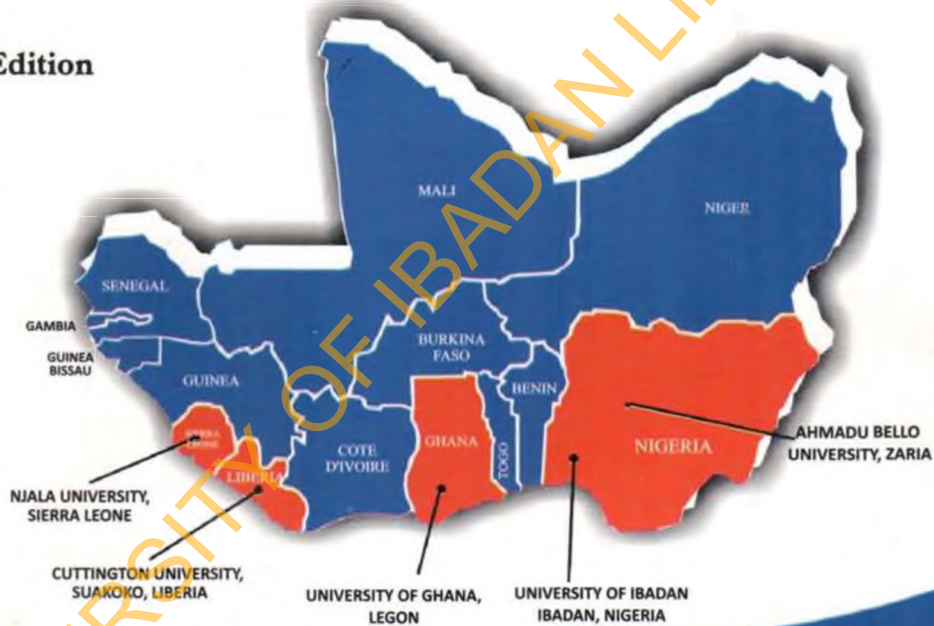


OPPORTUNITIES FOR FIELD RESEARCH AND SHORT COURSE IN HUMAN-ANIMAL DISEASE SURVEILLANCE IN WEST AFRICA

First Edition



Babasola Oluseyi Olugasa



Centre for Control and Prevention of Zoonoses
CCPZ University of Ibadan, Ibadan, Nigeria

Opportunities for field research and short course in human-animal disease surveillance in West Africa

First Edition
(2014)

by

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Dedication

This book is dedicated to all my teachers who inspired me while learning under them, to my co-Principals, co-investigators and collaborators who sharpened my thoughts and efforts on the job, and to all my students who challenged and inspired me throughout my career. The book is also dedicated to my family for their ever present support in writing this book. Above all, to the glory of God Almighty, who inspired a sense of duty in us to care for the well-being of our neighbourhood in West Africa.

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Acknowledgment

The John D. and Catherine T. MacArthur Foundation funded the establishment of the Centre for Control and Prevention of Zoonoses, University of Ibadan, Nigeria, to improve postgraduate training for surveillance of human-animal diseases in West Africa as a priority programme to address major zoonoses challenge in the sub-region.

Administrative oversight for the project was provided by Professor Isaac F. Adewole, Vice-Chancellor, University of Ibadan, Nigeria. Professor Rotimi O. Oderinde (MacArthur Grant Liaison Office - MGLO, University of Ibadan) and his immediate predecessor in office, Professor Godwin O.S. Ekhaguere, ensured adequate formation and operational supervision of the grant. Collaboration between veterinary and medical faculty within the University of Ibadan was led by Professor Victor O. Taiwo, Dean, Faculty of Veterinary Medicine, Professor Bankole O. Oke (Former Dean), Professor Gabriel A.T. Ogundipe (Former Dean), Professor Temitope Alonge (Chief Medical Director, University College Hospital, Ibadan), Professor Ajuwon (Dean, Faculty of Public Health, University of Ibadan) and Professor Oyewale Tomori (President, Nigerian Academy of Science).

Sub-regional educational collaboration network was facilitated by Dr. Henrique K. Tokpa (President, Cuttington University, Liberia), Professor Abu Sessey (Vice-Chancellor Njala University, Sierra Leone), Professor George K. Aning (Dean, School of Veterinary Medicine, University of Ghana), Professor Albert B. Ogunkoya (Ahmadu Bello University, Zaria, Nigeria), Dr. Ighodalo F. Ijagbone (Director-General, Nigerian Institute of Science Laboratory Technology, Ibadan), Professor Onyebuchi C. Chukwu (Honourable Minister of Health, Federal Republic of Nigeria), Dr. Florence Chenoweth (Honourable Minister of Agriculture, Liberia), Dr. Walter Gweneewale (Honourable Minister of Health and Social Welfare, Liberia), Dr. Muhammed S. Ahmed (Executive Director, National Veterinary Research Institute, Nigeria), and Dr. K. Ibrahim (Chairman, Nigerian Veterinary Medical Association-Oyo State Branch), Dr. Kwesi B. Darkwa (President, Ghana Veterinary Medical Association, 2007-2010), Dr. Osei Agyemang Bonsu (President, Ghana Veterinary Medical Association, 2010-2014).

Materials for curriculum review were provided by experts within and beyond West Africa. They include Professor Gabriel O. Esuruoso (Founding Head, Department of Veterinary Public Health and Preventive Medicine, University of Ibadan, Nigeria), Dr. George W. Beran (Distinguished Emeritus Professor, Iowa State University), Professor Harold L. Russel (Department of Public Health, Saint Georges University, Granada, West Indies), Dr. Bolanle Wahab (Department of Urban and Regional Planning, University of Ibadan, Nigeria), Dr. George Nipah (former Deputy Director, Ministry of Food and Agriculture, Ghana), Dr. Richard Suu-Ire (University of Ghana and immediate past President, Commonwealth Veterinary Medical Association), and Dr. Saidu Kanu (Head, Department of Animal Science, Njala University, Sierra Leone). Adoption of both revised and newly developed curricula was facilitated by Professor Bankole O. Oke (Former Dean, Faculty of Veterinary Medicine, University of Ibadan, Nigeria), Professor Francis Egbhokhare (Department of Linguistics and African Languages, University of Ibadan and former Director, Distance Learning Centre, University of Ibadan, Nigeria), Dr. Sola Adedaja (Senior Lecturer, Teacher Education, University of Ibadan, Nigeria), Dr. Theodore Brown (Vice-President, Academic Affairs, Cuttington University, Liberia), Professor Samuel A. Agbede (Department of Veterinary Public Health and Preventive Medicine, University of Ibadan, Nigeria), Professor Victor O. Adetimirin (Head, Department of Agronomy, University of Ibadan, Nigeria), Dr. Isaac G. Adeyemi (Department of Veterinary Public Health and Preventive Medicine, University of Ibadan, Nigeria), Dr. Magbagbeola D. Dairo (Department of Epidemiology and Medical Statistics, University of Ibadan, Nigeria), Dr. Ayotunde J. Fasunla (Department of Otorhinolaryngology, University of Ibadan, Nigeria) and Mrs. Bamke Okunribido (Consultant, Public Health Project Monitoring).

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to host and participate in the Nigeria Bio-security Engagement Training Programme, funded by the United States Department of State. These two programmes offered on-site best practices in field research and short course for the detection and diagnosis of high consequence zoonotic pathogens. The training afforded the CCPZ team to test-run some of its equipment for zoonoses surveillance. It also provided model instructional materials for training and fieldwork guidelines. Mrs. A. Sanni-Adeniyi (Deputy Director, Zoonoses, Federal Ministry of Health, Abuja, Nigeria) and Professor Albert B. Ogunkoya (Ahmadu Bello University, Zaria, Nigeria) facilitated CCPZ's hosting of the first international Conference on Rabies in West Africa (RIWA), 2012.

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This book was made possible by all the persons here mentioned and many more. All errors are mine.

Babasola Oluseyi Olugasa

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Foreword

This book highlights the mandate of the Centre for Control and Prevention of Zoonoses (CCPZ), Faculty of Veterinary Medicine, University of Ibadan, Nigeria. It describes a Certification Programme based on Participation in Human-Animal Disease Surveillance (CPDS) in West Africa. The rationale for the programme is founded on the principal idea that a new system of local production of manpower is needed to control high consequence zoonotic diseases in West Africa. However, building the capacity for early detection and surveillance of zoonotic diseases is an on-going process that requires multi-level training. West Africa in the time past had suffered from lack of inclusive surveillance programmes that would educate the general public of the dreaded zoonotic diseases and hence, the need to evolve novel training opportunities for personnel in zoonoses control programme is a panacea. CCPZ certification in human-animal disease surveillance is novel in West Africa.

The opportunities presented in this book will enable and engage graduates to efficiently collaborate with lay citizens and utilize their capabilities in the effective surveillance of zoonotic diseases in West Africa. Additionally, the opportunities take the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan to excellence in service. Once graduates are competent in the surveillance of zoonotic diseases, they will be able to develop local networks for planning and implementation of disease surveillance, which is necessary to support their control and prevention. The new programmes available for zoonoses surveillance are unique packages to improve public health education, science and services in West Africa.

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Preface

The author gives an account of the important achievements of the Centre for Control and Prevention of Zoonoses (CCPZ), University of Ibadan, Nigeria in its first three years of formation. The aim is that, it will serve as a veritable source of knowledge about the centre, its mode of operation, network and opportunities that are made available, as well as some of its developmental challenges.

The CCPZ is a project founded in the University of Ibadan by the John D. and Catherine T. MacArthur Foundation to improve postgraduate programmes for surveillance of human-animal diseases in West Africa. It was established to address public health education challenges, review and develop curricula that would create opportunities for training skilled manpower, developing community engagement activities that lay members of the community may associate with as team players in zoonoses detection, surveillance and control for common good. As such, education in this field is multi-level and multi-disciplinary, geared towards making professionals and lay members of the community to find a connection in the available information, knowledge and good will, and for playing a timely role in solving the human-animal disease surveillance challenge in West Africa. This is the focus of this book, which has been deliberately made simple as possible for all who would find it, pick it and read it to understand the message and act on it.

