication skills was perceived as fair. This calls for the reinforcement of the training on communication skills so as to improve on the graduates' competency of this soft skill.

More than half of the graduates interviewed perceived themselves to be prepared to handle emerging public health challenges. The employers' rating on graduate preparedness was also positive with more than half of them rating graduates as good and excellent. Those graduates who perceived themselves as not prepared cited challenges that included lack of practical exposure, depth and scope of unit courses, as well as the dynamics nature of public health issues.

It is also concluded that the graduates perceived themselves to be prepared to handle emerging public health challenges and this was fortified by the graduates' experience in the field and the number of years worked.

The study also concludes that professional training is needed to boost graduates' competencies at their place of work. The main support options available to the graduates from the employers included reducing workload and study leave. However graduates feared lack of support from the employers with the possibility of being required to quit their jobs in lieu of their professional advancement. Otherwise support for professional training to graduates was favored and supported by both the employers and the graduates, but a lot of collaboration and collective planning is paramount in meeting the professional needs of the individual graduate's health care worker.

6.2. Recommendations

These are specific actions to be taken with regards to the findings of the study.

6.2.1 Policy recommendation

Policy recommendations serve to inform people who are faced with policy choices on particular issues about how research and evidence can help make the best decisions.

6.2.1.1 Recommendation for institutions of higher learning

i. There is urgent need for relevant skills development to reduce skill mismatch with tasks in the field

ii. There is need to involve various stakeholders like the industry, alumni, practitioner organizations during every cycle of curriculum review to ascertain that curriculum content and implementation matches the real job requirements

iii. Develop infrastructure specific to each course offered at the respective institution of higher learning

iv. Recruit adequate, qualified staff who should receive continuing training to be able to produce industry level graduates

v. Reinforce the need for practical exposure by either inviting industry based experts for lectures, student industry placement, and where possible establish an equipped learning resource Centre for practical exposures

vi. Focus on training on adaptability skills for graduates to be able to adopt and cope in different work environment.

6.2.1.2 Recommendation to the Public Health Officers and Technicians Council

i. Have input in curriculum reviews with focus on the job and market needs of the graduates.

ii. Develop professional development courses to attract professionals seeking for additional knowledge as demanded by market or labor needs

iii. Maintain quality assurance in learning institutions through constant monitoring and inspection/assessment as well as feedback mechanisms for improvement

6.3 Recommendations for further research

These are aspects that can be improved in order to make future research on this topic more accurate and more meaningful to represent the whole population of Environmental Health graduates and Environmental Health Professionals

i. The present study focused only on B.Sc. Environmental Health graduates from Moi University and their corresponding practitioner organizations. To obtain results that can be generalized to the entire country on the subject matter, future

research to include other institutions of higher learning offering Bachelor of Science in Environmental Health degree program.

ii. Further research to assess how accreditation, certification and credentialing affect the capacity of work force training and performance.

iii. This current study focused on core competencies in general, thus future studies on the same to focus on the core competencies per tier to compare how competencies are demonstrated in each tier.

iv. Further research on the same aspects to include qualitative aspect for the employers to get in depth perceptions of these employers on the various aspects of graduate competency levels.

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APPENDIX 1: TRANSMITTAL LETTER FOR GRADUATES

Hellen Jepngetich
Moi University, School of Medicine
Department of Medical education
P.O Box 4606 – 30100, Eldoret, Kenya
13th December, 2016

Dear Sir /Madam,

R**E: CONSENT FOR INTERVIEW**

I am a student at Moi University Eldoret Kenya, pursuing a Doctor of Philosophy degree

(D. Phil.) in Medical Education. As a partial fulfilment of the requirements for the award

of the degree, I am carrying out a research study on **"Perceptions of B.Sc Environmental**

Health Graduates' Academic Competencies and Public Health Requirements in

Kenya: Graduate and Employer perceptions"

The study is a descriptive cross-sectional study which involves collecting data using
questionnaires and in depth interviews. The questionnaires will be availed to you through
your email via a link if you consent to participate. At a later time, we will arrange to meet
for further interview one on one at a venue convenient to you. You have been selected as
one of the respondents for this study because you completed your undergraduate degree
(B.SC.EVH) from Moi University.

The purpose of this study therefore is to seek your consent to participate by responding to
the questions in the survey tools and to also be available if called upon for the interview.

The information provided will be treated with the highest degree of confidentiality. Upon
completion of this study, the findings will be used for academic purposes and will be
availed to you.

If you accept to be a respondent, please sign this consent form

Sign _____ Date_____

Thank you for accepting to participate in the study

Hellen Jepngetich

Tel. 0721271337

Email: jepngetichkeny@gmail.com

APPENDIX II: GRADUATE QUESTIONNAIRE

STUDY TITLE: **"Perceptions of B.Sc Environmental Health Graduates' Academic Competencies and Public Health Requirements in Kenya: Graduate and Employer perceptions"**

DATE: _____ **REF. NO:** _____

Do not write your name anywhere in the questionnaire.

SECTION A: Demographic Data

1. Age group

   ☐ < 25 years   ☐ 25 – 34 years   ☐ 35 – 44 years
   ☐ 45 - 54 year   ☐ 55 – 64 years   ☐ Above 65
2. Sex ☐   Male   ☐ Female

3. Year of qualification/ graduation ………………………………….

4. What is your current career field?

   ☐Research   ☐Monitoring and Evaluation   ☐Nutrition
   ☐HIV/AIDS   ☐Non –communicable diseases   ☐Disease surveillance
   ☐Water and sanitation ☐ Administration   ☐Disaster management
   ☐Community health   ☐ Academia   ☐Infection prevention
   ☐Others (Specify) ………………….……………………………….

5. Name of current employer………………………………………….

6. Current position with the current employer …..……………………

7. Length of working with current employer

   ☐ < 1 year   ☐ 1 – 3 years   ☐ > 3 – 5   ☐ above 5 years ☐ others (Specify) ……

8. a) Before this, did you work with any other employer?
      ☐ Yes   ☐ No

   b) If Yes, what were some of the reasons for changing job?
   ....
   ....
   ....
   ....
   ....

SECTION B: Graduate competency as per undergraduate training

9. For the following questions, please rate if the training you received met the competency levels for the undergraduate. The B.Sc. Environmental Health Curriculum Objectives - EVH Program Outcomes has been used. For each parameter, kindly indicate if additional training is required to improve skills/performance/ competency.

Kindly indicate your competency in a scale of 1 – 4 where;

1 – "Poor", 2 – "Fair" 3- Good" 4 -"Excellent"

S.No	EVH program outcome	Public Health competency (Adapted Council of linkages between PH and Academia	Your competency rating	Additional training requirement
1	Planning health preventive activities	Puts out strategies of change to improve health	□ **Excellent** □ **Good** □ **Fair** □ **Poor**	
2	Planning health promotive activities	Develops actions to increase peoples control of health	□ **Excellent** □ **Good** □ **Fair** □ **Poor**	
3	Implementing preventive & promotive activities	Institute activities for public health improvement	□ **Excellent** □ **Good** □ **Fair** □ **Poor**	
4	Evidence based decision making	Describes reviews of scientific evidence related to public Health issue, concerns or intervention into practice of public health	□ **Excellent** □ **Good** □ **Fair** □ **Poor**	
5	Water and sanitation programs	Management of organizational change	□ **Excellent** □ **Good** □ **Fair** □ **Poor**	
6	Surveillance and control of communicable diseases	Communication skills	□ **Excellent** □ **Good** □ **Fair** □ **Poor**	
7	Food quality control assuring	Ascertains food quality control	□ **Excellent** □ **Good**	

			□ Fair	
	food quality		□ Poor	
8	Conducting sanitary inspections	Identifies sources of health problems and institutes preventive/promotive measures	□ Excellent □ Good □ Fair □ Poor	
9	Occupational health and safety	Generates variables that measure public health conditions	□ Excellent □ Good □ Fair □ Poor	
10	Planning and implementing training programs in EVH	Advocates for individual team and organizational learning opportunities within organization	□ Excellent □ Good □ Fair □ Poor	
11	Formulation and development of EVH policies	Policy development & Program planning skills	□ Excellent □ Good □ Fair □ Poor	
12	Enforcing laws, regulations and by laws relevant to public health	Ensures public health programs are consistent with public health laws and regulations	□ Excellent □ Good □ Fair □ Poor	
13	Conducting research and suggesting solution to public health problems	Contributing to building the scientific base of public Health	□ Excellent □ Good □ Fair □ Poor	
14	Engaging in Continuing professional development	Developing strategies for continuous quality improvement	□ Excellent □ Good □ Fair □ Poor	

10. Basing on the undergraduate training that you received, would you say the training you received formed the basis of your job position?
   □ Yes   □ No

11. Would say the skills you attained in your undergraduate training is adequate to undertake you current tasks? □ Yes   □ No

12. With your basic degree skills in B.Sc. EVH, would you say you are prepared to handle emerging public health challenges? □ Yes   □ No
   How would you rate your educational competency in relation to your current workforce and practice?
   □ **Excellent**   □ **Good**   □ **Fair**   □ **Poor**

Overally, how would you rate the content of the BSc. Curriculum you trained in?

□ **Excellent**   □ **Good**   □ **Fair**   □ **Poor**

15. What is your rating on using Problem based learning as a strategy for implementing Bsc. EVH Curriculum?

□ **Excellent**   □ **Good**   □ **Fair**   □ **Poor**

13. What would you say about your ability and preparedness to handle public health emergencies?

□ **Excellent** □ **Good** □ **Fair** □ **Poor**

16. If you were to undertake additional training to improve your competency; how would your employer support you?

□ Fund my studies □ Grant study leave □ reduce workload to give room for studies   □No   form   of   support   □   others (specify)…………………………………………………….

17. Are there any competency challenges that you have ever faced while working since graduation? □Yes □ No

If   yes,   kindly   suggest   any   measures   to   address them……………………………………………………………………………… …………………………………………………………………………………

18. Any suggestion about the curriculum to improve B.SC Environmental Programme? Kindly list them below

1. ……………………………………………………………

2. ……………………………………………………………

3. …………………………………………………………….

4. …………………………………………………………….

5. ……………………………………………………………

Thank you very much for your time, cooperation and responses.

APPENDIX III: GRADUATE INDEPTH INTERVIEW GUIDE

 Questions on "Perceptions of B.Sc. Environmental Health Graduates' Academic Competencies and Public Health Requirements in Kenya: Graduate and Employer perceptions"

DATE: _____ REF. NO: _____

a)   Age: _____Sex: _____Employment status_____

b) Position at the organization: _____

c) How long did you take before you got employed after internship? From the time of graduation?

d) How difficult was it to seek for employment with B.Sc. EVH? Probe for relevance, expectation, popularity of the course? University? Pioneer graduates?

e) Tell me about your work as you compare with your training? Probe for prior knowledge about their roles/ job description?

f) What would you say about your performance and the organization expectations?

g)   Are there any competencies you may be lacking? Tell me more about them?

h) How can these be improved to the future graduates?

i)   You remember the mode of teaching at Moi CHS? Tell me about it (probe for concerns, what people say about it, how it compares with lecture methods? Did it help you? Would you like it changed?

j) Tell me about your thoughts on the Moi University EVH Curriculum and the work you do, any courses to be included? Any to be removed? Any redundant?

k) Does the organization/ employer support additional professional training for you as graduates? Probe for ways of support, any scheduled routines trainings?, Subject areas?

l) What areas have you found wanting/challenging to you as an EVH Graduate?

m) Any comments to school, department, program?

Thank you very much for your time

APPENDIX IV: INFORMED CONSENT FOR EMPLOYER'S

Study Title: Perceptions of B.Sc. Environmental Health Graduates' Academic Competencies and Public Health Requirements in Kenya: Graduate and Employer perceptions"

Introduction
You are being asked to take part in a research study. This information is provided to tell you about the study after which you will indicate your free will to participate. Please be free to ask any related questions.

Purpose of the study
The purpose of the study is to assess the extent at which B.Sc. Environmental Health curriculum structure and implementation conform to graduates' practice   and workforce demands.
Your participation in the study
Taking part in this research study is voluntary and you have a right to decline participation. Saying no will not affect your rights to health care or any other services.   If you agree to participate in the assessment, please respond to the listed questions and comments in the questionnaire, which will take 5 to 10 minutes of your time. You are free not to answer any specific question and to stop at any time or point without any consequences. There is no right or wrong answer or comment. Please be as honest as possible

Confidentiality
The information you provide will be treated confidentially. Your permission will be sought should there be any occasion requiring you to be identified as the respondent.