The author has presented his experience as an insider of the University of Ibadan community, and has provided explanations on the formation objectives, actualization, operationalization and sustainability of the CCPZ. As a result of this, the document does not necessarily represent the official position of the CCPZ in all cases. Where the facts provided represent the didactic position of the centre, it was stated with reference made to one or more specific official documents. Where information provided represents a personal opinion of the author, it was so indicated. It is my pleasure to invite all to read this book which offers great insight into addressing a major challenge in West Africa.

Olayinka O. Ishola *DVM, MPVM, PhD, FCVSN*

Acting Head, Department of Veterinary Public Health and Preventive Medicine
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LIST OF CONTENTS

<i>Title page</i>	<i>i</i>
<i>Publishers' page</i>	<i>ii</i>
<i>Dedication</i>	<i>iii</i>
<i>Acknowledgment</i>	<i>iv</i>
<i>Foreword</i>	<i>viii</i>
<i>Preface</i>	<i>ix</i>
<i>List of contents</i>	<i>x</i>
<i>List of tables</i>	<i>xii</i>
<i>List of figures</i>	<i>xiii</i>
Chapter 1: INTRODUCTION	1
1.1 The formation of Centre for Control and Prevention of Zoonoses, University of Ibadan, Nigeria	1
1.2 Policy statement on the place of field research in human-animal disease surveillance	3
1.3 Concepts and definitions of short course in disease surveillance	6
1.4 Objectives of human-animal disease surveillance training programme	6
1.5 Justifications for short course in human-animal disease surveillance	7
1.6 Conclusion	9
Chapter 2: DEVELOPMENT OF CURRICULUM FOR HUMAN-ANIMAL DISEASE SURVEILLANCE	11
2.1 Background information	11
2.2 Types of curriculum	13
2.3 University wisdom in the service of stakeholders	14
2.4 Non-degree and degree programmes	20
2.5 Operationalizing the new programmes	21
2.6 Conclusion	22

Chapter 3: A SHORT COURSE IN HUMAN-ANIMAL DISEASE SURVEILLANCE	23
3.1 Background information	23
3.2 Objectives of the short course	24
3.3 Requirements for admission	24
3.4 Method of application	26
3.5 Course modules and duration	26
3.6 Mode of instructional delivery	28
3.7 Conclusion	29
Chapter 4: OPPORTUNITIES FOR FIELD RESEARCH IN HUMAN-ANIMAL DISEASE SURVEILLANCE	31
4.1 Background information	31
4.2 Objectives of zoonoses field research	32
4.3 Requirements for admission	33
4.4 Method of application	33
4.5 Modules in Systematic Epizootiology	33
4.6 Mentoring mode and duration	37
4.7 Conclusion	41
BIBLIOGRAPHY	43
INDEX	50
APPENDIX: Three-Year Formative Report, Centre for Control and Prevention of Zoonoses (CCPZ), University of Ibadan, Ibadan, Nigeria, 2012-2014	52

LIST OF FIGURES

1.1	Vice-Chancellor, University of Ibadan, Nigeria and invited experts for epizootiology curriculum review workshop, December, 2012	8
2.1	West African Administrative Board of the CCPZ	15
2.2	Dean, Postgraduate School, University of Ibadan, the Dean and Sub-Deans of collaborating Faculties with the CCPZ team	15
2.3	Cross-sections of the CCPZ curriculum review workshop	16
2.4	Invited experts and stakeholders at curriculum review workshop with the Doyen of One-Health, Nigeria	16
2.5	Stakeholders at the adoption of Curriculum for Human-Animal Disease Surveillance Programme in West Africa	17
2.6	Cardinal academic and professional bodies present at adoption of short course and field research curricula of the Centre for Control and Prevention of Zoonoses, Ibadan, March, 2014	18
3.1	Various stages of renovation, installation and commissioning of CCPZ Learning Centre, Njala University, Sierra Leone	25
3.2	University of Ibadan CCPZ laboratories with personnel for geo-spatial data analysis and detection of pathogens at the molecular and immuno-histo-chemical levels	28
3.3	CCPZ partner research laboratories, Ibadan, Nigeria with personnel for genome sequencing and bio-informatics of isolated pathogens in West Africa	29
4.1	President, Cuttington University, Liberia in his office with staff and students of the University of Ibadan, Nigeria who visited Liberia on field research	34
4.2	Catchment areas for field research in human-animal disease surveillance in West Africa	35
4.3	Success stories of field research in Lassa fever mapping and forecasting, Liberia, 2013	39
4.4	Success stories of field research into rabies-like-illness and spatial pattern of Lassa fever cases among humans, Liberia, 2013	40

LIST OF TABLES

3.1	Course modules and their durations	26
3.2	Training Modules in Human-Animal Disease Surveillance Certificate Programme	27
4.1	Modules in Systematic Epizootiology for Field Research in Human-Animal Disease Surveillance	34

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Chapter 1

INTRODUCTION

1.1 The formation of Centre for Control and Prevention of Zoonoses, University of Ibadan, Nigeria

Higher education in West Africa is needed to address the critical manpower that confronts the considerable public health challenges in the sub-region.¹⁻¹⁰ The University of Ibadan, Nigeria successfully responded to the need by establishing a Centre for Control and Prevention of Zoonoses (CCPZ) in January 2012, to improve postgraduate programmes for surveillance of human-animal diseases in West Africa. This initiative received support from the John D. and Catherine T. MacArthur Foundation, Chicago, Illinois with a grant for a period of three years (2012-2014).¹¹⁻¹²

The Centre is devoted to the goal of improving postgraduate training for surveillance of human-animal diseases by promoting collaboration between Veterinary and Medical Schools and

management of preventable animal-to-human diseases (zoonoses) in West Africa.⁹ The centre offers training and research at certificate and postgraduate levels, which was founded on multi-level, multi-disciplinary expertise to build sub-regional capacity for human resource development in zoonoses containment.⁵⁻⁸ The centre's research laboratories focus on emerging, endemic and neglected diseases, and provide decision support systems for sub-regional control and prevention of zoonoses.

Zoonoses are infections and infestations that are transmitted from animals to humans and vice-versa, under natural conditions contributes an estimated 2.4 billion cases of human illness and 2.2 million deaths each year in low and middle income nations of the world, including West Africa. Human-animal diseases, such as anthrax, brucellosis, cysticercosis, Dengue fever, Ebola virus disease, Lassa fever, influenza, rabies, tuberculosis and yellow fever are also

among the quite preventable health problems. CCPZ supports postgraduate curricula in human-animal disease surveillance with training modules that include risk mapping and visualization with geographic information systems (GIS), data management for analytical planning, exposure science, surveillance, statistical and modelling approaches, molecular epizootiology and to harness indigenous knowledge for zoonotic disease research and control activities.

The programmes of the centre are targeted to provide professionals such as veterinarians, physicians, epidemiologists, public health officers, pharmacists, agricultural scientists, educators, economists, pathologists, parasitologists, microbiologists, sociologists, extension workers and artists to learn together in a collaborative way to promote human, animal and environment health in the sub-region of West Africa.

CCPZ vision

A world class centre of academic excellence in the surveillance, control and prevention of diseases in the human-

animal-environment interfaces.

CCPZ mission

Improve the health of people, animals and the common environment through robust collaborative postgraduate training programmes, empowering career professionals to respond more effectively and efficiently to the containment and control of emerging, endemic, and neglected zoonoses in West Africa at individual, community and population levels.

The programme is also designed to build a critical mass of highly trained individuals with the practical knowledge, skill and network required for sub-regional control and prevention of zoonoses. Thus, improving field research capacity, training and mentoring in West Africa.

CCPZ receives applications from candidates seeking admission into postgraduate programmes at the University of Ibadan. Training modules include non-degree certificate short course and elective curriculum for systematic field

research. Each of the modules complement other training programmes offered by other academic departments and units of the University of Ibadan, Nigeria and the other collaborating tertiary institutions in West Africa. Thus, a unique opportunity for learning and acquiring competence in human animal disease surveillance is provided at the University of Ibadan along with major West African collaborators to fill the existing gaps.

1.2 Policy statement on the place of field research in human-animal disease surveillance

Surveillance of zoonotic diseases at the human-animal-environment interface in West Africa, is an ongoing systematic collection and analysis of data which leads to clearer understanding of the mode of exposure and the optimal strategies that required to effectively and efficiently control, prevent and eliminate the diseases within human and animal populations. This requires field research. In the process, conducting field investigations to detect and diagnose,

for example, suspected cases of avian, human or swine influenza, rabies or Lassa fever in communities in West Africa, involving animal and human dense populations constitute the usual activities. Laboratory confirmation techniques, including Enzyme-Linked Immuno-sorbent Assay (ELISA), Immunoblotting Assay, Polymerase Chain Reaction and whole virus isolation and characterization were used in the confirmation of each of these cases.

As a matter of policy, it is critical to identify the pathogen or syndrome, the human and animal population at risk of exposure, their local environment and time of disease occurrence in a systematic collection of data during surveillance. Following case detection in each of these examples of human and animal diseases, the filling of gaps in surveillance data, correcting the under-reporting and poor quality reports was a major challenge. Equally, statistical and modelling approaches, the application of geographic information systems and remote sensing applications in exposure science, veterinary public health and

zoonosis research and control activities, harnessing these knowledge and toolkits in culturally sensitive manner are policies of the CCPZ team.

CCPZ contributes to zoonoses surveillance education, practice and development, using evidence-based planning for control and preparedness in response, based on scientific model. As a result, field research uses human and animal hospital records, community level public participatory approaches to data capture, Global Positioning System (GPS), application of remote sensing data captured on satellite images, all integrated into Geographic Information Systems (GIS) software as tool for data evaluation and management to reasonably fill data gaps in this area of surveillance, which is essential for public health and preventive medicine planning activities and delivery.

The opportunity to model annual zoonosis case-pattern and apply it to make forecast as well as spatial distribution predictions opens an endless opportunity for field research. Subsequently, field research utilizes geo-

spatial and statistical methods to analyze and develop spatial and time-trend models that would enable epidemiologists to predict case-pattern of specific diseases at the human-animal-environment interfaces over a five-year period at a time, such that public health planning could be effectively done in each case to "arrive at the site of an epidemic before the pathogen gets there".