Benefits/Risks/Discomfort
 The study will help in strengthening the infrastructure of public Health workforce training and practice

Contact persons;
Any questions/ clarifications about the study, please contact Hellen Jepngetich, of P.O Box 1780, Eldoret on kenyhellen@yahoo.com
In case of questions about your rights as a research subject, may contact Institutional Review Ethics Committee (IREC) 053 33471 Ext.3008. IREC is a group of people that reviews studies for safety and to protect the rights of study subjects.

Part II: Consent of Subject:
 I have read or have had read to me the description of the research study. The investigator or his/her
 representative has explained the study to me and has answered all of the questions I have at this time. I
 have been told of the potential risks, discomforts and side effects as well as the possible benefits (if
 any) of the study. I freely volunteer to take part in this study.

_____   _____
Name of Participant   Signature of subject/thumbprint Date and Time
(Witness to print if the
Subject is unable to write

          _____   _____
Name of Representative/Witness   Relationship to Subject
          _____   _____   _____
Name of person Obtaining Consent   Signature of person obtaining consent   Date

APPENDIX V: B.Sc. EVH EMPLOYER'S QUESTIONNAIRE

STUDY TITLE: **Perceptions of B.Sc. Environmental Health Graduates' Academic Competencies and Public Health Requirements in Kenya: Graduate and Employer perceptions"**

DATE: _____ **REF. NO:** _____

Do not write your name anywhere in the questionnaire.

SECTION A: DEMOGRAPHIC DATA

1. Organization ………………………………………
2. Age group

   ☐ < 30 years   ☐ 30 – 39years   ☐ 40 – 49 years
   ☐ 50 - 59years   ☐ 60 – 69years   ☐ > 70 years

3. Sex   ☐ Male   ☐ Female
4. Current position

   ☐ Head of Department
   ☐ Human resource
   ☐ Supervisor
   ☐ Program manager
   ☐ Administrator
   ☐ Others (Specify)…………………………………………….
5. Duration worked for the institution

   ☐ < 2 years
   ☐ 2 – 5 years
   ☐ 5 - 10 years
   ☐ > 10 years
   ☐Others (Specify) …………………

SECTION B: Graduates Competency assessment

   Kindly **rate** the graduates' competency under the selected skills adopted from the council of linkages between PH and Academia in a scale of 1 – 4 where;

1 – "Poor", 2 – "Fair" 3- Good" 4 -"Excellent"

6. Analytic and assessment skills
   a. Ability to review health status of population and their related determinants of health and illness ☐ **Excellent** ☐ **Good**   ☐ **Fair**   ☐ **Poor**
   b. Can describe the characteristics of population based health problems ☐ **Excellent** ☐ **Good**   ☐ **Fair**   ☐ **Poor**

    c. Able to apply ethical principles in the collection, maintenance and dissemination of data and information □ **Excellent** □ **Good** □ **Fair** □ **Poor**

7. Planning skills

    a. Can evaluate information relevant to specific public health policy issues □ **Excellent** □ **Good** □ **Fair** □ **Poor**

    b. Determining policy for public health organization □ **Excellent** □ **Good** □ **Fair** □ **Poor**

    c. Ensuring public health programmes are consistent with the public Health laws and regulations □ **Excellent** □ **Good** □ **Fair** □ **Poor**

8. Communication skills

    a. Communicates the role of public health within the overall health system
□ **Excellent** □ **Good** □ **Fair** □ **Poor**

    b. Ensures variety of approaches are considered and used to disseminate public health information □ **Excellent** □ **Good** □ **Fair** □ **Poor**

9. Job knowledge

    a. Ability to follow verbal and/or written instructions. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

    b. Ability to use proper procedures. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

    c. Depicts know how while using methods and tools. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

    d. Shows improvement on repetitive tasks. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

    e. Able to train others (if applicable). □ **Excellent** □ **Good** □ **Fair** □ **Poor**

    f. Has practical and technical knowledge on job performance □ **Excellent** □ **Good** □ **Fair** □ **Poor**

10. Quality of work by the employee (Graduate)

    a. Works accurately and precisely □ **Excellent** □ **Good** □ **Fair** □ **Poor**

    b. Ability to recognize and point out substandard workmanship. □ **Excellent** □ **Good** □ **Fair** □**Poor**

    c. Displays thoroughness and completeness in work activity. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

    d. Takes proper care of equipment □ **Excellent** □ **Good** □ **Fair** □ **Poor**

11. Productivity

    a. Ability to complete assigned work on time □ **Excellent** □ **Good** □ **Fair** □ **Poor**

    b. Proper time management. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

    c. Organized in executing assigned responsibilities □ **Excellent** □ **Good** □ **Fair** □ **Poor**

12. Reliability

    a. Meeting timelines. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

b. Works independently with minimum supervision. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

c. Shows efficiency in completing tasks within required time frames. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

d. Puts in extra time and effort. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

e. Gives the best efforts within minimum job standards. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

13. Teamwork

a. Works well with supervisors, peers, and subordinates. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

b. Sets an example with a positive and supportive attitude. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

c. Communicates well with coworkers and supervisors. □ **Excellent** □ **Good** □ **Fair** □ **Poor**

d. Promotes teamwork in the work place □ **Excellent** □ **Good** □ **Fair** □ **Poor**

14. Please rate the graduates' preparedness to handle emerging public health problems and challenges

□ **Excellent** □ **Good** □ **Fair** □ **Poor**

15. Are there any professional training needs to boost the graduate's competencies? □ Yes

□ No If yes, please

indicate…………………………………………………………………………

16. Does your organization support additional professional training for the graduate?

□ Yes □ No

If yes, please indicate the form of support

□ Fund studies/training

□ Grant study leave

□ reduce workload to give room for studies

□ Others (specify)…………………………………………….

17. Are there any specific areas that the organization wished the graduates would be more conversant with? □ Yes □ No

If Yes, please state the areas…………………………………………………………………………

……………………………………………………………………

18. Are there any areas you have found challenging to the EVH Graduates' performance □ Yes □ No

If yes, please indicate the areas

…………………………………………………………………………………………………

………………………………………………………………………

19. How do you rate the Moi University EVH Graduates as compared to those of other institutions?

□ Excellent □ Good □ Fair □ Poor

Thank you very much for your time and responses.

APPENDIX VI: IREC FORMAL APPROVAL

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471//2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET

Reference: IREC/2016/78
Approval Number: 0001701

9th August, 2016

Ms. Hellen Jepngetich,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

INSTITUTIONAL RESEARCH &
ETHICS COMMITTEE
09 AUG 2016
APPROVED
P.O. Box 4606-30100 ELDORET

Dear Ms. Jepngetich,

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

"Assessment of B.SC Environmental Health Graduates' Academic Competencies in Relation to Real Life Public Health Demands and Practice in Kenya".

Your proposal has been granted a Formal Approval Number: *FAN: IREC 1701* on 9th August, 2016. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 8th August, 2017. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc	CEO	-	MTRH	Dean	-	SOP	Dean	-	SOM
	Principal	-	CHS	Dean	-	SON	Dean	-	SOD

APPENDIX VII: BACHELOR OF SCIENCE, ENVIRONMENTAL HEALTH PROGRAM CURRICULUM

BACHELOR OF SCIENCE IN ENVIRONMENTAL HEALTH
The programme shall be called Bachelor of Science in Environmental Health

1.1   Introduction

An estimated 12.6 million people died as a result of living or working in an unhealthy environment in 2012 – nearly 1 in 4 of total global deaths, according to the latest estimates from WHO. Environmental risk factors, such as air, water and soil pollution, chemical exposures, climate change, and ultraviolet radiation, contribute to more than 100 diseases and injuries. By focusing on reducing environmental and social risk factors, nearly a quarter of the global burden of disease can be prevented. Examples include promoting safe household water storage, better hygiene measures, safer management of toxic substances in the home and workplace. At the same time, actions by sectors such as energy, transport and agriculture are required urgently, in cooperation with the health sector, to address root environmental and social causes of ill-health that lie beyond the direct control of the health sector.

Our environment and health are pivotal to today's world and its future sustainability; health is the focal point of humanity and without proper health systems, our existence would be at stake. Simultaneously, climate change, global warming, pollution, and the depletion of natural resources present serious issues that affect our long-term well-being.

At Moi University, the School of Public Health has been established to equip students with the skills required to help develop solutions to these significant, global issues, and to develop individuals with a broad knowledge of the continuously evolving health sciences field. The Bachelor of Science in Environmental Health program will provide one with the knowledge and skills to successfully confront these challenges in a systematic manner, and to make an important contribution to the Kenyan health workforce on graduation.

The Central Board of Health in the Ministry of Health in their meeting on 10th June, 1992 recommended the training of Public Health Officers at BSc. level in the Faculty of Health Sciences, Moi University.

The Kenya Vision 2030 is the national long-term development blue print that aims to transform Kenya into a newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a "clean and secure environment". Industrialization and technological advances will bring about new environmental health

issues. This will require an Environmental Health Officer who is highly trained to deal with these issues competently.

The Kenya Constitution of 2010 created forty seven (47) counties that formed the basis of devolution. This led to devolution of functions, including health to counties. The counties are in need of highly trained Environmental Health Officers (PHOs) to serve in county governments. Health services were previously centralized and managed in Nairobi leaving low level staff in the districts which have now been elevated to counties.

The B. Sc. Environmental health graduates have high demand because the Ministry of Health and Health related NGO's employ them immediately after passing final examination.

1.2 Vision Moi University
To be the University of choice in nurturing innovation and talent in science, technology and development.

1.3 Mission of Moi University
To preserve, create, and disseminate knowledge, conserve and develop scientific, technological and cultural heritage through quality teaching and research; to create a conducive work and learning environment; and to work with stakeholders for the betterment of society.

1.4 Core Values of the University
   i. Promotion and defence of intellectual and academic freedom, scholarship and relentless search for truth.

   ii. Fostering teamwork, innovation, networking, tolerance, and a culture of peace.

   iii. Embracing excellence, transparency & accountability.

   iv. Practicing professionalism, meritocracy, equality, integrity and social justice.

   v. Maintaining self-respect, discipline, responsibility, institutional loyalty, national patriotism & international competitiveness.

   vi. Continual improvement of services in order to remain competitive and relevant.

1.5 Vision of College Health Sciences
To be a center of excellence in the training of health professionals, conduct of health research and provision of extension services nationally and internationally.

1.5.1 Vision of School of Public Health
A regional and international center of excellence in training, research, practice and service in Public Health.

Vision of the Department of Environmental Health

To be a Regional and International centre of excellence in Environmental health training, research and development.

1.6   Mission of College of Health Sciences

To produce competently trained health professionals capable of dealing with current and emerging health challenges of the 21st century.

1.6.1 Mission of School of Public Health

To produce public health graduates who have practical and intellectual skills appropriate to the health needs of present and future society.

Mission of the Department of Environmental Health

To train environmental health practitioners through innovative medical education strategy and produce professionals who will approach environmental health issues with a holistic perspective and critically analyze problems with a view to integrating theory and practice in the assessment and provision of preventive and promotive health services

1.7   Philosophy of the Programme

The Bachelor of Science (B.Sc.) Environmental Health Programme aims at producing graduates capable of addressing environmental health issues from a global perspective and analyzes environmental health problems with a view to proposing solutions. Environmental Health student will acquire the necessary knowledge and skills through the Problem Based Learning (PBL) strategy conducted in form of overviews, lectures, tutorials, self-directed learning, practical, assignments, projects, demonstrations, field visits and attachments. The students will gain practical skills by conducting applied research, and participating in the prevention and control of diseases through community health education activities during attachments.

1.8   Rationale of the Programme

Training of Environmental health graduates, will support United Nations Sustainable Development Goals number 3 and 6 and Kenya Vision 2030 which identifies foundations for National transformation among them health, environment, water and sanitation. The Water and Sanitation Program (WSP, 2012), a multi-donor partnership administered by the World Bank established that Poor sanitation costs Kenya 27 billion Kenyan Shillings each year, equivalent to US$324 million. The Ministry of Health, in its 2014 – 2018

Strategic Development Plan, indicates the need to recruit 7,282 environmental health personnel among others. The programme will also provide avenue for progression to degree level of those with the Diploma in environmental health/public health.

A Stakeholders' meeting was held on 10th to 13th May 2016 to validate the curriculum. Their inputs and suggestions were considered in order to enrich the curriculum.

The need for developing manpower in this discipline has been necessitated by increasing environmental health challenges resulting from natural causes and human activities including urbanization, industrialization, and generation of -wastes, global warming, emerging and re-emerging diseases, non-communicable diseases and bioterrorism. In addition, the devolved system of governance in Kenya calls for increased health work force. For the country to cope with these environmental health challenges it is necessary to train adequate Environmental Health Practitioners capable of integrating theory and practice in assessing, and managing environmental health issues affecting the health of the people

1.9 Goal of the Programme
The goal of the program is to produce competent Environmental health professionals capable of managing environmental health issues using innovative approaches for the wellbeing of the community through planning, implementing, monitoring and evaluating preventive and promotive health programmes.

Objectives of the Programme

1. Plan, implement and evaluate sanitation programmes.

2. Monitor the prevention and control of communicable and non-communicable diseases

3. Assure food and water quality and safety.

4. Assure environmental safety and management

5. Assure occupational safety and health.

6. Enforce laws, regulations and by- laws relevant to Environmental Health.

7. Engagement in Continuing professional development

8. Conduct research on Environmental Health.

9. Formulate and develop environmental health policies.

1.11 Expected learning outcomes of the programme.

1. Develop and apply strategies to prevent and control communicable non-communicable diseases.

2.   Carry out disease surveillance and disease investigation.

3   Ensure food quality.

4   Protect community water resources and ensure water quality

5   Design, construct and inspect sanitary facilities

6   Approve building plans, conduct premises inspections and write reports.

7   Assess Health risks for work places and develop mitigation measures.

8   Assess Environmental Pollution.

9   Enforcement Environmental/Public Health Regulations, and standards

10   Conduct scientific research and publish on Environmental Health issues

11   Formulate and develop environmental health policies.

0   ACADEMIC REGULATIONS FOR THE PROGRAMME
2.0.1 Admission Requirements for the programme

1. All candidates admitted to the Bachelor of Science Degree in Environmental Health in the School of Public health must satisfy the following requirements:-

   (i)   They must satisfy common University regulations on admission.

   (ii)   In addition, candidates must obtain at least the minimum cut-off points for the year as determined from one of the following subject clusters drawn from the Kenya Certificate of Secondary Education (KCSE) at "C+" level for each of the following subjects: Mathematics or Physics; Chemistry/Physical sciences; Biology/Biological Sciences; English/Kiswahili

2. Those holding qualifications equivalent to the above from institutions recognized by Moi University Senate may be considered.
3. Those with "A" level; 3 principal passes in Biology, chemistry and either physics or maths may be admitted.
4. Those with a Diploma in Environmental Health or a related field and a minimum of C in KCSE may be considered for credit transfer in accordance with Moi University policy on credit transfer.

2.0.2   Course Requirements.
(a) Student Class Attendance
This shall be in accordance with Moi University Rules and Regulations Governing Undergraduate Examinations

b) Obligations of the Lecturer
>This shall be in accordance with Moi university procedure for curriculum delivery

2.0.3 Regulations on Credit transfer in the Programme
>This shall be in accordance with Moi University policy on credit transfer

2.0.4   Management and Administration of the Programme

The programme will be housed in the School of Public Health, Department of Environmental Health. The Dean of the school will be responsible for overall leadership of the Programme and answerable to theDeputy Vice Chancellor Academics, Research and Extension. Administration of the programme shall be led by the Head of Environmental Health Department in accordance to Moi University quality procedures.

2.1   Duration of the Programme

The Bachelor of Science in Environmental Health will normally take a minimum of four (4) years and a maximum of eight(8) years,unless on the recommendations of the School Board for exemption and senate approval.

2.2   Mode of delivery of the programme.

A semester mode shall be used, employing methods that encourage learner-centered-active learning including small group tutorials, overview lectures, discussions, demonstrations, laboratory work, practical sessions, field trips, research projects and field attachments. The programme will be taught using any of the following three methods – full- time, part-time and distance learning modules (DLM). Full-time and part-time modes of study will use face to face strategy. The DLM method will use both hard and soft materials modeled for self-study. The materials will include interactive questions and tests that allow the student to gauge their progress as they study.

2.3   Assessment and Examination Procedures

The course lecturer/ tutor shall assess progress through continuous assessment guided by University Examinations Regulations.

Assessments will include a minimum of two Continuous Assessment Tests (CATs) that may include: take home assignments, seminar presentations, field assessments, laboratory practical assessments, and End of Semester Examinations (ESE) and proposals, abstracts and an oral defense of the students research work.

The B.Sc. Environmental health degree course shall be examined as follows:
   i.   Continuous Assessment Test (CAT) shall include a written paper, a practical, supervision assessment, log book marks, seminar presentation or a report. The CAT shall be marked out of 30%.

ii. End of Semester Examination (ESE) shall be marked out of 70%.
iii. End of Semester (ESE) examinations shall include a written paper and practical where indicated.
iv. Courses involving field activities like Field Attachment, Research methodology and Project shall be examined as follows:-
v. Individual oral presentation, logbook, and tutor assessments including group presentations at the end of the course shall constitute CAT marks of 30%.
vi. Final report by the student or the group shall constitute End of Semester (ESE) marks of 70%. The courses with practical shall earn 55marks for theory and 15 marks practical giving a total of 70%.
vii. The Pass mark shall be 40%.
viii. End of the Semester Examinations (ESE) for the various courses shall be examined according to the schedule below.

Exam Code	Exam Title	Weight Units	Written Practical (*)
MAT: 100	Mathematics for Environmental Health	3	1x3hrs
PEH: 101	Basic Life Support and Emergency Care	3	1x3hrs
BBT: 111	Physics for Health Sciences	3	1x3hrs
EHB: 111	Principles of Chemistry	3	1x3hrs
PEH: 102	Principles of Behavioral Sciences	3	1x3hrs.
PEH: 110	Human Anatomy and Physiology	4	1x3hrs *
PEH: 111	Principles of Environmental Health	4	1x3hrs
PEH: 112	Anatomy & Physiology of Food Animals	4	1x3hrs
PEH: 113	Technical Drawing & Land surveying	5	1x3hrs
PEH: 100	Introduction to Computer Applications	3	1x3hrs
HRD: 100	Communication Skills I	3	1x3hrs
PEH: 114	Climate Change and Health	3	1x3hrs
HRD: 104	Quantitative Skills	3	1x3hrs
	Total	**44**	

Year Two

Exam Code	Exam Title	Weight Units	Written Practical (*)
PEH: 200	Biostatistics	3	1 x 3hrs
PEH: 209	Biochemistry	4	1x3hrs *
PEH: 210	Immunology	4	1x3hrs
PEH: 211	Microbiology & Parasitology	5	1x3hrs *
PEH: 212	Ecology	3	1x3hrs *
PEH: 213	Entomology & Pest Management	5	1x3hrs *
PEH: 214	Water Supply and Quality Control	5	1x3hrs*
PEH: 215	Human Nutrition	3	1x3hrs
PEH: 216	Conservancy	3	1x3hrs
PEH: 217	Epidemiology	3	1x3hrs
PEH: 218	Field Attachment I	6	Report
	Total	**44**	

Year Three

Exam Code	Exam Title	Weight Units	Written Practical (*)
PEH: 300	Research Methodology	3	Report
PEH: 310	Building Science & Technology	6	1x3hrs
PEH: 311	Liquid Waste Management	6	1x3hrs
PEH: 312	Solid Waste Management	5	1x3hrs
PEH: 313	Environmental Pollution & Control	4	1x3hrs
PEH :314	Introduction to pharmacology and toxicology	4	1x3hrs
PEH: 315	Meat Pathology & Inspection	5	1x3hrs *
PEH: 316	Food Science and Technology	5	1x3hrs *
PEH: 317	Health Services Management	4	1x3hrs
PEH: 318	Project Mgt, Monitoring & Eva	3	1x3hrs
	Total	**45**	

Year Four

Exam Code	Exam Title	Weight Units	Written Practical
PEH 400 E:	Environmental Health Elective	4	Report
PEH: 410	Land Development & Settlement Mgt.	4	1x3hrs
PEH 411	Biotechnology and Health	3	1 x 3 hrs
PEH 412	Communicable & Non-Comm Diseases	4	1x3hrs
PEH 413	Field Attachment (Community Health II)	6	Report
PEH: 414	Occupational Safety & Health	4	1x3hrs
PEH 415	Research Project	5	Report
PEH: 416	Ports Health	3	1x3hrs
PEH: 417	Public Health Laws	3	1x3hrs
PEH: 418	Disaster Preparedness & Management	3	1x3hrs
PEH: 419	Environmental Impact Assessment & Audit	3	1x3hrs
PEH: 420	Health Promotion	3	1 x 3 hrs
	Total	**45**	

2.3.1 Grading system

Each course shall be graded as follows:

Percentage Marks	Letter Grade	Performance
70 – 100	A	Excellent
60 – 69	B	Good
50 – 59	C	Average
40 – 49	D	Pass

Graduation Requirements

The common graduation requirements of Moi University shall apply.

Compensation within the University Grading System
(i)   Compensation shall be possible, but not compulsory, for Regular Examinations.
(ii)   Compensation shall be considered by School Board of Examiners when results are being processed at the end of every academic year.
(iii)   Candidates who score 37, 38 or 39 may be compensated to obtain the minimum pass mark of 40%. Compensation must be transacted between closely related courses only.
(iv)   A candidate must obtain at least a weighted average of 50% for all courses including the mark obtained in the failed paper, in the academic year's courses, to qualify for compensation.
(v)   No candidate shall receive compensation for more than one course per semester.
(vi)   Marks for compensation shall be obtained by subtracting marks from a subject with a close correlation with the subject being compensated. Compensation shall be in the ratio of compensated mark to compensating mark of 1:2 marks to be effected once.

Classification of Degrees

Class	Percentage Marks
First Class Honors	70 – 100%
Second Class Honors (Upper Division)	60 – 69%
Second Class Honors (Lower Division)	50 – 59%
Pass	**40 – 49%**

NB: A candidate who repeats any year of study on academic grounds shall NOT pass with honours.

2.4   Course loading/Units Offered for the Programme

The programme has a total of forty seven (47) courses covered in 179 units of which six (6) are common courses. All courses/units are taught in a semester of 17 weeks. The programme has foundation courses in year one, principles courses in year two which spiral into professional courses in year three and four.
 NB: Total lecture hours/ units for graduation
 One (Century) unit of study = 16 hours of lectures
 Or 32 hours of tutorials
 Or 48 hours of practical
 Or 48 hours of Self-Directed Learning (SDL)

2.5   Course Coding

The course codes shall be 100 to 400 series for year one to four as follows:

1st Year-	100 series
2nd Year-	200 series
3rd Year-	300 series
4th Year-	400 series

The course codes will carry the abbreviation PEH where "P" refers to Public Health school and "EH" the program, "Environmental Health". Other course codes used will refer to courses belonging to other programmes within Moi University (MAT, BBT, EHB and HRD).

2.6 Course Evaluation

Course evaluation will include all aspects of the course: the course content, instructional process, instructional equipment for the delivery; instructional and reference material and assessments.

Lecturers involved in the teaching of the course will provide formative evaluation of and such evaluation will be based on:

    a. Infrastructure and equipment provided by the University for Delivery of course content

    b. Instructional and reference materials that are provided to the lecturers for effective teaching and learning.

    c. Teaching and learning environment including information technology support.

    d. The design, structure and the level a course offered.

    e. The lecturer evaluation of the course unit is expected to provide feedback to the programme Department on the adequacy of the course inform of content, delivery, challenges and improvement that is required.

2.7   Quality Assurance

Moi University is committed to providing quality education and services that meet the needs of its customers and stakeholders through quality and relevant teaching, research, community service and outreach. The university is committed to quality work and learning environment that is grounded in intellectual and academic freedom, teamwork, quest for excellence, professionalism, discipline and continuing improvement of its programmes, activities and services so as to achieve client/customer satisfaction.

2.7.1 Moderation of Examinations

The common procedures for moderation of examinations of Moi University shall apply.

2.7.2 Curriculum review
The BSc. Environmental Health curriculum will be reviewed after every four years. Input shall be sought from stakeholders including staff, students, graduates, alumni, government and employers regarding current and changing trends in the academic and work environments.