To make the information explicitly clear to the lay persons in a community, each forecast and prediction is translated into thematic map, offering user-friendly visualization of case distribution patterns within base maps of target communities. Developing these knowledge into toolkit for strategic planning and preparedness based on forecasts is a landmark achievement in CCPZ's contribution to zoonotic disease surveillance education and the practice and development of their control and prevention. The opportunity of annual zoonoses forecasts available, data-profile and thematic maps would be used for predictions at designated Geospatial Information Infrastructure (GII), notably at the Centre for Control

and Prevention of Zoonoses (CCPZ), University of Ibadan. The results shared with relevant agencies for targeted response in form of informative, user-friendly maps will be uploaded and hosted on the internet at the zoonoses map pavilion, with accessibility to lecturers, students and lay members of the community in West Africa.

Lecturers and supervisors are drawn from all participating institutions. The programme rely on joint teaching, research and supervision of students. The CCPZ promotes collaboration between Veterinary and Medical Schools and Services in the sub-region to train personnel for competence in human-animal disease surveillance and control.

Collaborating institutions within and beyond West Africa

Nigeria

1. Ahmadu Bello University, Zaria
2. Federal Ministry of Agriculture, Abuja, Federal Capital Territory (FCT)
3. Federal Ministry of Health, Abuja, FCT
4. National Zoonoses Centre, University of Ibadan

5. National Veterinary Research Institute, Vom, Plateau State
6. Nigerian Institute of Science Laboratory Technology, Ibadan
7. Nigerian Medical Association
8. Nigerian Veterinary Medical Association

Ghana

1. Ghana Veterinary Medical Association
2. Kwame Nkrumah University of Science and Technology, Kumasi
3. Ministry of Food and Agriculture, Accra
4. Ministry of Health, Accra
5. University of Ghana, Legon, Accra

Liberia

1. Cuttington University, Suakoko, Bong County
2. Ministry of Agriculture, Monrovia, Montserrado County
3. Ministry of Health and Social Welfare, Monrovia, Montserrado County
4. Central Agricultural Research Institute, Suakoko, Bong County

Sierra Leone

1. Njala University, Njala, Sierra Leone
2. Ministry of Agriculture, Forestry and Food Security, Freetown

3. Ministry of Health and Sanitation,
Freetown

United States of America

Center for Food Security and Public
Health, Iowa State University, Ames,
Iowa

Opportunities for the certificate of participation and non-degree post-graduate research with multi-level, multi-disciplinary expertise in zoonosis surveillance and control are provided through this collaboration network. Research laboratories within CCPZ network focus on emerging, endemic and neglected diseases, and provide decision support systems for sub-regional control and prevention of zoonoses.

1.3 Concepts and definitions of short course in disease surveillance

The concept of short course emanated from both social and economic costs consideration in undertaking a regular academic year of study, especially among career individuals. An academic year is considered to be the annual teaching or examination period during which

students attend courses or take final examinations, not taking minor breaks into account (UNESCO, 2012). While this may be shorter than 12 months, it is usually not less than 9 months within West Africa.

However, a short course may be one day to 3 months in duration. The concept of short course focuses on block teaching, which refers to a 'block' of time, such as a number of weeks that is devoted to a particular topic or prescribed set of learning objectives and outcomes. It can also indicate a way of organizing the training day using long class periods (more than 60 minutes, often 90-minutes and sometimes much longer) to include more activities and materials to engage trainees in field surveillance and laboratory detection of zoonotic diseases.

1.4 Objectives of human-animal disease surveillance training programme

1.4.1 Zoonosis surveillance training (ZST) enables participants to refresh their skills or develop new skills, and to keep in touch with latest research and

knowledge in efforts to improve local or regional disease surveillance;

1.4.2. ZST offers culturally adaptive curriculum contents specific to key locations in West Africa for human-animal disease surveillance;

1.4.3. It offers vocational knowledge and skills in thematic map design, it is used in disease case pattern visualization and description along space (spatial) and time (temporal) variables within a local or national environment;

1.4.4 ZST offers knowledge, skills and right attitude towards laboratory detection and diagnosis of specific diseases within the sub-region.

1.4.5 It offers statistical and modeling techniques for analyzing and predicting case-pattern of disease over foreseeable future;

1.4.6 It builds teamwork for monitoring local and regional case response.

1.5 Justification for short course in human-animal disease surveillance

Failure to pay adequate attention to the control of many of the endemic human animal diseases in the developing countries has led to their classification as neglected diseases by the World Health Organization (WHO). Outbreaks of infections and diseases naturally transmitted between humans and animals in West Africa have often had negative health impacts, that bordered on social and economic disaster. The need to produce adequate number of skilled manpower in the surveillance, control and prevention of zoonotic diseases is a major justification for short-courses and field research programme in West Africa.

With the constant and inevitable interaction of man and animals, zoonotic diseases remain a genuine threat to human health and survival of their livestock, companion animals and

wildlife. Indeed, zoonotic diseases have been described as the main threat to human survival in the twenty-first century and beyond (Smith et al., 2011). For instance, it has been demonstrated that Marburg and Ebola viruses which are zoonotic diseases can cause heavy casualties when there is an outbreak, often have their origins in animals (mostly wild animals).

Many prevailing zoonotic diseases such as anthrax, brucellosis, cryptosporidiosis, hydatidosis, influenza, rabies and tuberculosis, have been found either during normal biomedical practices or as a result of sporadic surveys in various parts of West Africa. Scientific information on such diseases remains epidemiologically fragmentary; hence, planning for their proper control or containment is limited. A number of emerging zoonoses such as avian influenza are being introduced into new areas, often across geographic borders, where they were previously absent and are termed emerging diseases.

In most cases, animals play an essential role in maintaining the infection in nature



Figure 1: Vice-Chancellor, University of Ibadan, Nigeria and invited experts for epizootiology curriculum review workshop, December, 2012

The Vice-Chancellor, University of Ibadan, Nigeria, Professor Isaac F. Adewole (R-L: third on front row) received delegates to the First International Conference on Rabies in West Africa (RIWA) and Related Curriculum Review Workshop of the CCPZ, 4-7 December, 2012. Experts here posed are (R-L): Mr. Roland Suluku (Njala University, Sierra Leone), Professor Albert B. Ogunkoya (Ahmadu Bello University, Zaria, Nigeria), Mrs. A. Sanni-Adeniyi (the Federal Ministry of Health, Abuja, Nigeria), Dr. George Nipah (the Ministry of Food and Agriculture, Accra, Ghana), Dr. Richard Suu-Ire (University of Ghana, Legon). (Second row, R-L): Professor Harold L. Russel (University of the West Indies, Granada), Dr. K. Oyewola (Vice-President, Nigerian Veterinary Medical Association), Dr. Babasola O. Olugasa (CCPZ), Mr. O.M. Oladejo (Director, University of Ibadan Public Communication), Mr. David O. Ayegba (Ahmadu Bello University, Zaria). (Third row R-L), Dr. Simeon I.B. Cadmus (CCPZ, University of Ibadan, Nigeria) and Dr. Kolade Oluwagbemigun (CCPZ Programme Officer).

and contribute in varying degrees to the distribution and actual transmission of infection in human and animal populations. These diseases have a variety of transmission mechanisms that may be direct, such as in rabies and anthrax, or indirect, via vectors, food, water and the environment, as in the case of bovine tuberculosis and cysticercosis. Some of the diseases, such as brucellosis, *et cetera*, also have multiple routes of infection.

Short courses is suitable for individuals who are working in public health departments and are interested in some of the topics covered, and wish to learn more, refresh or modernize their skills in selected areas often find this programme meeting their professional needs. In addition, a short course attended prior to enrolment in a regular postgraduate course could be a great advantage. The CCPZ short course is particularly helpful and recommended for Epidemiologists, Epizootiologists, Geographers, Physicians, Veterinarians, researchers, scientists, Animal Health Extension Officers and Health Sociologists, teachers in Agriculture, Public Health, Medical and Veterinary Medical Colleges.

1.6 Conclusion

To this end, CCPZ is an international hub for training and research in the surveillance of human-animal diseases in West Africa. CCPZ trains people to identify the causal agents, associated risk factors and their containment promotion in such a way that leads to certification and field research on a non-degree basis, yet helping candidates to fulfil degree requirements at the postgraduate level. Thereby, provides enabling environment for them to excel in degree programmes.

CCPZ's mission is to build capacity for containment of endemic, emerging and neglected zoonoses in West Africa through inclusive learning that strengthens inter-University collaboration, increase postgraduate enrolment in epizootiology oriented programmes and provide incentives for mentoring, research and service delivery in zoonoses surveillance across board of West Africa.

Over the three-year period of September 2011 to September 2014, the John D. and Catherine T. MacArthur Foundation supported the University of Ibadan to

improve its postgraduate training in the surveillance of human-animal diseases in West Africa. The project was implemented under three headings namely: curricula development; training, research and conferencing; and community engagement. During this period, the Master of Science Epizootiology curriculum in the Department of Veterinary Public Health and Preventive Medicine was revised by selected sub-regional experts and stakeholders in One-Health education, practice and development.

The established non-degree short course and field research programmes are already providing added value-chain through increased operational visibility, student and faculty interest for participation in disease surveillance and control at the human-animal-environment interfaces. Case referral and utilization of expertise in facilitation of countrywide programmes for strengthening zoonosis education and service, has accorded the project national and sub-regional recognition.

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Chapter 2

DEVELOPMENT OF CURRICULUM FOR HUMAN-ANIMAL DISEASE SURVEILLANCE

2.1 Background information

In Teramo, Italy, 1999, a tripartite commission convened by World Health Organization (WHO),^{3, 4, 55, 60} adopted a consensus definition for Veterinary Public Health as the contributions to the physical, mental and social well-being of humans through an understanding and applications of veterinary science. It was believed that this new definition was more consistent with the original WHO definition of health and also with the values, goals and targets of the WHO vision "Health for all in the 21st century".