2.7.3 Student Evaluation of the Instructor and Course

Students attending a given course will evaluate the respective course lecturer on presentation of prescribed course content, instructional process and assessment procedures. The student's evaluation of the lecturer is a continuous process meant to enhance the quality of teaching and to provide feedback to the lecturer through the department.The student evaluation of the course form will be administered to a representative percentage of students by the Quality Assurance Unit as per the Moi University Regulations

3.0   STRUCTURE OF THE PROGRAMME
3.1   Table 1: Course Distribution and Structure

						YEAR ONE	
S. No.	CODE	1ST SEMESTER	UNITS	S. No.	CODE	2ND SEMESTER	UNITS
		Common Courses (C)				Required Courses (R)	
1	MSE 100	Basics of medical education (PBL)	1	1	PEH 102	Principles of Behavioral Sciences	3
2	MAT: 100	Mathematics for Environmental Heath	3	2	PEH 111	Principles of Environmental Health	4
3	BBT 111	Physics for Health Sciences	3	3	PEH 112	Anatomy & Physiology of Food Animals	4
4	EHB 111	Principles of Chemistry	3	4	PEH 113	Technical Drawing & Land Surveying	5
5	PEH 101	Basic Life Support and Emergency Care	3	5	PEH 114	Climate Change and Health	3
6	HRD 100	Communication Skills 1	3	6	PEH 110	Human Anatomy & Physiology	4
7	PEH 100	Introduction to Computer Applications	3				
8	HRD 104	Quantitative Skills	3				
Total Units			22	Total Units			23

YEAR TWO							
S. No.	CODE	1st SEMESTER	UNITS	S. No.	CODE	2nd SEMESTER	UNITS
Required Courses (R)				**Required Courses (R)**			
1	PEH 200	Biostatistics	3	1	PEH 213	Entomology & Pest Management	5
2	PEH 209	Biochemistry	4	2	PEH 214	Water Supply and Quality Control	5
3	PEH 210	Immunology	4	3	PEH 215	Community Nutrition	3
4	PEH 211	Microbiology& Parasitology	5	4	PEH 216	Conservancy	3
5	PEH 212	Ecology	3	5	PEH 217	Epidemiology	3
				6	PEH 218	Field Attachment I (Community health I)	6
Total Units			19	**Total Units**			25
YEAR THREE							
S. No.	CODE	1st SEMESTER	UNITS	S. No.	CODE	2nd SEMESTER	UNITS
Required Courses (R)				**Required Courses (R)**			
1	PEH 300	Research Methodology	3	1	PEH 314	Introduction to Pharmacology and Toxicology	4
2	PEH 310	Building Science & Technology	6	2	PEH 315	Meat Inspection and Pathology	5
3	PEH 311	Liquid Waste Management	6	3	PEH 316	Food Science & Technology	5
4	PEH 312	Solid Waste Management	5	4	PEH 317	Health Services Management	4
5	PEH 313	Environmental Pollution and control	4	5	PEH 318	Project Management, Monitoring and Evaluation	3
Total Units			24	**Total Units**			21
YEAR FOUR							
S. No.	CODE	1st SEMESTER	UNITS	S. No	CODE	2nd SEMESTER	UNITS
Required Courses (R)						**Required Courses (R)**	

1	PEH 410	Land development and settlement management.	4	1	PEH 413	Field Attachment II (Community health II)	6
2	PEH 411	Biotechnology and Health	3	2	PEH 416	Ports Health	3
3	PEH 412	Communicable and Non Communicable Diseases	4	3	PEH 417	Public Health laws	3
4	PEH 414	Occupational Safety and health	4	4	PEH 418	Disaster preparedness and management	3
5	PEH 415	Research Project	6	5	PEH 419	Environmental Impact Assessment and Audit	3
				6	PEH 420	Health education and Promotion	3
				7	PEH 400E	Environmental health Elective	4
Total Units			**21**	**Total Units**			**25**

3.2 Table II: Programme Matrix

Year	Courses			
	Semester	**Semester II**	**Total Courses**	**Total Units**
I	8	6	14	45
II	5	6	11	44
III	5	5	10	45
IV	5	7	12	45
Total	23	24	47	179

3.3 Table III Matrix of Courses and Learning outcomes

	Courses	Program Learning outcomes										
CODE	**COURSE TITLE**	1	2	3	4	5	6	7	8	9	10	11
	YEAR I											
MSE 100	Basics of medical education (PBL)	X									X	X
HRD 100	Communications skills I	X	X								X	X
HRD104	Quantitative Skills				X	X	X	X	X		X	
MAT 100	Mathematics for Environmental Health		X	X	X	X	X	X	X		X	
EHB 111	Principles of Chemistry			X	X	X		X	X	X		
BBT 111	Physics for Health Sciences				X	X	X			X	X	
PEH 100	Introduction to Computer applications		X		X	X	X				X	X
PEH 101	Basic Life Support and Emergency Care	X	X	X				X		X		
PEH 102	Principles of Behavioral Sciences	X	X					X		X	X	X
PEH 110	Human Anatomy & Physiology	X	X	X								X

Code	Course											
PEH 111	Principles of Environmental Health	X	X	X	X	X				X	X	X
PEH 112	Anatomy & Physiology of Food Animals	X	X	X							X	X
PEH 113	Technical Drawing & Land Surveying	X			X	X	X	X				
PEH 114	Climate change and Health	X	X				X			X	X	X
	YEAR II											
PEH 200	Biostatistics	X	X	X	X						X	X
PEH 209	Biochemistry	X	X	X	X				X			
PEH 210	Immunology	X	X	X								X
PEH 211	Microbiology& Parasitology	X	X	X	X	X		X	X			
PEH 212	Ecology	X	X	X				X				
PEH 213	Entomology & Pest Management	X	X	X	X	X					X	
PEH 214	Water Supply and Quality Control	X	X	X	X	X	X	X	X	X	X	X
PEH 215	Community Nutrition	X	X	X						X	X	X
PEH 216	Conservancy	X		X	X	X		X	X		X	
PEH 217	Principles of Epidemiology	X	X		X					X	X	X
PEH 218	Field Attachment I (Community health I)	X	X	X	X	X	X	X	X		X	
	YEAR III											
PEH 300	Research Methodology	X	X	X	X	X	X	X	X	X	X	X
PEH 310	Building Science & Technology	X	X	X	X	X	X	X	X	X	X	X
PEH 311	Liquid Waste Management	X	X	X	X	X	X	X	X	X	X	X
PEH 312	Solid Waste Management	X		X	X	X	X	X	X	X	X	X
PEH 313	Environmental Pollution and control	X	X	X	X	X	X	X	X	X	X	X
PEH 314	Meat Pathology & inspection	X	X	X	X	X		X	X	X	X	X
PEH 315	Food Science & Technology	X	X	X	X	X	X	X	X	X	X	X
PEH 316	Health Services Management	X	X	X							X	X
PEH 317	Project Management, Monitoring and Evaluation	X	X	X		X	X		X		X	X
	YEAR IV											
PEH 410	Land development and settlement management.	X		X	X	X	X		X	X	X	X
PEH 411	Health education &promotion	X	X	X	X			X	X	X	X	X
PEH 412	Communicable and Non Communicable Diseases	X	X	X	X	X			X		X	X
PEH 413	Field Attachment II (Community health II)	X	X	X	X	X	X	X	X	X	X	X
PEH 414	Occupational Safety and health	X		X		X	X	X	X	X	X	X
PEH 415	Research Project	X	X	X	X	X	X	X	X	X	X	X
PEH 416	Ports Health	X	X	X	X	X		X		X		X
PEH 417	Public Health laws	X	X	X	X	X	X	X	X	X	X	X
PEH 418	Disaster preparedness and management			X	X	X	X	X	X	X	X	X
PEH 419	Environmental Impact Assessment & Audit	X	X	X	X	X	X	X	X	X	X	X
E 400	Environmental health Elective	X	X	X	X	X	X	X	X	X	X	X

KEY

Expected learning outcomes of the programme.

1.   Develop and apply strategies to prevent and control communicable non-communicable diseases.

2.   Carry out disease surveillance and disease investigation.

3.   Ensure food quality.

4.   Protect community water resources and ensure water quality

5.   Design, construct and inspect sanitary facilities

6.   Approve building plans, conduct premises inspections and write reports.

7.   Assess Health risks for work places and develop mitigation measures.

8.   Assess Environmental Pollution.

9.   Enforcement Environmental/Public Health Regulations, and standards

10.   Conduct scientific research and publish on Environmental Health issues

11.   Formulate and develop environmental health policies.

Source: B.Sc. Environmental Curriculum approved by senate on 20th march 2012 and signed by the Moi University Vice Chancellor on 16th May 2012.

APPENDIX VIII: PUBLIC HEALTH CORE COMPETENCIES

The Council on Linkages between Academia and
Public Health Practice
Tier 1, Tier 2 and Tier 3 Core Competencies for Public Health Professionals (ADOPTED
May 3, 2010)

Introduction

The Core Competencies for Public Health Professionals (Core Competencies) are a set of skills desirable for the broad practice of public health. They reflect the characteristics that staff of public health organizations (collectively) may want to possess as they work to protect and promote health in the community. The Core Competencies are designed to serve **as a starting point** for academic and practice organizations to understand, assess, and meet education, training and workforce needs.

About the Three Tiers – 1, 2 and 3

Tiers 1, 2 and 3 reflect the Core Competencies that public health professionals at different stages of their career may wish to have. Specifically, Tier 1 Core Competencies apply to entry level public health professionals (i.e. individuals that have limited experience working in the public health field and are not in management positions); Tier 2 Core Competencies apply to individuals with management and/or supervisory responsibilities; and Tier 3 Core Competencies apply to senior managers and/or leaders of public health organizations.

On May 3, 2010, the Council on Linkages between Academia and Public Health Practice (a coalition of representatives from 17 national public health organizations) unanimously adopted Tier 1 and Tier 3 Core Competencies, as well as minor changes to the Tier 2 Core Competencies. Tier 2 Core Competencies were originally adopted in June 2009. However, it was noted that some minor changes to Tier 2 Core Competencies were desirable in order to ensure a logical progression of competencies from Tier 1 to Tier 2 to Tier 3. "Guidance definitions" for the Tier 1, Tier 2 and Tier 3 Core Competencies are listed on page 18 of this document.

Why the Core Competencies are Important

Over 50% of state and local health departments and more than 90% of public health academic institutions are using the Core Competencies to identify and meet workforce development needs. To learn more about how public health organizations are using the Core Competencies, go to www.phf.org/programs/council/Pages/Core_PublicHealthCompetencies_Examples_of_use.aspx.

Please Note

In the tables below, a grey background is used to denote that the same competency appears in more than one Tier. It should be noted that while the same competency may appear in more than one Tier, the way one demonstrates competence may vary from Tier to Tier.

A sample of public health competencies as spread across the tiers;

Analytical/Assessment Skills		
Tier 1 [i]	**Tier 2 (Mid Tier) [ii]**	**Tier 3 [iii]**
1A1. Identifies the health status of populations and their related determinants of health and illness	1B1. Assesses the health status of populations and their related determinants of health and illness	1C1. Reviews the health status of populations and their related determinants of health and illness conducted by the organization
1A2. Describes the characteristics of a population-based health problem	1B2. Describes the characteristics of a population-based health problem	1C2. Describes the characteristics of a population-based health problem
1A3. Uses variables that measure public health conditions	1B3. Generates variables that measure public health conditions	1C3. Evaluates variables that measure public health conditions
1A4. Uses methods and instruments for collecting valid and reliable quantitative and qualitative data	1B4. Uses methods and instruments for collecting valid and reliable quantitative and qualitative data	1C4. Critiques methods and instruments for collecting valid and reliable quantitative and qualitative data
1A5. Identifies sources of public health data and information	1B5. References sources of public health data and information	1C5. Expands access to public health data and information
1A6. Recognizes the integrity and comparability of data	1B6. Examines the integrity and comparability of data	1C6. Evaluates the integrity and comparability of data
1A7. Identifies gaps in data sources	1B7. Identifies gaps in data sources	1C7. Rectifies gaps in data sources

1A8. Adheres to ethical principles in the collection, maintenance, use, and dissemination of data and information	1B8. Employs ethical principles in the collection, maintenance, use, and dissemination of data and information	1C8. Ensures the application of ethical principles in the collection, maintenance, use, and dissemination of data and information

Policy Development/Program Planning Skills

Tier 1	Tier 2	Tier 3
2A1. Gathers information relevant to specific public health policy issues	2B1. Analyzes information relevant to specific public health policy issues	2C1. Evaluates information relevant to specific public health policy issues
2A2. Describes how policy options can influence public health programs	2B2. Analyzes policy options for public health programs	2C2. Decides policy options for public health organization
2A3. Explains the expected outcomes of policy options	2B3. Determines the feasibility and expected outcomes of policy options	2C3. Critiques the feasibility and expected outcomes of various policy options
2A4. Gathers information that will inform policy decisions	2B4. Describes the implications of policy options	2C4. Critiques selected policy options using data and information