The group considered the contributions that Veterinary Public Health could make to human health on global basis, with an emphasis on developing countries. The United Nations has expressed a policy on

training programmes for zoonoses surveillance, control and prevention, especially in the developing countries.⁴ In 2001, the WHO/FAO/OIE experts noted that the concept of a National Zoonoses Centre at the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan in offering training to improve programmes for surveillance of human-animal diseases at multi-levels, is a welcome development.⁴

Based on this background, and right from its formation, the goal of the CCPZ was to facilitate a systematic review of multi-level training to complement the Master of Science in Epizootiology curriculum for a team approach to problem solving, research, control programmes and communication, essential to ensure that veterinary contributions to the improvement of human health would be both significant and sustainable. The centre

was to facilitate such review and curriculum development in the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan; by faculty and staff of the department, along with selected sub-regional experts and stakeholders in One-Health education, practice and development, through regional meetings and workshops. The revised and developed curricula would be suitable for training of physicians, veterinarians, epidemiologists, public health workers, agriculturists, statisticians, educators, economists, pathologists, parasitologists, geographers, sociologists, extension workers and artists in novel task-sharing strategies in human-animal disease surveillance in West Africa.

In 2012, a workshop of invited experts on curriculum review and development was convened by a Sub-Committee of the Centre for Control and Prevention of Zoonoses (CCPZ), with terms of reference to work with the Department of Veterinary Public Health and Preventive

Medicine, University of Ibadan to ensure a consensus review and recommendation on a curriculum that would improve post-graduate training for surveillance of human-animal diseases in West Africa. Their recommendation was adopted in principle by the department, November, 2013.

A curriculum was developed for a Certificate of Participation in Human-Animal Disease Surveillance. This paved a way for the first cohort of ten trainees under the Short Course Certificate training in September, 2014. Subject to their recommendations, published July 2013 in *Epizootiology and Animal Health in West Africa (EAHWA)*, a sub-regional decision-support journal, the experts' review and original research papers have informed CCPZ stakeholders' 2014 policy on curriculum for West Africa that would allow lay community members and Community Health Officers at the primary care level to be offered admission and enrolled to participate in non-degree Certificate training program-

me on human-animal disease surveillance. Their participation in task-sharing along pre-exposure monitoring and post-exposure treatment compliance in confirmed case could reduce mortality due to neglected zoonoses significantly. A typical example was rabies elimination in the Philippines (Beran, 2013).

The recommendations by CCPZ expert advisors, adopted by the Stakeholders in March 2014, corroborated a tripartite report by the World Health Organization (WHO), World Organization for Animal Health (OIE) and the Food and Agriculture Organization (FAO) that people in developing countries can significantly improve their health outcomes by novel task-sharing strategies in the control of zoonoses (WHO/FAO/OIE, 2001).

2.2 Types of curriculum

After painstaking perusal of the adopted curricula review, experts and teachers of human-animal disease surveillance had unanimously agreed that the curriculum

lays the foundation for comprehensive educational reforms aimed at achieving quality learning outcomes. Hence, curriculum review processes require frequent involvement of public discussion and consultation with all stakeholders.

The papers may be summarized into the three major types of curriculum in order to focus the review process, provide evidence for policymakers and administrators to see the choices, adopt the wisdom upon which they were made as a benchmark in developmental initiatives for meeting teaching and learning needs.

2.2.1 Competency-based curriculum

A curriculum that emphasizes what the learners are expected to do rather than mainly focusing on what they are expected to learn. In principle, such a curriculum is learner-centred and adaptive to the changing needs of students, teachers and society. It implies that learning activities and environments

are chosen for learners to acquire and apply the knowledge, skills and attitudes to situations they encounter in everyday life, as pointed out by Esuruoso (2013),¹² Olugasa and Fasunla (2013),¹⁵ Beran (2013),²⁵ and Benavot (2002).⁵⁴

2.2.2 Core curriculum

This is the whole and or entire body of knowledge, skills and attitudes of a particular subject expected to be learned by all students. Generally, it is a set of subjects and learning areas that are common to all students in disease surveillance, such as epidemiology (epizootiology) and bio-metrics.^{10,14,17,34,54}

2.2.3 Elective curriculum

Courses or subjects are elective when learners are permitted to choose according to their interests and needs. Typically offered in tertiary education level to complement the core curriculum which all learners must follow.^{17,18,34,54,58,62}

2.2.4 Functional curriculum

A specially designed curriculum aimed at teaching important skills deemed to be

necessary for living and working independence of learners with cognitive impairments.^{34,54,55,57}

2.2.5 Culturally responsive curriculum

A curriculum that respects learners' cultures and prior experiences. It acknowledges and values the legitimacy of different cultures,^{18,24,34,54,55} not just the dominant culture of a society. It incorporates cultural aspects into the curriculum, rather than adding it on as an extra or separate module or course.

2.3 University wisdom in the service of stakeholders

Esuruoso (2013),²¹ provided a logic path for programme formulation and curriculum adaptation (pie chart of human wisdom) to optimize manpower training, in human-animal disease surveillance.^{10-13,}

⁵⁴⁻⁵⁸ He opined that knowledge, experience and the judicious use of both with divine grace are ultimately needed to structure a curriculum and operate it in a cycle of development, implementation, evaluation and revision to ensure that a curriculum is up-to-date and relevant.



Figure 2.1: West African Administrative Board of the CCPZ (from 2nd L-R): Dr. SIB Cadmus (Co-Principal Investigator), Professor G.A.T. Ogundipe (Head, Department of Veterinary Public Health and Preventive Medicine, University of Ibadan), Dr. K.B. Darkwa (President, Ghana Veterinary Medical Association), Dr. B.O. Olugasa (Principal Investigator), Professor G.O.S. Ekhaguere (MacArthur Grant Liaison Officer, University of Ibadan), Mrs. O.A. Sanni-Adeniyi (Deputy Director, Federal Ministry of Health, Abuja, Nigeria), Professor V.O. Taiwo (Dean, Faculty of Veterinary Medicine, University of Ibadan) Professor A.B. Ogunkoya (Ahmadu Bello University, Zaria), Professor George K. Aning (Dean, Veterinary School, University of Ghana, Legon), Dr. George Nipah (Deputy Director, Ministry of Food and Agriculture, Accra, Ghana), Dr. Adekunle B. Ayinmode (Co-PI) and Dr. Saidu Kanu (Head, Department of Animal Science, Njala University, Sierra Leone).



Figure 2.2: Dean, Postgraduate School, University of Ibadan, the Dean and Sub-Deans, collaborating faculties and the CCPZ team after a round-table discussion with Professor G.O.S. Ekhaguere, MacArthur Grant Liaison Officer, March 2012.

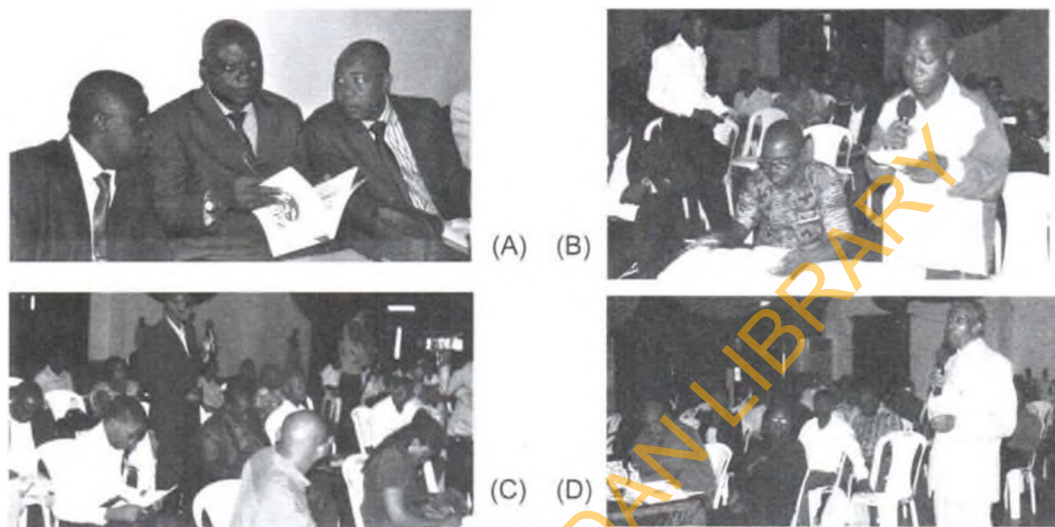


Figure 2.3: Cross-sections of the CCPZ curriculum review workshop. (A) Opened by the Deputy Vice-Chancellor (Academics), University of Ibadan, Professor Abel Idowu Olayinka, with the Dean of Veterinary Medicine, University of Ibadan, Professor V.O. Taiwo and the Chief Medical Director, University College Hospital, Ibadan, Professor Temitope Alonge. (B) Experts from Ghana and Nigeria (C and D) gave the history, professional, academic and developmental insights to curriculum for human-animal disease surveillance.



Figure 2.4: Invited experts and stakeholders at curriculum review workshop with the Doyen of One-Health, Nigeria, Professor Gabriel Oluwole Esuruoso (Founding Head, Department of Veterinary Public Health and Preventive Medicine, University of Ibadan), after the opening session, International Conference Centre, University of Ibadan. December 2012.



(A)

Figure 2.5: Stakeholders at the adoption of Curriculum for Human-Animal Disease Surveillance Programme in West Africa. The meeting was chaired by Professor Bankole Oke (Former Dean, Faculty of Veterinary Medicine, University of Ibadan), Co-Chaired by Professor Rotimi Oderinde (MacArthur Grant Liaison Officer, University of Ibadan), and discussions moderated by Professor Francis Egbokhare, (Former Director, Distance Learning Centre, University of Ibadan, Nigeria).



(B)

Discussants from Agriculture, Education, Science, Human and Veterinary Medicine backgrounds and the Office of International Programmes, University of Ibadan were present at the stakeholders' meeting. Professor Victor O. Adetimirin, Dr. Sola Adedoja, Dr. Ayotunde Fasunla, Dr. Johnson F. Ojo, Dr. Isaac G. Adeyemi, Mrs. 'Bamke Okunribido, Mrs. Bolaji Bankole and members of the CCPZ Team.

- (A) Consultant, Public Health Project Monitoring and Evaluation responded to the curricula for adoption



- (B) The Chairman, Nigerian Veterinary Medical Association, Oyo State, endorsed the curricula for adoption



- (C) Professor of Epizootiology, wildlife and fish diseases, University of Ibadan, supported the curricula for adoption.