Policy Development/Program Planning Skills

Tier 1	Tier 2	Tier 3
2A7. Incorporates policies and procedures into program plans and structures	2B8. Develops policies for organizational plans, structures, and programs	2C9. Ensures the consistency of policy integration into organizational plans, procedures, structures, and programs
2A8. Identifies mechanisms to monitor and evaluate programs for their effectiveness and quality	2B9. Develops mechanisms to monitor and evaluate programs for their effectiveness and quality	2C10. Critiques mechanisms to evaluate programs for their effectiveness and quality

2A9. Demonstrates the use of public health informatics practices and procedures	2B10. Incorporates public health informatics practices	2C11. Oversees public health informatics practices and procedures
2A10. Applies strategies for continuous quality improvement	2B11. Develops strategies for continuous quality improvement	2C12. Implements organizational and system- wide strategies for continuous quality improvement
		2C13. Integrates emerging trends of the fiscal, social and political environment into public health strategic planning

Communication Skills		
Tier 1	**Tier 2**	**Tier 3**
3A1. Identifies the health literacy of populations served	3B1. Assesses the health literacy of populations served	3C1. Ensures that the health literacy of populations served is considered throughout all communcatio n strategies
3A2. in Communicates in writing and orally, person, and through electronic means, with linguistic and cultural proficiency	3B2. Communicates in writing and orally, in person, and through electronic means, with linguistic and cultural proficiency	3C2. Communicates in writing and orally, in person, and through electronic means, with linguistic and cultural proficiency
3A3. Solicits community-based input from individuals and organizations	3B3. Solicits input from individuals and organizations	3C3. Ensures that the public health organizati on seeks input from other organizati ons and

		individuals
3A4. using Conveys public health information a variety of approaches	3B4. Uses a variety of approaches to disseminate public health information	3C4. Ensures a variety of approaches are considered and used to disseminate public health information
3A5. Participates in the development of demographic, statistical, programmatic and scientific presentations	3B5. Presents demographic, statistical, programmatic, and scientific information for use by professional and lay audiences	3C5. Interprets demographic, statistical, programmatic, and scientific information for use by professional and lay audiences
3A6. Applies communication and group dynamic strategies in interactions with individuals and groups	3B6. group Applies communication and dynamic strategies in interactions with individuals and groups	3C6. Applies communication and group dynamic strategies in interactions with individuals and groups

Communication Skills		
Tier 1	**Tier 2**	**Tier 3**
		3C7. Communicates the role of public health within the overall health system

Cultural Competency Skills		
Tier 1	**Tier 2**	**Tier 3**

4A1. Incorporates strategies for interacting with persons from diverse backgrounds	4B1. Incorporates strategies for interacting with persons from diverse backgrounds	4C1. Ensures that there are strategies for interacting with persons from diverse backgrounds
4A2. Recognizes the role of cultural, social, and behavioral factors in the accessibility, availability, acceptability and delivery of public health services	4B2. Considers the role of cultural, social, and behavioral factors in the accessibility, availability, acceptability and delivery of public health services	4C2. Ensures the consideration of the role of cultural, social, and behavioral factors in the accessibility, availability, acceptability and delivery of public health services
4A3. Responds to diverse needs that are the result of cultural differences	4B3. Responds to diverse needs that are the result of cultural differences	4C3. Responds to diverse needs that are the result of cultural differences
4A4. Describes the dynamic forces that contribute to cultural diversity	4B4. Explains the dynamic forces that contribute to cultural diversity	4C4 Assesses the dynamic forces that contribute to cultural diversity
4A5. Describes the need for a diverse public health workforce	4B5. Describes the need for a diverse public health workforce	4C5. Assesses the need for a diverse public health workforce
4A6. Participates in the assessment of the cultural competence of the public health organization	4B6. Assesses public health programs for their cultural competence	4C6. Assesses the public health organization for its cultural competence

Cultural Competency Skills		
Tier 1	**Tier 2**	**Tier 3**
		4C7. Ensures the public health organization's cultural competence

Community Dimensions of Practice Skills		
Tier 1	**Tier 2**	**Tier 3**
5A1. Recognizes community linkages and relationships among multiple factors (or determinants) affecting health	5B1. Assesses community linkages and relationships among multiple factors (or determinants) affecting health	5C1. Evaluates the community linkages and relationships among multiple factors (or determinants) affecting health
5A2. Demonstrates the capacity to work in community-based participatory research efforts	5B2. Collaborates in community-based participatory research efforts	5C2. Encourages community-based participatory research efforts within the public health organization
5A3. Identifies stakeholders	5B3. Establishes linkages with key stakeholders	5C3. Establishes linkages with key stakeholders
5A4. Collaborates with community partners to promote the health of the population	5B4. Facilitates collaboration and partnerships to ensure participation of key stakeholders	5C4. Ensures the collaboration and partnerships of key stakeholders through the development of formal and informal agreements
5A5. Maintains partnerships with key stakeholders	5B5. Maintains partnerships with key stakeholders	5C5. Maintains partnerships with key stakeholders
5A6. Uses group processes to advance community involvement	5B6. Uses group processes to advance community involvement	5C6. Uses group processes to advance community involvement
5A7. Describes the role of governmental and non-governmental organizations in the delivery of community health services	5B7. Distinguishes the role of governmental and non-governmental organizations in the delivery of community health services	5C7. Integrates the role of governmental and non-governmental organizations in the delivery of community health services
Community Dimensions of Practice Skills		
Tier 1	**Tier 2**	**Tier 3**

5A8. Identifies community assets and resources	5B8. Negotiates for the use of community assets and resources	5C8. Negotiates for the use of community assets and resources through MOUs and other formal and informal agreements
5A9. Gathers input from the community to inform the development of public health policy and programs	5B9. Uses community input when developing public health policies and programs	5C9. Ensures community input when developing public health policies and programs
5A10. Informs the public about policies, programs, and resources	5B10. Promotes public health policies, programs, and resources	5C10. Defends public health policies, programs, and resources
		5C11. Evaluates the effectiveness of community engagement strategies on public health policies, programs, and resources

Public Health Sciences Skills		
Tier 1	**Tier 2**	**Tier 3**
6A1. Describes the scientific foundation of the field of public health	6B1. Discusses the scientific foundation of the field of public health	6C1. Critiques the scientific foundation of the field of public health
6A2. Identifies prominent events in the history of the public health profession	6B2. Distinguishes prominent events in the history of the public health profession	6C2. Explains lessons to be learned from prominent events in the history in comparison to the current events of the public health profession
6A3. Relates public health science skills to the Core Public Health Functions and Ten Essential Services of Public Health	6B3. Relates public health science skills to the Core Public Health Functions and Ten Essential Services of Public Health	6C3. Health Incorporates the Core Public Health Functions and Ten Essential Services of Public Health into the practice of the public health sciences

6A4. Identifies the basic public health sciences (including, but not limited to biostatistics, epidemiology, environmental health sciences, health services administration, and social and behavioral health sciences)	6B4. Applies the basic public health sciences (including, but not limited to biostatistics, epidemiology, environmental health sciences, health services administration, and social and behavioral health sciences) to public health policies and programs	6C4. Applies the basic public health sciences (including, but not limited to biostatistics, epidemiology, environmental health sciences, health services administration, and social and behavioral health sciences) to public health policies and programs
6A5. Describes the scientific evidence related to a public health issue, concern, or, intervention	6B5. Conducts a comprehensive review of the scientific evidence related to a public health issue, concern, or, intervention	6C5. Integrates a review of the scientific evidence related to a public health issue, concern, or, intervention into the practice of public health

Public Health Sciences Skills

Tier 1	Tier 2	Tier 3
6A6. Retrieves scientific evidence from a variety of text and electronic sources	6B6. Retrieves scientific evidence from a variety of text and electronic sources	6C6. Synthesizes scientific evidence from a variety of text and electronic sources
6A7. Discusses the limitations of research findings	6B7. Determines the limitations of research findings	6C7. Critiques the limitations of research findings
6A8. Describes the laws, regulations, policies and procedures for the ethical conduct of research	6B8. Determines the laws, regulations, policies and procedures for the ethical conduct of research	6C8. Advises on the laws, regulations, policies and procedures for the ethical conduct of research
6A9. Partners with other public health professionals in building the scientific base of public health	6B9. Contributes to building the scientific base of public health	6C9. Contributes to building the scientific base of public health

			6C10. Establishes partnerships with academic
			and other organizations to expand the public health science base and disseminate research findings

Financial Planning and Management Skills

Tier 1		Tier 2		Tier 3	
7A1.	Describes the local, state, and federal public health and health care systems	7B1.	Interprets the interrelationships of local, state, and federal public health and health care systems for public health program management	7C1.	Leverages the interrelationships of local, state, and federal public health and health care systems for public health program management
7A2.	Describes the organizational structures, functions, and authorities of local, state, and federal public health agencies	7B2.	Interprets the organizational structures, functions, and authorities of local, state, and federal public health agencies for public health program management	7C2.	Leverages the organizational structures, functions, and authorities of local, state, and federal public health agencies for public health program management
7A3.	Adheres to the organization's policies and procedures	7B3.	Develops partnerships with agencies within the federal, state, and local levels of government that have authority over public health	7C3.	Manages partnerships with agencies within the federal, state, and local levels of government that have authority over public health situations or with specific issues, such as emergency events

		7B4. Implements the judicial and operational procedures of the governing body and/or administrative unit that oversees the operations of the public health organization	7C4. Manages the implementation of the judicial and operational procedures of the governing body and/or administrative unit that oversees the operations of the public health organization
7A4. Participates in the development of a programmatic budget		7B5. Develops a programmatic budget	7C5. Defends a programmatic and organizational budget

Financial Planning and Management Skills			
Tier 1		Tier 2	Tier 3
7A5. Operates programs within current and forecasted budget constraints		7B6. Manages programs within current and forecasted budget constraints	7C6. Ensures that programs are managed within current and forecasted budget constraints
7A6. Identifies strategies for determining budget priorities based on federal, state, and local financial contributions		7B7. Develops strategies for determining budget priorities based on federal, state, and local financial contributions	7C7. Critiques strategies for determining budget priorities

		7C8. Determines budgetary priorities for the organization
7A7. Reports program performance	7B8. Evaluates program performance	7C9. Evaluates program performance
7A8. Translates evaluation report information into program performance improvement action steps	7B9. Uses evaluation results to improve performance	7C10. Uses evaluation results to improve performance
7A9. Contributes to the preparation of proposals for funding from external sources	7B10. Prepares proposals for funding from external sources	7C11. Approves proposals for funding from external sources
7A10. Applies basic human relations skills to internal collaborations, motivation of colleagues, and resolution of conflicts	7B11. Applies basic human relations skills to the management of organizations, motivation of personnel, and resolution of conflicts	7C12. Applies basic human relations skills to the management of organizations, motivation of personnel, and resolution of conflicts

Financial Planning and Management Skills

Tier 1	Tier 2	Tier 3
7A11. Demonstrates public health informatics skills to improve program and business operations	7B12. Applies public health informatics skills to improve program and business operations	7C13. Integrates public health informatics skills into program and business operations
7A12. Participates in the development of contracts and other agreements for the provision of services	7B13. Negotiates contracts and other agreements for the provision of services	7C14. Approves contracts and other agreements for the provision of services
7A13. Describes how cost-effectiveness, cost-benefit, and cost-utility analyses affect programmatic prioritization and decision making	7B14. Uses cost-effectiveness, cost-benefit, and cost-utility analyses in programmatic prioritization and decision making	7C15. Includes the use of cost-effectiveness, cost-benefit, and cost-utility analyses in programmatic prioritization and decision making

		7C16. Incorporates data and information to improve organizational processes and performance
		7C17. Establishes a performance management system

Leadership and Systems Thinking Skills

Tier 1	**Tier 2**	**Tier 3**
8A1. Incorporates ethical standards of practice as the basis of all interactions with organizations, communities, and individuals	8B1. Incorporates ethical standards of practice as the basis of all interactions with organizations, communities, and individuals	8C1. of Incorporates ethical standards of practice as the basis of all interactions with organizations, communities, and individuals
8A2. Describes how public health operates within a larger system	8B2. Incorporates systems thinking into public health practice	8C2. Integrates systems thinking into public health practice
8A3. Participates with stakeholders in identifying key public health values and a shared public health vision as guiding principles for community action	8B3. Participates with stakeholders in identifying key values and a shared vision as guiding principles for community action	8C3. Partners with stakeholders to determine key values and a shared vision as guiding principles for community action
8A4. Identifies internal and external problems that may affect the delivery of Essential Public Health Services	8B4. Analyzes internal and external problems that may affect the delivery of Essential Public Health Services	8C4. Resolves internal and external problems that may affect the delivery of Essential Public Health Services
8A5. and Uses individual, team organizational learning opportunities for personal and professional development	8B5. Promotes individual, team and organizational learning opportunities	8C5. Advocates for individual, team and organizational learning opportunities within the organization
8A6. Participates in mentoring and peer review or coaching opportunities	8B6. Establishes mentoring, peer advising, coaching or other personal development opportunities for the public health workforce	8C6. Promotes mentoring, peer advising, coaching or other personal development opportunities for the public health workforce, including him or herself

Leadership and Systems Thinking Skills

Tier 1	Tier 2	Tier 3
8A7. Participates in the measuring, reporting and continuous improvement of organizational performance	8B7. Contributes to the measuring, reporting and continuous improvement of organizational performance	8C7. Ensures the measuring, reporting and continuous improvement of organizational performance
8A8. Describes the impact of changes in the public health system, and larger social, political, economic environment on organizational practices	8B8. Modifies organizational practices in consideration of changes in the public health system, and the larger social, political, and economic environment	8C8. Ensures organizational practices are in concert with changes in the public health system, and the larger social, political, and economic environment
		8C9. Ensures the management of organizational change

[i] Tier 1 Core Competencies apply to public health professionals who carry out the day-to-day tasks of public health organizations and are not in management positions. Responsibilities of these public health professionals may include basic data collection and analysis, fieldwork, program planning, outreach activities, programmatic support, and other organizational tasks.