Figure 2.6: Cardinal academic and professional bodies present at adoption of short course and field research curricula of the Centre for Control and Prevention of Zoonoses, Ibadan, March, 2014

Based on a clear understanding of the shared roles and responsibilities in the funded project to improve postgraduate programmes for human-animal disease surveillance, and its teaching³⁰³⁹; a consensus on modification was reached. Six courses in Systematic Epizootiology were recommended by the CCPZ project team to the Department of Veterinary Public Health and Preventive Medicine for adoption and presentation for approval by the Board of the Postgraduate School and Senate of the University of Ibadan.

In the light of the foregoing, it would be advantageously right to set the records straight on the constitution, review and recommendation of the sub-committee constituted for the review of the curricula and the adoption of the same by the stakeholders and West African Board to operate first as non-degree short course and elective field research modules in Systematic Epizootiology for surveillance of human-animal diseases in West Africa. We there fore substantiate the status here adopted with information from the Board for the benefit of the doubt. [Available in the first annual report of CCPZ, 2012].

COMMUNIQUE OF THE GOVERNING BOARD

The Interim Governing Board of the Centre for Control and Prevention of Zoonoses (CCPZ) in West Africa met at the University of Ibadan on Thursday, the 9th of August, 2012 to deliberate on progress made since the inception of CCPZ project which is supported by the John D and Catherine T MacArthur Foundation. The overall objective of the project is to improve graduate programmes in the surveillance of human-animal diseases in West Africa. The Board observed that the activities as reported by the implementation committee, at the meeting of 8 August 2012 were in line with project objectives and commendable. It observed that in view of the need to involve not only the anglophone West African countries, fellowship awards must be made to include postgraduate students from francophone West Africa.

Involvement of government agencies at national and regional levels shall be pursued through the activities of a Networking Committee. Research and training improvement shall be driven by a committee for effective development of a robust curriculum for global health education and research in West Africa. In so doing, the project shall achieve the set objectives advanced by the University of Ibadan and its collaborating Universities and national agencies, private organizations in West Africa and significantly increase global safety against zoonoses.

The Vice-Chancellor, University of Ibadan shall communicate the composition of the Project Governing Board and objectives of the CCPZ to the respective colleague Vice-Chancellors as well as national and regional bodies.

CCPZ's grant administration, vested in the MacArthur Foundation Grant Implementation Committee (MFGIC), is chaired by the Vice-Chancellor. Other members are Deputy Vice-Chancellor (Administration), Deputy Vice-Chancellor (Academic), Registrar, Bursar, University Librarian, Provost of the College of Medicine, the MacArthur Grant Liaison Officer, Chairpersons/Principal Investigators of all the activity-specific sub-committees of the MFGIC, Director of the University Management Information System (MIS), and the Programme Officer, MacArthur Grant Liaison Office.

The Development Committee, Senate and Council of the University of Ibadan by tradition, recognize the importance of innovation that brings about new approaches and solutions into academic and professional programmes. Review and revision which aim to identify gaps and weaknesses with a view to increasing efficiency through reform on existing curriculum is bottom-line to this. CCPZ's new programmes have been developed putting all these provisions into account

as relates to disease surveillance at the human-animal-environment interfaces. The MFGIC serves as a feedback as well as forward looking mechanism for the achievement of CCPZ goals, and reports to the University Council.

2.4 Non-degree and degree programmes

A non-degree programme was adopted as a strategy in actualizing the new programmes. The nature of public health challenges associated with zoonoses in West Africa requires novel manpower training and development methods that are more flexible than offered in conventional degree programmes. A non-degree programme offers flexible and practical modules for individuals who are unable to be off their jobs for a considerable length of time. The short course modules, which may be delivered as distance learning or as on-campus non-degree-programmes meet the novelty required. Being competence focussed, and as obtain in vocational training, non-degree ensures the right environment for addressing local manpower challenges.

Other programmes already exist to cater for the needed academic degrees in disease surveillance at the University of Ibadan. They include, the Master of Science in Epizootiology (M.Sc. Epizoot.), Master of Veterinary Public Health (MVPH), Master of Preventive Veterinary Medicine (MPVM), and the Master of Public Health (MPH), Mphil, MPhil-PhD and PhD. Thus, a multi-level, multi-disciplinary and non-degree options were feasible and adopted.

2.5 Operationalizing the new programmes

The MFGIC endorsed the process of putting the adopted curricula into practice in collaboration with leading West African tertiary institutions. The initiative developed by CCPZ for sub-regional use is intended to harmonize curricular contents, offer common standards, and assessment in a way to foster integration and facilitate the mobility of students and teachers across the countries. Thus, the two new programmes adopted by stakeholders in CCPZ may increase sub-regional network for zoonoses surveillance.

Major programmes already exist to cater for academic and professional degrees in disease surveillance at the University of Ibadan. The MFGIC in its wisdom therefore, endorsed the process of putting into practice, the non-degree certificate and field research programmes in collaboration with leading West African tertiary institutions.

In-service train-the-trainer short course, as well as the development of new textbooks and fieldwork guidelines were included in the project implementation process. This was adopted for training of physicians, veterinarians, epidemiologists, public health workers, agriculturists, statisticians, educators, economists, pathologists, parasitologists, microbiologists, geographers, sociologists extension workers and artists in human-animal disease surveillance in West Africa. The initiative by CCPZ is intended to harmonize curricular contents, offer common benchmarks along multi-level training programmes in human-animal disease surveillance competence, a way to foster integration and facilitate the mobility of students and teachers across the countries. The two new programmes

adopted by CCPZ stakeholders may increase sub-regional education network for excellence in zoonoses surveillance, with hub at the University of Ibadan.

2.6 Conclusion

The Centre for Control and Prevention of Zoonoses, University of Ibadan, Nigeria has facilitated the review process for improving postgraduate programmes for surveillance of human-animal diseases in West Africa. The centre facilitated the selection of sub-regional experts and stakeholders to attend a series of interactive meetings and workshops for curriculum review and development. The process was approved by the University of

Ibadan MFGIC.

The new certificate short course, and the revised curriculum for field research in Systematic Epizootiology have been adopted and become operational in the 2013/2014 academic session in the University of Ibadan. The first and second cohorts of students have been enrolled and mentored in field research in Systematic Epizootiology as non-degree programmes. The two curricula will serve an inclusive training opportunity for physicians, veterinarians, epidemiologists, public health workers, agriculturists, statisticians, educators, sociologists, economists, pathologists, parasitologists and more interested individuals in West Africa.

Chapter 3

A SHORT COURSE IN HUMAN-ANIMAL DISEASE SURVEILLANCE

3.1 Background information

The short course in the Centre for Control and Prevention of Zoonoses on Human-Animal Disease Surveillance is a four-week long programme, designed to train and build competence of participants in community data gathering towards the detection and diagnosis of pathogens and the control of diseases at the human-animal-environment interfaces. Surveillance is the ongoing systematic collection, analysis and interpretation of health data, and including timely dissemination^{40,53} of the resulting information to those who need it for action.^{55,56,60} The short course in surveillance, therefore, covers the fundamentals of planning, implementation and evaluation of the control and prevention of zoonoses at all levels.

The short course was adopted by CCPZ stakeholders on 28 March 2014. The aim of the short course was to focus on what participants are expected to do in disease surveillance at the community level, so

that they can acquire and apply the knowledge, skills and attitudes to situations seen in everyday life. The programme is grouped into three modules; **Module I** provides an introduction to human-animal disease surveillance and safety levels in surveillance, **Module II** provides basic applications of specialized tools and methods, **Module III** provides consolidated practical exercises, with individual or group mini-project. On successful completion of the three modules, a Certificate of Participation in Human-Animal Disease Surveillance is awarded to trainees.

The short course is offered twice a year, or once every semester at the University of Ibadan Centre for Control and Prevention of Zoonoses, and at Njala University Learning Centre. The programme may be attended at any of the two locations in West Africa. Thus promoting equity in access to disease surveillance training as a liberal art and science for career persons in public health service in West Africa.

It is also for persons intending a career in community health planning and practice, who would like to build their knowledge and skills in the surveillance of diseases of humans and animals.

3.2 Objectives of the short course

The fundamental objective of the short course is for trainees to have the opportunity to participate in the field and laboratory-based activities that are involved in human-animal disease surveillance and to build relevant skills. Trainees will gain effective knowledge and competence in acquiring data from the community, and using the data to detect and respond to priority zoonoses. By participating, candidates would acquire knowledge in hands-on learning of identified risk factors and exposure events, which will enable them to respond to the burden of zoonoses, reducing associated illness in West Africa.

The specific objectives are to enable participants to:

- 3.2.1. Identify cases and events of zoonosis, including outbreaks within local community;
- 3.2.2. Report suspected case, or event of zoonosis to public health officials;
- 3.2.3. Collect specimens from animals

and humans for laboratory tests, detection and diagnosis;

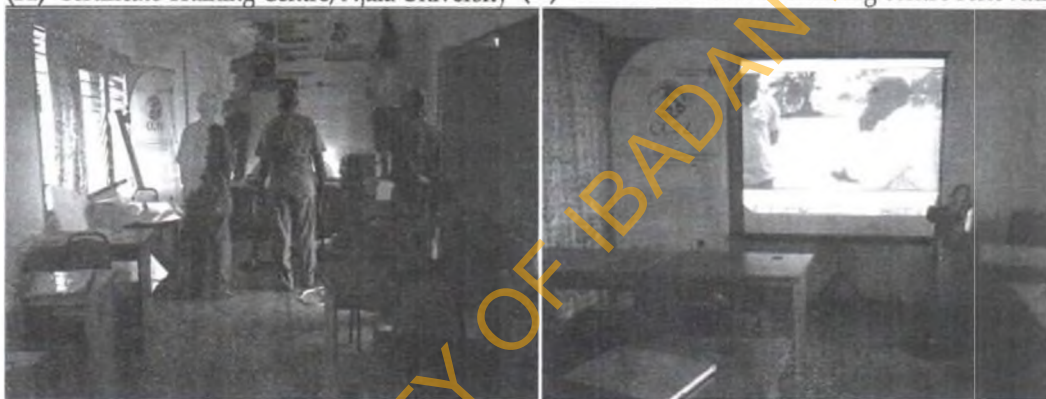
- 3.2.4. Use Global Positioning System (GPS) to record geographic coordinates of locations of case exposure;
- 3.2.5. Conduct laboratory diagnosis of pathogens involved;
- 3.2.6 Map and evaluate the data collected in space and time using Geographic Information Systems (GIS) and offer clear interpretation of the case pattern, exposure and spread;
- 3.2.7. Prepare a culturally responsive plan to work with community in outbreak management;
- 3.2.8. Prepare a public health campaign plan for vaccination of animals or humans against priority zoonosis;
- 3.2.9. Evaluate successes or failures of investigation and response.
- 3.2.10. Review ethical issues in a visit to a facility with zoonosis outbreak.