[ii] Tier 2 (Mid Tier) Core Competencies apply to individuals with program management and/or supervisory responsibilities. Other responsibilities may include: program development, program implementation, program evaluation, establishing and maintaining community relations, managing timelines and work plans, presenting arguments and recommendations on policy issues etc.

[iii] Tier 3 Core Competencies apply to individuals at a senior/management level and leaders of public health organizations. In general, an individual who is responsible for the major programs or functions of an organization, setting a strategy and vision for the organization, and/or building the organization's culture can be considered to be a Tier 3 public health professional. Tier 3 public health professionals (e.g. health officers, executive directors, CEOs etc.) typically have staff that report to them.

APPENDIX IX: PRACTITIONER ORGANIZATION

S. No	Practitioner organization	Frequency	S. No	Practitioner organization	Frequency
1.	County Government	16	21.	World Vision	5
2.	Ministry of Health	11	22.	AMREF	4
3.	MTRH	5	23.	Kenyatta National Hospital	4
4.	AMPATH	15	24.	Unilever Kenya	2
5.	UNICEF	2	25.	Busara Research Centre	1
6.	Red Cross	4	26.	Pan Africa Research	1
7.	Plan International	1	27.	Handicap Kenya	1
8.	APHRC	2	28.	Kenya Army	2
9.	Aga khan Hospital	4	29.	Jomo Kenyatta University of Agriculture and Technology	3
10.	Moi University	3	30.	Mater Hospital	2
11.	PHOTC	2	31.	Western Water & Sanitation Company	1
12.	Deaf empowerment Kenya	1	32.	Mediheal group of Hospitals	2
13.	Mt. Kenya University	3	33.	Masinde Muliro University	2
14.	Eldoret Water and Sanitation Company	1	34.	Kenya Bureau Statistics	1
15.	Kenya Medical Training college	4	35.	Pathfinder international	2 / 2
16.	Impact Research & Development	1	36.	Family health Options, Kenya	2
17.	Nairobi hospital	2	37	Care Kenya	2
18.	Aids health foundation	1	38.	International Medical Corps	1
19.	Spire health care	1	39.	Kenyatta University	2
20.	Kakuma Refugee Camp	1			

APPENDIX X: MAP OF KENYA SHOWING MU-CHS

Source:
https://www.google.com/maps/place/Moi+University+College+of+Health+SciencesQ

APPENDIX XI: PREPAREDNESS PERCEPTIONS OF ENVIRONMENTAL HEALTH GRADUATES IN HANDLING EMERGING PUBLIC HEALTH CONCERNS IN KENYA

Source:

https://www.google.com/maps/place/Moi+University+College+of+Health+SciencesQ

Preparedness Perceptions of Environmental Health Graduates in Handling Emerging Public Health Concerns in Kenya

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Abstract: Background: Public Health workforce faces varied challenges ranging from workforce shortages to debates on relevance and the adequacy of their training. This is particularly true to graduates undertaking Bachelor of Science degree in Environmental Health (BSc EVH) because of the wide areas in the job market that they can be absorbed into. Consequently there are concerns of mismatch between the academic training and their job market demands and expectation which hinge on the preparedness of these graduates to handle public health activities and obligations. Aim: The purpose of this study was to assess the graduates' preparedness to handle emerging public health concerns. Methods: A cross-sectional descriptive study design employing both quantitative and qualitative methods was done from September 2016 to April 2017. The graduates were stratified by year of graduation and a total of 229 were randomly recruited into the study. The participants were interviewed using a pretested semi-structured questionnaire. An interviewer guide was also used to further interrogate graduates. Data was analyzed for proportions and associations using statistical package for social sciences (SPSS) version 20. Results: Among 188 graduates that completed the questionnaires, 79 (42%) were aged 25-34 years, 71(37.8%) aged 35-44 years, 29(15.4%) aged 45-54 and 9(4.8%) were ≤25 years. More than half (111(59%) of the graduates were males. All graduates were distributed over more than 12 public health career areas. On preparedness, 123 (65.4%) perceived to be prepared to handle emerging public health challenges whereas 65 (34.6%) said that they were unprepared. Among those who reported that they were prepared, there was a higher median competence score compared to those who opined that they were not prepared (2.93 vs 2.79, Z=2.472 and p=0.013). A unit increase in the competence

score indicates increased chance of being prepared by 10.6% (OR; 1.106; 95% CI: 1.042-1.174, p=0.001). Conclusion: Our findings indicate that majority of the graduates perceived to be prepared to handle emerging public health concerns though a significant 34.6% felt that they were inadequately prepared. Therefore the depth of specific course content and implementation is still an area of concern to graduates. Recommendation: Forge and strengthen collaborations between the training institutions and the practitioner organizations to tailor graduate training to industry requirements.

1. Introduction

Environmental health is a rapidly evolving field of study and practice and professionals working in this field have to deal with increasingly complex situations in their work stations. They face a range of challenges ranging from demographic transition, natural disasters, epidemics to ill health that is worsened by poverty particularly those living in resource constrained countries [1] and global threats such as terrorism activities.[2] All these critical situations of public health need specialized knowledge and effectiveness among public health professionals. However, published reports indicate that there are professionals who may lack the requisite skills despite being fully trained [3]. This lack of congruence between what is taught and what is required at the work place could result in lack of confidence on public health practitioners by the prospective employers [4].

Since the 20th century, there has been integration of modern science content into the public health curricula at the universities and other institutions of higher learning but despite this, fresh health challenges that threaten the health of the public still loom [5]. Public Health occurrences such as disasters and disease outbreaks coupled with political changes clearly indicate that the challenges faced are not static, but can change considerably in a short time. This therefore calls for adequate training in competencies required for Environmental health practitioners to handle all possible scenarios in public health and research. Despite this, competency training framework has not been adequately developed to fit the African settings [6]. Comparatively, the more developed countries have

organizations regulating competencies for example the Pan American Association of Public Health (PAHO) [7]. Additionally, Whittaker et al (2010) has reported that the association of schools of public health in the European regions (ASPHER) is in the process of initiating a public health competency framework by organizing brainstorming workshops on professional public health competencies [8]. Curriculum development in Environmental Health education and training ought to form part of the public health competency framework that can be used to identify needs for EVH capacity building worldwide as new priorities and challenges arise [9, 10, 11]. It is true that countries worldwide ranging from United States, United Kingdom, and Nigeria experience public health incidents that change considerably in a short time thus indicating that public health practitioners' ought to be ready and equipped to change so as to meet the demands and challenges. This notwithstanding, public health workforce research has focused more on categorical issues rather crosscutting issues yet what is evident is the need for competent work force infrastructure to compliment other public health structures for a better focus on public health challenges [12, 13]

Indeed public health has evolved over decades and workforce development has been evolving too. Criticism on workforce training has been strong as evidenced by a report in 1988 by institute of medicine on the future of public health in general which states that building stronger public health workforce competency for the future is lacking and is impacting negatively on the health of populations [14]. Consequent to this report, schools of public health, professional bodies, federal agencies, and employers were called to remedy the situation.[15] The Institute of Medicine report of 2000 records some success to this effect, but a lot of work remains [16]. Evidently, workforce development has been a much needed discourse and indeed great changes have been reported though with greater emphasis has been on strengthening health systems [5]. Even with this, there are frequent occurrences of health insecurities and concerns which have been recurrent despite health professional being continually being trained and released to the labour market. This raises the question on the adequacy and preparedness of the public health professionals churned out of training institutions. Further, the workforce faces a crisis in the face of changing training demands evidenced by gaps in the existing training programs. There is

therefore need to identify these training needs for public health professionals which will then ploughed back into the curriculum to equip future graduates for better outcomes [17, 18]

2. Objective

The objective of the study was to explore the graduates' perceptions on their preparedness to handle emerging public health challenges.

3. Methodology

A cross sectional study that involved both qualitative and quantitative methods were used in the study. The quantitative aspect involved the use of pretested semi structured questionnaires for the graduates. Further in-depth interviews were also done at a later time with the graduates for more insights on issues that sprung up from the responses in the structured questionnaire.

The study targeted a sample of 229 graduates using existing records at the School of Public Health. The graduates were stratified by year of graduation then proportionately recruited into the study. Contacts of mobile telephone numbers and email addresses of the sampled were retrieved for purposes of communication. The data was then collected through an online survey. In this regard, an introductory letter was send through their email addresses as well as through their mobile phones in form of a text message. An informed consent was then sent together with a link containing the survey questions. Only those who consented to participate in the study were directed to the link of survey questions while those declining were thanked and wished a good day.

In addition, in-depth interviews were used to collect additional information to triangulate the responses from the questionnaires. A total of 22 graduates working in various organization were interviewed. The interviewer subjected every graduate to the same format of similar questions. An audio recorder was used during the interviews which were later transcribed

Descriptive data was summarized and analyzed using frequencies, modes, means and standard deviation. The findings from the in depth interviews were transcribed into written words and used for narrations.

Ethical approval was obtained from Institutional Research and Ethics Committee (IREC), a College

of Health Sciences,

Moi University and the Moi Teaching and Referral Hospital committee. Informed consent was sought from all the participants. Participation was voluntary and the information provided was treated with confidentiality and anonymity.

4. Results

a. Graduate Demographic Characteristics

Among 188 graduates that completed the questionnaires, 79 (42%) were aged 25-34 years, 71(37.8%) aged 35-44years, 29(15.4%) aged 45-54 and 9(4.8%) were ≤25years. More than half (111(59%) were males while 28(36.4%) were females. Further analysis revealed no relationship between graduate demographic characteristics and preparedness (Age group chi = 0.940 P value = 0.816, Gender z = 1.662 P value = 0.096).

b. Graduates Experience with Current Employer and Preparedness

The Kruskal wallis test revealed a chi value of 7.872 and p value of 0.049 between the graduates who were prepared and those not prepared in the varying categories of work experience with current employer. These findings revealed a significant relationship between experience (years worked with current employer) and preparedness to handle emerging public health challenges chi = 7.872, p=0.049). Higher proportion of those who had worked for more than 5 years were more prepared compared to those who had worked for less than 1 and 3 years (81% and 71%) respectively.

c. Graduates Perception on Their Preparedness to Handle Emerging Public Health Challenges

More than half of the graduates 123(65.4%) perceived to be prepared to handle emerging public health challenges while 65(34.6%) perceived to be unprepared. These who perceived not to be prepared cited challenges such as problems in translating theory to practice, inexperience, of lack of field exposure, soft skills and poor confidence in public forum activities as exemplified by the narrations

below;

> ………. I possess the skills, but in theory. Being in the field was a huge frustration…..at some point I was told to that I needed to "grow wings……….
>
> 38 year old IDI

Even though more than half perceived to be prepared, they reported discontentedness on the content and depth of their training as reported by one of the respondent who said;

> " Very little was taught on disaster preparedness, yet
>
> when out here I need to know a lot on it like regulations and litigations which were never mentioned during my training "

Other graduates were particularly concerned on the scope of the training done with most of them indicating that the training was not tailored to local situations. This lead to missed opportunities to identify local and regional public health disasters that needed appropriate and sustainable mitigation strategies.

> "…….the scope on disaster management was misleading….during my time, I only heard a little on international disasters used as examples as if there were none within our own setup. It hurts having such a nice course with major units with students gaining very little…..no wonder few graduates' engage in this field………

The graduates who perceived not to be adequately prepared gave various reasons for the inadequacies. These included inadequate practical sessions, lack of hands on training, missing aspect on monitoring and evaluation as well as lack of field exposure to real life experiences as exemplified by the narration below.