3.3 Requirements for admission

Applicants must have completed a first degree in Agriculture, Biological Science, Community Health, Environmental Science, Health Geography, Medicine, Veterinary Science or related programmes to be eligible for admission into the short course in human-animal disease surveillance programme in West Africa.



(A) Certificate Training Centre, Njala University (B) Commencement of learning centre renovation



(C) Installation of reading desks and posters (D) Demonstration of learning aids



(E) Sign board on Njala University campus (F) Faculty brief on use of Learning Centre

Figure 3.1: Various stages of renovation, installation and commissioning of CCPZ Learning Centre, Njala University, Sierra Leone, April - June, 2014

Disease surveillance, effective planning for its control and the implementation in West Africa requires skills at multi-levels. As a result, the World Health Organization encouraged training of lowlevel public health manpower. The choice of Zoonoses Surveillance Advisors, or Community Health Advisors is a novel strategy of the CCPZ short course. Hence, surveillance education is operated as a non-degree certificate credit transfer between the University of Ibadan, Nigeria and Njala University, Sierra Leone on this basis for more effective control and prevention of priority zoonotic diseases, including rabies, tuberculosis, toxoplasmosis, Lassa fever and Ebola virus disease in West Africa.

3.4 Method of application

APPLICATION FOR ADMISSION INTO SHORT COURSE IN HUMAN-ANIMAL DISEASE SURVEILLANCE

The centre advertises for applications from eligible candidates seeking admission into the Short Course in Human-Animal Disease Surveillance programme at the University of Ibadan and Njala University. The training is held twice a year (each semester of an academic session) and offers unique opportunities for learning and acquiring competence to serve in human-animal disease surveillance in West Africa.

Application form should be obtained from the centre's webpage at www.ccpz.ui.edu.ng, completed and forwarded with two referee letters to the:

Programme Officer,
CCPZ, A-306 Faculty of Veterinary
Medicine Building, Farm Road,
University of Ibadan, Ibadan, Nigeria

If selected, participants or their institutions will be responsible for travel, accommodation and living expenses during the entire training period. However, training materials on the field, classroom and laboratory are free of charge.

3.5 Course modules and duration

Successful applicants will be exposed to training modules in the following areas:

Table 3.1: Course modules and their durations

Module	Title	Duration
Module I	Introduction to Human-Animal Disease Surveillance	1 week
Module II	Basic application of specialized tools and methods	1 week
Module III	Practical consolidation exercises	2 weeks

Table 3.2: Training Modules in Human-Animal Disease Surveillance Certificate Programme

Module	Highlight	Description
Introduction to Human-Animal Disease Surveillance	General introduction	Introduces the training objectives of the short course in Human-Animal Disease Surveillance Programme. Discusses West African Biosecurity Engagement Programmes, the role of One-Health Approach and Community Surveillance Advisors.
	Fundamentals of zoonoses	Provides an overview of what zoonoses are, identifying some priority endemic, emerging and neglected zoonoses, their causal agents, signs, symptoms and risk factors.
	Approaches to diagnosis	How to detect a case of zoonosis, using a protocol each for medical, environmental and socio-cultural detection to diagnosis.
	Spatial distribution and risk factors	Provides information about where specific cases of zoonoses happen, why they occur, what the risk factors are, how exposures are categorized; and common gaps in exposure perception and indigenous beliefs.
	Control and prevention	How knowledge can motivate change in individual and community response to risk of exposure to some priority zoonoses and stop them. Principles and practices of biosafety, biosecurity and biocontainment.
Basic application of specialized tools and methods		
Geographic Information Systems (GIS) applications	Geographic referencing and spatial analysis	Geographic referencing of zoonosis case at point of exposure (location) using Global Positioning System (GPS). Use of aerial photograph to enhance population census, and identify exposure location. Non-spatial data collection and use in risk analysis and thematic map design.
Molecular Tools applications	Pathogen confirmatory diagnosis	Laboratory-based diagnosis of pathogens by genome detection, using Polymerase Chain Reaction and sequencing of genome extracted from pathogens from field surveys. Usage and values of the FTA cards.
Indigenous knowledge applications	Indigenous knowledge and beliefs	Information about popularly held beliefs about priority zoonoses. The differences between facts and opinion about priority zoonoses, among indigenous beliefs and common gaps in exposure perception.
Statistics applications	Time-series in forecasting	Use of time-series analysis, linear and spatial regression techniques for predicting case pattern of major zoonoses.
Monitoring and Evaluation	Project appraisal	Use of participatory evaluation methods in assessing project status and progress towards realization of set objectives and expected outcomes.
Skill-building opportunities		
Practical consolidation	Practical exercises	One week of rotation between the GIS and diagnostic laboratories for practical consolidation in the use of specific tools and methods.
Mini-Project	Research skills	Two weeks of individual or group research projects.

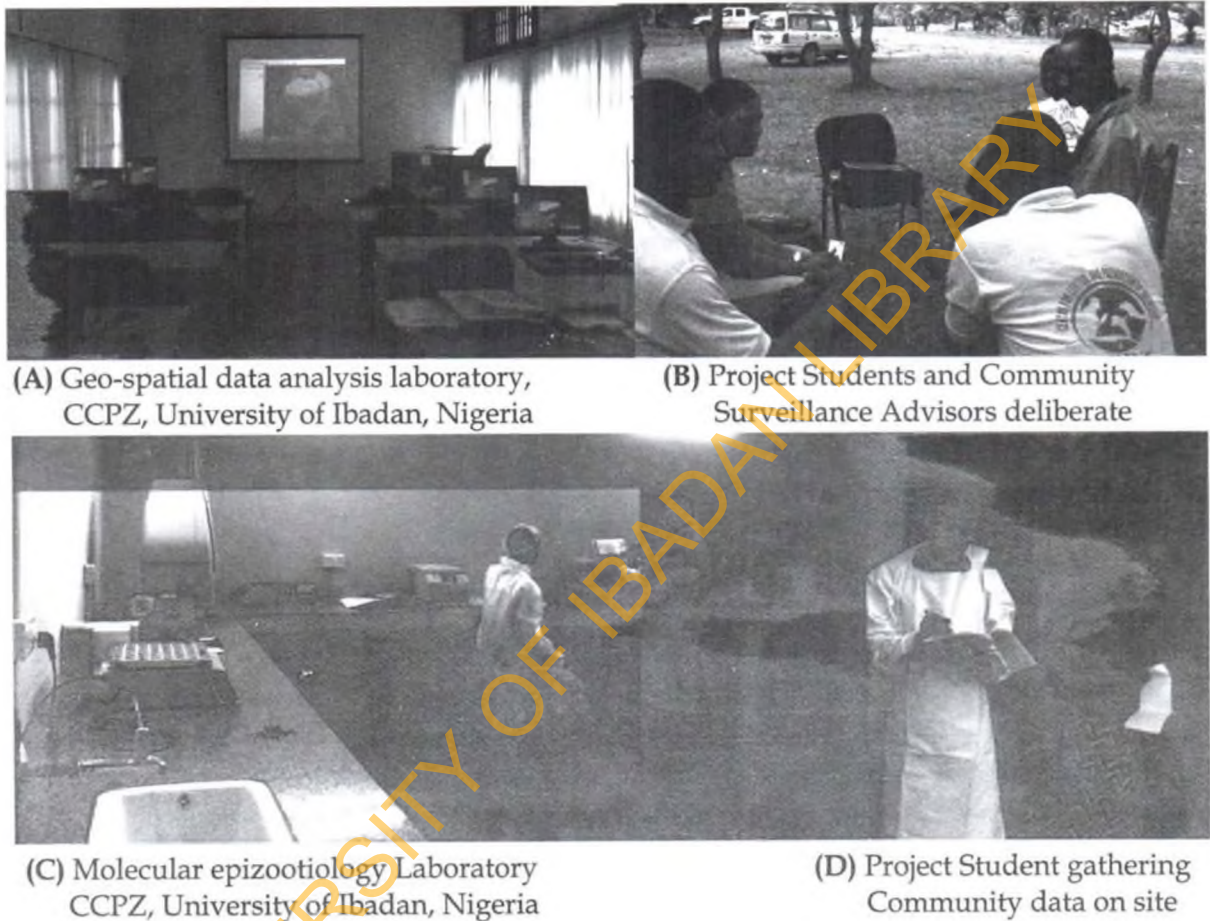


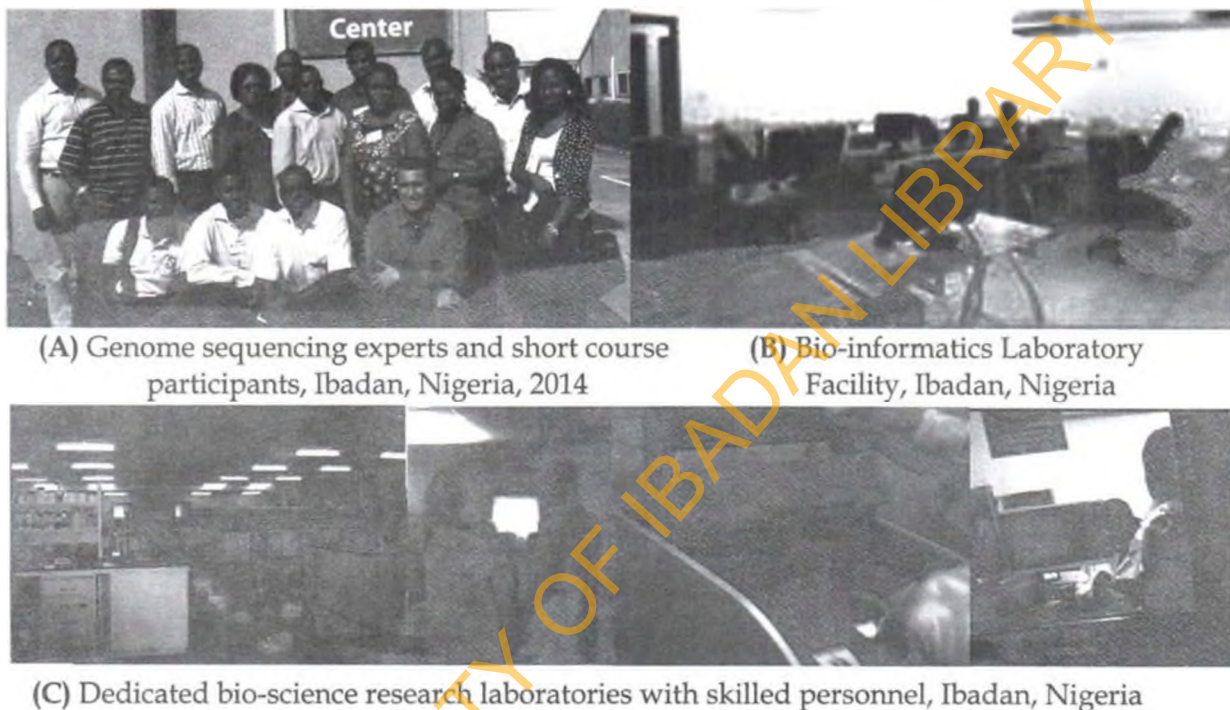
Figure 3.2: University of Ibadan CCPZ laboratories with personnel for geo-spatial data analysis and detection of pathogens at the molecular and immuno-histo-chemical levels