> "….the training was purely theoretical….. I would love if the department could establish laboratories for conducting water and safety quality……"

d. Association Between Competence and Preparedness to Handle Emerging Public Health Challenges

On testing the association between competence and preparedness to handle emerging public health challenges, there was a significant difference in the median score between graduates who were prepared to handle emerging public health challenges and those who were not. Those prepared had a higher median competence score compared to those not prepared (2.93 vs 2.79, Z=2.472 and

p=0.013) respectively. Similarly, Simple binary logistic regression indicated that a unit increase in the competence score increased the chances of being prepared by 10.6% (OR; 95%CI: 1.106; 1.042-1.174, p=0.001)

5. Discussion

Findings from the study indicate that more than half of the graduates 123(65.4%) perceived to be prepared to handle emerging public health challenges while 65(34.6%) perceived that they were unprepared. These results are consistent with the findings of a study done by Hsu and team in Texas, United States of America on public health preparedness of health providers where out of the 73.2% healthcare workers trained in emergency response, only 45.8% were prepared to respond to public health emergencies [19]. Nevertheless, the proportion of the graduates who perceived unprepared after all the years of training is a major concern. This is contrary to the fact that employers want better prepared graduates and students are asking to be trained to be employable too.[20] However, these findings are not different from the findings of Markenson et al (2005) where they found out that despite extensive training in public health emergencies, the practitioners still felt unprepared for emergencies [2] This study findings are further supported by Subbarao et al (2008) who in their study based on educational framework alludes that preparedness is a process and competencies must be reviewed over time [21]. Therefore continuing professional development of environmental health practitioners is necessary for them to be on the forefront in disease prevention and surveillance. In fact strengthening the capacity of these professionals goes a long way in meeting the World Health Organization's goal of preparedness and an aspect of strengthening institutional and human resource management [22, 23] These findings therefore constitutes an important aspect and an opportunity for the employers particularly at the national and county government to use these graduates for preparedness planning. Findings from in-depth interviews revealed issues of training related to the curriculum content and scope. The training content seemed to be below the job demands and that the content was inadequate hence graduates believed that they were not sufficiently prepared to handle emerging public health challenges [24-26] The in depth interviews

indicated that majority of the healthcare workers portrayed willingness to participate in public health emergencies, therefore called for adequate and proper training. The results on these studies and the current study underscore the importance of developing tailored educational approaches to address the

needs of graduates so as to meet market demands.

Regarding graduates years worked and preparedness, the findings revealed a relationship between the number of years worked and preparedness to handle public Health challenges (chi =7.872, p=0.049). This could probably be due to the on job training as well as the graduates' field experiences. This study findings concurs with a descriptive study on nurses perception to respond to major disasters which observed that those with prior experience were confident in handling disasters [23] These findings further concurs with Gebbie's et al (2002) which found that no two emergencies or disasters were alike, but in each situation, competencies for effective response were the same and depended on the healthcare workers experience [27].

This study findings further revealed that a unit increase in the competency score increases the graduates chances of being prepared by 10.6% (OR; 95%CI: 1.106; 1.042-1.174, p=0.001). This agrees with Hoges et al (2005) who avers that there is need to focus and direct attention to the competency boosting of health care workers for better healthcare outcomes [28] Additionally this study findings is consistent to the findings of a research done on emergency preparedness competencies of public health inspectors in China by Ning Ning et al (2014) on emergency preparedness competencies of public health inspectors which found significant differences among inspectors competency domains as per adjusted odds regression levels [29].

6. Conclusion

From the findings and the discussions, it can be deduced that graduates perceived themselves to be prepared to handle emerging public health challenges though a significant 34.6% felt they were not well prepared. Competency scores influenced the graduates' preparedness and that graduates' experience in the field and the length of working years improved their work competencies. There are training concerns on content and scope of specific course units' in relation to job demands.

7. Recommendations

The study recommends collaboration between the higher education management and practitioner organization to relook into the curriculum content and tailor to meet educational approaches. This will enhance competency scores that will have ripple effects on the graduates' preparedness.

Acknowledgements

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APPENDIX XII: ENVIRONMENTAL HEALTH GRADUATES' WORK SKILLS COMPETENCIES: PERSPECTIVES FROM THE EMPLOYERS AND THE GRADUATES

Environmental Health Graduates' Work Skills Competencies: Perspectives from the Employers and the Graduates

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Abstract

Introduction: Environmental health is a rapidly evolving field, and profes- sionals working in this field have to deal with increasingly complex environ- mental and public health concerns. Consequently, their skill development is a key component in ascertaining their abilities to match work requirements to the satisfaction of their employers. Training and education of these profes- sionals requires involvement of the relevant stakeholders to apt their technic- al skills in preparation of the role to be undertaken. Thus, the universities and other institutions of higher learning, in their efforts to improve graduate output should understand the labor market. Additionally, due to constant transformation and reorganization of strategies and plans by practitioner or- ganizations, employers' perspective in assessing graduates' abilities and per- formance is necessary. **Aim:** The purpose of this study was to assess the em- ployers' perspectives on the graduates' abilities to handle work demands. **Methods:** A cross sectional descriptive study design involving employers and graduates of environmental health program of Moi University using mixed methods was carried out. Pre-tested semi structured paper questionnaires were administered to 45 employers, while online survey was carried out on 227 sampled graduates. In-depth interviews were further subjected to the graduates to corroborate issues raised. Quantitative data analysis was done using statistical package for social scientists (SPSS) version 20 where the data was summarized using frequencies and proportions. Qualitative data was thematically analyzed. **Results:** The overall employer assessment of the gra- duates' abilities to handle work demands was satisfactory with 18 (46.1% 7 of

the employers rating them as good). On self-assessment, 116 (61.7%) of the graduates reported not to have faced any skills competency challenge at their work place and only 57 (30.3%) reported adequacy in skills acquired during undergraduate training. From the in-depth interviews, the graduates ap- plauded the current curriculum implementation strategy of Problem Based Learning (PBL) but faulted the infrastructural inadequacies for low compe- tencies and inadequate skills. The in-depth interviews further revealed a pic- ture of graduates struggling with skills' mismatch in their job placement. **Conclusion:** The study revealed a good rating by employers on the graduates' competency skills but a high proportion (69.7%) of graduates reported lack of adequate skills to match their work demands. **Recommendations:** Institu- tions of higher learning need to invest in infrastructural elements of curricu- lum implementation to boost more practical sessions for better skills' acquisi- tion that matches the industrial needs.

1. Introduction

Public health workforce is vital for protecting the safety of the public. The de- velopment of a fully competent public health workforce is a key component of the nation's public health. It is also critical to the improvement of population health globally. However, there is a growing rate of unemployment among uni- versity graduates, yet employers are lamenting on their inability to get skilled workforce for hire [1]. This has raised a heated debate across the globe on the quality of graduates being trained and released into the job market. One of the factors singled out for graduate unemployment in Kenya is an increasing mis- match between education skills, practical and the domains of the

job market [2]. This has led to the mounting increase in global concerns and the campaigns for the need for competent public health workforce that is responsive to the ev- er-changing public health complexities [3]. This indeed is an aspect of quality assurance and high competency training also advocated for by the Kenyan Commission for University Education (CUE) established in 2012 under the Uni- versities Act No. 42 of 2012 as a successor to the Commission for Higher Educa- tion in Kenya. This commission is mandated to regulate University Education to ascertain quality education for national, regional and global competitiveness [4] [5]. The Kenyan Commission for Higher Education (CUE) has been trying to tackle the quality crisis seen in Kenyan universities by undertaking sweeping re- views, crackdowns and other forms of quality audits. Despite all these measures, a host of questionable practices affecting the quality of the Kenya's rapidly ex- panding higher education sector and that of its graduates still exists [4] [6] [7].

As the global university enrolment rate soars high, graduates from Kenyan

universities have increased from 25,523 in 2012 to 49,020 in 2015 [8]. This rapid increase is however not corresponding to their abilities to undertake work re- quirements. A study by the interuniversity council of East Africa revealed that more than 50% of the graduates are poorly prepared for the job market with Kenyan graduates ranging the highest at 67%. This raises serious concerns for the various academic institutions in their continued journey of training and ge- nerating graduates into the labor market. It is well known that these institutions of higher learning use varying curriculum as well as varying curriculum imple- mentation strategies. Whereas the curricula vary for the different academic in- stitutions, what is less clear is whether what is taught matches the competency requirements for the real world work requirements [9]. Several other studies and annual reviews on outcome based workforce development in public health have placed higher hopes on a successful academic-practical partnership to improved public health outcomes [10] [11]. If industries are encouraged to continuously give feedback to academic institutions on graduate trainee's assessment, a key aspect of targeted training would be institutionalized and could eventually revo- lutionize graduate outcomes [1] [12]. This study sought to determine the em- ployer's perspectives on the graduates' abilities to handle work demands. The graduates' self-assessment on the adequacy of the competencies acquired during their training, the competency challenges faced as well as their career placements were also explored.

2. Materials and Methods

2.1 Study Design

A cross sectional study using both quantitative and qualitative methods was used.

2.2 Study Site

The study was based at the Department of Environmental Health, Moi Univer- sity, and College of Health Sciences.

2.3 Study Population

The study population encompassed B.Sc. Environmental

Health graduates and their respective employers in the various practitioner organizations.

2.4 Study Sample and Target

The study targeted a sample of 227 graduates and 45 employers. Graduates who had graduated from the school of public, Moi University from the year 1999 to 2015 were targeted. For the in-depth interviews, saturation level was reached at graduate number 22.

To get the graduates desired sample size, the Cochran's formula was used as follows;

$$n = z^2\, pq\, d^{\,2}$$

where:

n = The desired sample size.

z = the corresponding value confidence level of 95% in the normal distribu- tion table.

P = the proportion in the target population whose training matchs the work- force demands (used 60% as per the healthcare competency research done by Quality assurance project in Kenya) [13].

$q = 1 - p$.

d = the amount of discrepancy to correlate in p. It was set at 0.05.

$n = 1.96^2 \times 0.6 \times 0.4/0.05^2 = 368$.

Since the population under study was less than 10,000, then the sample size of the B.Sc. graduates was adjusted using Fischer Exact formula used for calculating sample sizes for population sizes less than 10,000 as below where

$$n = n_0$$

$$\left(1+\left(\left(n_0 -1\right)\right)\right)$$
$$N\right)\right)\text{the adjusted sample size.}$$

n_0—the calculated sample size from the Cochran's formula (368). N—The population size (600).

$$n = 368 \left(1+ 367\,600\right)$$
$$= 227$$

The employer organizations were mapped using the existing EVH alumni register versus their placement to establish the highest absorber of the graduates. A total of 45 practitioner organizations were targeted who had employed at least 2 graduates.

2.5 Sample Size Selection

The graduates were stratified by year of graduation and sex then proportionately recruited using simple random sampling. The employers were purposively re- cruited.

2.6 Inclusion Criteria

1.1.1. Graduates

The graduates must have graduated between the years 1998 and 2015, both years inclusive and have ever worked for least six months after qualifying from the university.

1.1.2. Employers

The employers must be employees of any practitioner organizations employing BSc. EVH graduates. They should have been involved in supervision of the graduates.

2.7 Exclusion Criteria

Graduates working outside Kenya were excluded whereas employers who have

not supervised graduates for at least six months were excluded.

2.8 Data Collection Methods and Tools

A pretested semi structured questionnaire was used to collect data from the graduates and the employers. The interviews with the graduates were carried out by administration of the questionnaires via an online survey while the one with the employers was self-administered. With this, appointments were made; a questionnaire was then delivered and collected at an agreed date and time.

The questionnaires had information to capture demographic (age, sex etc.) data of the graduates and the employer respondents. It also contained Likert scale items to assess the graduate's skills competencies as per the job require- ments by the employers. Other items in the questionnaire dealt with the gradu- ate's perception of the adequacy of their skills obtained during undergraduate training in preparation for the work demands.

For in-depth interviews, the graduates were subjected to oral questioning us- ing open ended questions until saturation level was achieved. An audio recorder was used during the interviews and later transcribed. The saturation level was achieved at graduate number 22.

2.9 Data Management and Analysis

Quantitative data was analyzed using SPSS version 20 whereby data was summa- rized using frequencies and proportions. Qualitative findings in-depth inter- views were transcribed into written words and used for narrations.

In assessing the graduates' performance by their employers, the core compe- tency skills for the broad practice of public health were adopted from the Coun- cil on Linkages between Academia and public health practice [14]. The skills as- sessed ranged from analytic/assessment skills to the job knowledge. Each core competency item that the employers used to assess the graduates' performance was evaluated using a Likert scale of 1 - 4 where 1—"Poor", 2—"Fair", 3—"Good", 4—"Excellent". The frequencies of

the scale responses per item were totaled and proportions calculated.

2.10 Ethical Considerations

Ethical approval was obtained from Institutional Research and Ethics Commit- tee (IREC, a College of Health Sciences), Moi University and the Moi Teaching and Referral Hospital committee. Informed consent was sought from all the par- ticipants. Participation was voluntary and the information provided was treated with confidentiality and anonymity.

3 Results

1.1. Graduates Demographic Characteristics

Of the 227 graduates sampled for the study, 188 completed the questionnaires, giving a response rate of 82.8%. The Among 188 graduates that completed the questionnaires, 79 (42%) were aged 25 - 34 years, 71 (37.8%) aged 35 - 44 years,

29 (15.4%) aged 45 - 54 and 9 (4.8%) were ≤25 years. More than half 111 (59%) of the graduates were males.

1.2. Graduates Career Placements

The graduates were distributed over more than 12 public health career areas. These included disaster preparedness and management 33 (17.6%), research 27 (14.4%), community health 16 (8.5%) and Infection prevention 16 (8.5%). There was also a category of other careers (17%) and included those who were running consultancy companies, working in private enterprise, and others based at the banks as banks clerk. The career distribution is as depicted in **Figure 1**.

1.3. Graduates Perceptions of Their Competencies to Handle Work Demands

Of all the graduates interviewed, 142 (75.5%) reported that their undergraduate training formed the basis for their current job. On the other hand, only 57 (30.3%) reported adequacy in their skills acquired during undergraduate train- ing and 72 (38.2%) of the graduates intimated that they had faced competency challenges at their work place.

The results from the in-depth interviews portrayed a mixed picture about the role played by their training in determining their competencies, with negative narrations

from those who reported competency challenges and praises from those who had not faced competency challenges as exemplified from the narra- tions below;

> *"… regrettably nobody mentioned strategies like PHASE, PHAST, CLTS,*
MHM *etc. which are common WASH terms … in fact, my employer won- dered what kind of public health I had done …"*

39 years old female

> *"… well for me the program is excellent and I enjoy applying the skills out here … the department just needs to improve on the weak areas like practi- cal orientation aspects …"*

35-year-old male.

> *"… need to review the curriculum to be up to date with the requirements of the job market; personally, I had to learn some aspects on job …"*

34-year-old Male.

1.4. Demographic Characteristics of the Employer Respondents

Out of the sampled 45 employers, 39 responded giving a response rate of 86.6%. Among the 39 employer respondents who participated in the study, 16 (41.0%) were aged between 50 - 59 years and 27 (69.2%) were male. Eleven (28.2%) of the employer respondents were field supervisors and the same number had worked for 2 - 5 years with the same employer. The details of the employer re- spondent demographic characteristics are shown in **Table 1**.
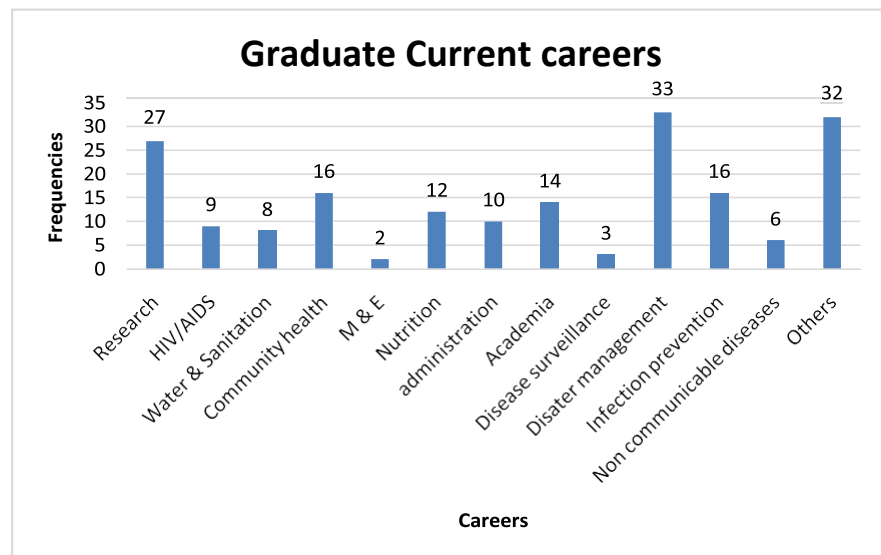
Figure 1. Distribution of graduate career placements.

Table 1. Demographic characteristics of the employer respondents.

Characteristic	Frequency (n)	Percent
Age-group (years)		
30 - 39	8	20.5
40 - 49	10	25.6
50 - 59	16	41.0
≥60	5	12.8
Gender		
Male	27	69.2
Female	12	30.8
Current position in the organization		
Head of department	6	15.4
Human resource manager	2	5.1
Field Supervisor	11	28.2
Program manager	3	7.7
Administrator	9	23.1
Others	8	20.5
Duration worked with current institution		
<2 years	10	25.6
2 - 5 years	11	28.2
5 - 10 years	9	23.1
>10 years	9	23.1

1.5. Employers' Perspectives on Graduates Performance on Assigned Tasks

On specific competency ratings, 20 (51.3%) of the employers rated graduates as

excellent on meeting timelines and being team players. Employers also rated graduates as good in planning and organizational skills 21 (53.8%), analytic and assessment skills 19 (48.7%) as well as in practical and technical skills. There was however, a significant proportion of employers who rated the graduates' com- munication skills as fair (30.8%). The overall mean score of the competencies was 3.30 with a standard deviation of 0.24. The employer rating of graduate's skills competencies is as shown in **Table 2**.

1.6. Employer Respondent Characteristics and the Assessment of Graduate's Skills Competencies

Analysis of the relationship between the graduates skills competency scores and the employer characteristic showed that, there was a statistically significant dif- ference in the competency scores between the positions of the employer respon- dents ($\chi2 = 12.916$; $p = 0.024$). The mean rank scores were higher among the category under others (26.31) and lower among program managers (6.67) as shown in **Table 3**.

1 Discussion

Findings from the study indicate that more than half of the employers 24 (61.5%) indicated that the environmental health graduates employed in their organizations had no challenges in their skills competencies. This finding is sim- ilar to the findings of a study done in Malaysia on Malaysian graduates' em- ployability skills where employers who had hired graduates from Malaysian universities were satisfied and happy with the graduates from these universities [15]. On the hand, 116/188 (61.7%) of the graduates reported that they did not face any competency challenges in their work place. This finding is consistent

with those of a study done by Prince *et al.* [16] where junior doctors transitioning from medical school to clinical practice in the Netherlands

reported that their undergraduate training was adequate in terms of skills acquisition that boosted their confidence in clinical practice. There was a significant proportion of employers (38.5%) reporting that environmental health graduates face skills competency challenges and a similar proportion (38.3%) of the graduates self-reporting inadequacies in their skills competencies. These findings in addi- tion to only 30.3% of the graduates reporting adequacy in skills acquired during undergraduate training could be postulated to be as a result of a disconnect of key training needs between the higher education and the world of work and this calls for concerted efforts from all the concerned stake holders to remedy the situation. With a substantive proportion of employers reporting graduates' competency challenges at their job placement, it seems the reliance upon the new graduates to foster innovative practices in organizations is fading away [17]. Graduates competency challenges have been associated with several factors dur- ing their course of training as well as skills change [18].

Despite these competency challenges being alluded to the

constant change of skills requirement by employers, there is

need to explore the development of

Table 2. Employer rating of

graduate's skills competencies.

Item P value	Frequencies (%)				Mean (SD)	Median	Min-Max	
	Poor	Fair	Good	Excellent				
Analytic and assessment skills	2.6	17.9	48.7	30.8	3.09 (0.77)	3	1 - 4	0.055
Planning and organization skills	0	12.8	53.8	33.3	3.21 (0.66)	3	2 - 4	0.225
Communication skills	0	30.8	38.5	30.8	3.00 (0.79)	3	2 - 4	0.004
Practical and technical skills	0	15.4	48.7	35.9	3.21 (0.70)	3	2 - 4	<0.001
Quality of work by the graduate	0	10.3	48.7	48.7	3.38 (0.67)	3	3 - 4	0.282
Completes assigned tasks on time	0	0	48.7	51.3	3.51 (0.51)	4	3 - 4	0.142
Meeting timelines	0	5.1	43.6	51.3	3.46 (0.60)	4	2 - 4	0.591
Team player	0	46.2	35.9	17.9	3.51 (0.51)	4	3 - 4	0.018

Note. N = 39. Scale: 1 = poor, 2 = fair, 4 = excellent.

Table 3. Employer respondent characteristics and the assessment of graduate's skills competencies.

Characteristic	N	Mean Rank	Test statistic	p-value
Age (years)				
30 - 39 years	8	15.25		
40 - 49 years	10	22.80	2.105 [a]	0.551
50 -59 years	16	20.53		
60 - 69 years	5	20.30		
Sex				
Male	26	19.67	0.258 [b]	0.797
Female	13	20.65		
Position in the organization				
Head of department	6	10.00		
Human resource manager	2	20.75		
Field Supervisor	11	23.86	12.916 [a]	0.024
Program manager	3	6.67		
Administrator	9	20.61		
Others	8	26.31		
Number of years worked				
<2 years	10	22.05		
2 - 5 years	11	21.82	6.278 [a]	0.099
5 - 10 years	9	11.89		
>10 yeas	9	23.61		

a-Kruskal-Wallis; b-Mann Whitney.

employability agenda in higher education and examine implications of organiza- tional change for graduates while assessing the attributes that graduates will need in their next phase of job placement [19] [20]. As this debate rages on, higher education institutions must be well informed of the graduate's expecta- tions from the world of work in order to adopt the proactive role in responding to preparing graduates to face future job tasks, new employment patterns and contributions to innovative society [21].

On specific competency ratings, 20 (51.3%) of the employers rated graduates as excellent on meeting timelines and being team players. This group of gra- duates in terms of competency and individual performance need to be com- mented for continued

performance. As Kurtz and team asserts in their study on modelling the world of work, excellent performers over time decline dramatical- ly due to organizational culture [22]. However, due to the current public health practice, public health graduates ought to maintain their public health know- ledge on the most recent advances of public health and attending CPD programs is one way of refreshing knowledge and remaining current.

The results of the current graduates' career placement revealed mixed expec- tations. The leading graduates' career was disaster management, followed closely with the careers grouped as others. Although disaster management, is an ex- pected outcome of the degree program training, the career grouped 'others' raised some concerns. The graduates' careers under 'others' included running of consultancy firms, entrepreneurship, banking and leadership in financial corpo- rations. This finding could suggest some aspect of graduates' competency chal- lenges and hence their subsequent choices to undertake less stressful tasks as were found out by Walsh *et al.*, [23] on their study on core competencies for

disaster medicine and public health. The finding could also mean that there is no sufficient market for the Bachelor of Science environmental health graduates and therefore opting to take up any other job available to earn a living. The study by Walsh *et al.*, [23] showed that despite being trained, public health gra- duates lacked critical knowledge and experience to operate under stressful con- ditions thereby resorting to other comfortable career options. Our study seem to point out some training gaps which could be identified as professional training needs and ploughed back to the graduates' curriculum for better workforce de- velopment as suggested by Aslam and team [24].

2 Conclusion

The study showed that the environmental health graduates' skills competencies were good as assessed by the employers and the employers also noted that the majority of the graduates employed in their organizations had faced no skills challenges in their place of work. A significant proportion of the graduates re- ported that they

faced competency challenges and lacked adequate skills to match their work demands. This inadequacy in skills could be an indicator of lack of practical experiences due to theoretical trainings and very limited field exposures. The curriculum content and scope should be expanded to meet the changing technological skill needs of the job market. For well-rounded training, institutions of higher learning should establish linkages and collaboration to enhance professional skills as well as well-developed workforce meeting industry demands.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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List of Abbreviations

CLTS: Community Led Total Sanitation;

MHM: Menstrual Hygiene Management;

PHAST: Participatory Hygiene and Sanitation Transformation; WASH: Water, Sanitation and Hygiene.

APPENDIX XIII: BUILDING SKILLS FOR THE NEXT GENERATION OF PUBLIC HEALTH WORKERS GRADUATE AND EMPLOYER PERSPECTIVES POSTER PRESENTATION

APPENDIX XIV: PLAGIARISM REPORT

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