3.6 Mode of instructional delivery

Each cohort of participants receives a range of instructional delivery modes that include a week of lectures, delivered during face-to-face contact hours. This is the mode of introduction of the course. Intermittent use of video recordings of special interest cases and events are used

in demonstration of various levels of personal safety equipment use. Second week to mentor by hands-on exercises is by face-to-face delivery. Participants are encouraged to ask as many questions as possible which play an important role in effective learning and science inquiry both for the participants and the teachers.

Opportunities for human-animal disease surveillance in West Africa



(A) Genome sequencing experts and short course participants, Ibadan, Nigeria, 2014

(B) Bio-informatics Laboratory Facility, Ibadan, Nigeria

(C) Dedicated bio-science research laboratories with skilled personnel, Ibadan, Nigeria

Figure 3.3: CCPZ partner research laboratories, Ibadan, Nigeria with personnel for genome detection, sequencing and bio-informatics of isolated pathogens in West Africa

The performance of individual and group mini-projects ensure close interactions with the community, Community Surveillance Advisors and among cohort members. In this way participant are able to optimize learning opportunities and build relevant skill through experiential learning during the short course. Instructional materials for class use and laboratory manuals were selected from global best resources, and adapted to the needs of adults in West Africa. The course mainstreams problem solving approach.

3.7 Conclusion

The short course in the Centre for Control and Prevention of Zoonoses brings together, leading sub-regional experts to expand access to human-animal disease surveillance education and practice of preventive planning, with attention to rural areas. The training is adopted by stakeholders in Nigeria, Ghana, Sierra Leone and Liberia. The multi-disciplinary backgrounds of teachers from West Africa and beyond is a strength of

By policy, the Centre for Control and Prevention of Zoonoses, University of Ibadan and the collaborators predict that the control of endemic, emerging and neglected zoonotic diseases offers a very real and highly cost-effective opportunity for alleviating poverty, and curtailing human-animal diseases in remote rural and marginalized peri-urban communities in West Africa. Their control also offers food security and public health to the people of West Africa. Experts have agreed that the skills required by disease surveillance personnel in West Africa is notably at multi-levels. The training of multi-disciplinary and multi-level personnel, including public health aides, in status of Community Surveillance Advisors is a novel strategy in building local capacity. The short course thus fills a critical gap in manpower training for the

monitoring and control of human-animal diseases.

The Certificate of Participation awarded on completion of the training is a non-degree status. Yet, the knowledge accruable, and the competence built are capable of making the participants more effective and efficient responders to the burden of zoonoses in West Africa. The short course is strategic and unique as a critical number of West African-trained physicians continues to migrate to richer countries and cities. Expanding the access to human-animal disease surveillance education and monitoring of local communities in the short- and long-term, fulfills the WHO recommendation on short training for mid-level service providers, resident in West Africa.

Chapter 4

OPPORTUNITIES FOR FIELD RESEARCH IN HUMAN-ANIMAL DISEASE SURVEILLANCE

4.1 Background information

Field research at the Centre for Control and Prevention of Zoonoses involves a range of well-defined inquiry methods, including the direct observation, interviewing, case record reviewing and clinical specimens' analysis. The essence of CCPZ field research curriculum is to combine the strengths of various methods^{48,49} in sociologic and epidemiologic inquiries to gain the most complete understanding of case-patterns of diseases at the human-animal-environment interfaces. More so is the combination of these with geographic, statistical and molecular diagnostic methods, without necessarily having to choose one approach over another in investigation^{48,49}. This enables ample opportunity for **triangulation**^{10,17,48,49} in analysis and modeling of past, present and future epidemics.

The CCPZ project team adopted field research in human-animal disease surveillance programme, January 2013

as a set of elective courses that were specifically designed to enable competence building for Master of Science students in Epizootiology programme^{5,21,17} at the University of Ibadan. The six modules (Table 4.1) of the programme harness multiple research techniques, to enable a more effective community-oriented disease surveillance training, which is designated as non-degree elective programme in **Systematic Epizootiology**^{5,21,17} for field research in human-animal disease surveillance.

The field research modules are offered once a year (in the first semester). The modules are specifically for students on Master of Science in Epizootiology programme. However, students on related programmes, who show high motivation towards field research are encouraged to apply. The centre mentors students to build their competence in the design and implementation of field research, with special interest in the triangulation of

analyses in order to make reliable and accurate predictions^{27,28,29}. Such that, the public health team could be guided to arrive at the site of an epidemic before the pathogen gets there. The first cohort of beneficiary students on this programme were enrolled in the 2013/2014 academic session and mentored in Liberia from March to July, 2013 (before the formal adoption of the programme by stakeholders) with some major success stories herein reported.

4.2 Objectives of field research in human-animal disease surveillance

The main objective of field research in human-animal disease surveillance is to provide a window of opportunities for self and community development in harnessing the unlimited benevolence of the community to key into a range of study designs and methods to investigate disease occurrence beyond the biomedical science applications, for community-oriented skills and capacity building.^{4-10, 12-17, 20-31, 33-35, 57, 60}

The specific objectives are:

- 4.2.1 Harnessing sociologic methods to investigate community knowledge, attitude and practices associated with priority diseases;
- 4.2.2 Harnessing geographic tools and methods to map priority zoonotic diseases;
- 4.2.3 Identify geographic risk factors associated with zoonotic diseases;
- 4.2.4 Biotechnology indigenization for surveillance and rapid detection of zoonotic pathogens;
- 4.2.5 Review and evaluate existing policies to mitigate zoonotic diseases;
- 4.2.6 Hands-on spatio-temporal data capture and information analysis for zoonoses spread visualization;
- 4.2.7 Hands-on isolation, characterization and diagnosis of selected zoonotic pathogens.
- 4.2.8 Hands-on planning of biological risk management against priority zoonoses;
- 4.2.9 Hands-on world-wide-web-based community information dissemination on human-animal disease and their control.

4.3 Requirements for admission

Eligibility for admission into the non-degree elective programme in Systematic Epizootiology modules for field research in human-animal disease surveillance is based primarily on admission status as a postgraduate student in Epizootiology programme at the University of Ibadan, Nigeria. Students in M.Sc. Epizootiology related programmes in the University of Ibadan would be equally considered.

Students enrolled for Epizootiology, Veterinary Epidemiology, Epidemiology in the Faculty of Public Health or any related disciplines in any of the collaborating Universities with the University of Ibadan (*see pages 5 and 6*) are eligible for admission into the programme. Such candidates would be offered a Visiting Scholar status, subject to approval by the Office of International Programmes, University of Ibadan. Staff of research institutes and the various Ministries of Health and Agriculture at Local Government Area, state, or national level in West Africa are eligible for admission into the programme.

There is limited number to enrol per semester. Therefore, merit and timeliness

of application would be considered towards final selection of participants. Each applicant must satisfy the guidelines for admission into the University of Ibadan, by possessing at least five credits at one sitting in the General Certificate of Education (GCE) Ordinary Level, and a Second Class division or equivalent in relevant first degree programmes.

4.4 Method of application

The centre advertises for applications from eligible candidates seeking admission into the non-degree elective programme in Systematic Epizootiology for field research in Human-Animal Disease Surveillance at the University of Ibadan. The programme offers unique opportunity for knowledge and skills building in the use of multiple methods for investigation of disease pattern in time and space in West Africa.

The programme is offered once a year in the first semester. Application form is available online at www.ccpz.ui.edu.ng. Eligible candidates should download the form, dully complete it and submit with a research proposal to the Programme Officer. (See page 26).

Figure: 4.1 President, Cuttington University, Liberia in his office with staff and students of the University of Ibadan, Nigeria who visited Liberia on field research

The research team, led by CCPZ Principal Investigator comprised four postgraduate students of the University of Ibadan, Nigeria. Two were doctoral research fellows in Epizootiology (Liberians) and two were Master's Scholars (Nigerians). Present were faculty from Ibadan. In-country study was facilitated by Dr. Henrique F. Tokpa, (3rd R-L) President, Cuttington University.



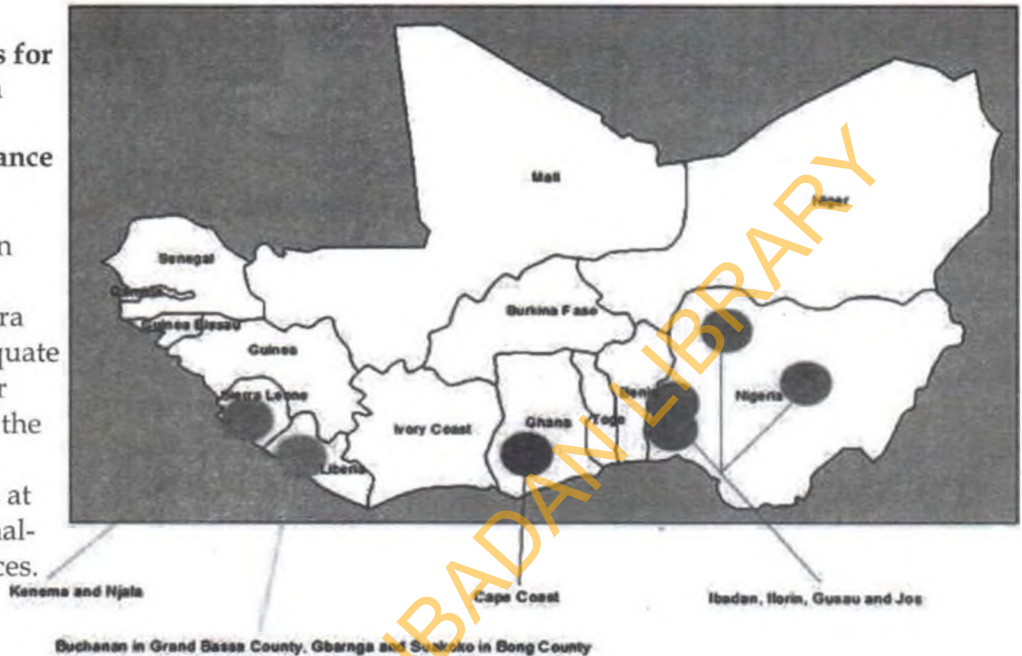
Table 4.1:

Modules in Systematic Epizootiology for field research in Human-Animal Disease Surveillance

Module	Title	Description
Systematic Epizootiology I	Zoonosis risk mapping and visualization with GIS	Mapping epizootiological data from active, passive and predictive surveillance. Presenting visual information about the distribution and pattern of spread of disease.
Systematic Epizootiology II	Geographic data management for community health planning	Developing data profile of priority diseases at the human-animal-environment interfaces to full level that enables effective planning for community health care.
Systematic Epizootiology III	Harnessing indigenous knowledge for zoonoses management	Popularly held beliefs about priority zoonotic diseases are used to evaluate data profile, enhance risk knowledge and development of observational data profile
Systematic Epizootiology IV	Molecular epizootiology for zoonoses surveillance	Provides practical applications of the use of nucleic acid in the detection, diagnosis, prevention and control of diseases at the human-animal-environment interfaces.
Systematic Epizootiology V	Statistical methods for zoonoses surveillance	Use of time-series analysis, linear and spatial regression techniques for predicting case pattern of major zoonoses.
Systematic Epizootiology VI	Monitoring and evaluation of zoonosis control project	Utilizing participatory evaluation methods to assess project implementation status and progress towards the realization of set objectives and expected outcomes.

Figure 4.2:
Catchment areas for field research in human-animal disease surveillance in West Africa

Selected towns in Ghana, Liberia, Nigeria and Sierra Leone offer adequate opportunities for field research in the surveillance of priority diseases at the human-animal-environments interfaces.



4.5 Modules in Systematic Epizootiology

SEP I: Zoonoses Risk Mapping and Visualization with GIS

Definitions of Geographic Information in terms of systems, science and study (GIS). Basic components of GIS. Spatial data capture and storage formats at the Human-Animal- Environment interface. Use of Global Positioning Systems (GPS). Introducing ArcGIS Desktop. Getting started with maps and data visualization. Displaying data using symbols. Adding non-spatial data into feature attributes. Analyzing spatial and non-spatial data for geographic association with health and disease. Spatial and temporal scan

statistics. Displaying health and disease risk factors on a map. Types and classification of human and animal health risks. Creating spatial and spatio-temporal models of "One-Health" importance. Projecting data in ArcMap. Use of disease risk visualization in research plans, project report, community^{20,22,25,26,35,40,44,48,49,55,56} outreach, scientific publication, monitoring and evaluation programmes. Case study in geodatabase design, observational data profiling and their use in estimating pattern of spread of disease.

Status: Non-degree, Elective Course I in Systematic Epizootiology

SEP II: Geographic data management for community health planning

Developing data profile of priority diseases at the human-animal-environment interfaces to comprehensive level that enables effective planning for community health. The concept of information system and criteria for operating as decision supporting system (DSS), predictive surveillance and components of community health planning. Spatial or Geographically Weighted Regression and Ordinary Least Square Methods in disease risk profiling. Use of mapping and visualization techniques in promoting predictive surveillance and essential team-work for human-animal diseases surveillance and control. Review of community health planning approaches and policies. Usual sources of data, means of collection, presentation mode and expected outcomes to support the operation of a community health planning committee. Case study in West Africa.^{55,59,60,61}

Status: Non-degree, Elective Course II in Systematic Epizootiology

SEP III: Harnessing indigenous knowledge for zoonoses management

Indigenous concepts about disease and their origin in West Africa. Popularly held beliefs about common diseases at the human-animal interfaces in local communities. Cultural practices about disease control and cure. Attitudes towards Orthodox Preventive Medicine. Common gaps in exposure perception. Implications of traditional, religious and linguistic values towards global health advances - the opportunities and challenges. Indigenous names of common diseases, indigenous recipes and tools used for their treatment and control. The nexus between indigenous knowledge, practice and global health advances in West Africa. Communication, negotiation and conflict areas. Traditional mode of communication, communication methods for rural development. The value of audiovisual aids in creative and effective communications among community dwellers.

Status: Non-degree, Elective Course II in Systematic Epizootiology

EPI IV: Molecular Epizootiology for Zoonoses Surveillance

Provides practical applications of the use of nucleic acid in the detection, diagnosis, prevention and control of diseases at the human-animal-environment interfaces. Methods used for the isolation or purification of DNA/RNA from biological specimens; the importance of purification in the successful detection of zoonotic pathogens. Use of molecular identification tools to preempt emerging zoonotic pathogens. The FTA card technology and safety issues in international shipment of biological agents in West Africa. The polymerase chain reaction (PCR). Gene sequencing and their roles in human-animal disease strains identification. Case studies in molecular^{11,42,43,46,47} epizootiology applications.

Status: Non-degree, Elective Course IV in Systematic Epizootiology

SEP V: Statistical methods for zoonoses surveillance

Use of time-series analysis, linear and spatial regression techniques for predict-

cting case pattern of major zoonoses.^{28,29} Sources and collection of primary data. Descriptive and categorical analysis of field research data. Analytical methods and disease modelling techniques within and between communities. Determining disease transmission index. Hands-on STATA statistical application software.

Status: Non-degree, Elective Course V in Systematic Epizootiology

SEP VI: Monitoring and evaluation of Zoonoses control projects

Use of participatory evaluation methods to assess project implementation and progress towards the realization of set objectives and expected outcomes. The concept, design and method of monitoring and evaluation of disease control projects. Logical framework approach, including setting of goal statement, purpose, objectively verifiable indicators, means of verification, assumptions, inputs, outcome and impact expected of a project. Use of qualitative, quantitative and mixed methods to review project status. Case study.^{1,2,59}

Status: Non-degree, Elective Course VI in Systematic Epizootiology

4.6 Mentoring mode and duration

The CCPZ Field Research in human-animal disease surveillance programme encourages and supports students who consider pursuing community studies in Systematic Epizootiology mode beyond the limits of the classroom curriculum. The CCPZ programme is proud to be affiliated with some of the leading universities in West Africa and several experts from multi-disciplinary backgrounds to mentor visiting scholars and students in the specific module of interest among the CCPZ's set of six training modules. CCPZ modules is one semester of hands-on in disease surveillance at any of its catchment locations (Figure 4.2).

A and B in Figure 4.3, and A, B, C, D and E in Figure 4.4 are some of the pointed field research projects that past scholars at the Centre for Control and Prevention of Zoonoses have conducted, through hands-on training towards fulfilling the requirements for their postgraduate degree project.

Experience a semester with CCPZ in the West Coast of Africa

CCPZ invites you to study for a semester on the field, mastering Systematic Epizootiology skills in West Africa. A unique experience of hands-on surveillance of human-animal diseases in specially selected countryside locations in West Africa makes learning of field research a fun. What we may simply call field research for dummies, in the explicit clarity, depth and blend of outdoor adventures that it provides. Participants would master Systematic Epizootiology of an endemic, emerging⁴¹ and neglected zoonoses, within their natural ecology. Are you interested in West Africa, its communities, and field research in human-animal diseases? If you answered yes to this question, then Semester with CCPZ in the West Coast of Africa is for you.

Learn the field applications of direct interview, field diagnostic kits, geographic referencing with GPS (Global Positioning System) and its integration into GIS at local Epidemiology Stations with CCPZ.



Letters to the Editor

Mapping of Lassa fever cases in post-conflict Liberia, 2008-2012: A descriptive and categorical analysis of age, gender and seasonal pattern

Page | 1

Sir,
Liberia is in the epicenter of Lassa fever (LF), being one of the Mano River Union (MRU) countries that are most heavily affected by the disease in West Africa.^[1-3] Liberia records annual cases since 1972.^[2-5] During the civil conflict of 1989-2003, health care services in the country were interrupted for about a decade and half.^[2,4] This situation was expected to aggravate the incidence of LF. As a result, ministers of health of the MRU countries endorsed a sub-regional strategic plan of action

method, which involves the expression of LF cases as a percentage of the total over the 5-year period was used. Percentages for corresponding months (rain and dry seasons) of different years were averaged. Finally, Arc GIS 10.1* software environment (Environmental Systems Research Institute, Redlands, California, USA) was used for map design.

Thematic maps of age, gender and spatial distributions revealed strength and weaknesses of surveillance. Consistently, cases presented were

(A) Success story on a combination of global positioning system (GPS), geographic information system (GIS), clinical case review and statistics to explain disease pattern

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Development of a time-trend model for analyzing and predicting case-pattern of Lassa fever epidemics in Liberia, 2013-2017

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(B) A subsequent analysis and triangulation of Lassa fever cases over five-year trend enabled prediction that was reported by the Centre for Control and Prevention of Zoonoses, and Cuttington University, a open access in Annals of African Medicine.

Figure 4.3: Success stories of Lassa fever mapping and forecasting, Liberia, 2013

Opportunities for human-animal disease surveillance in West Africa



(A) A rubber plantation scene, Liberia 2013



(B) Handling clinical specimens with FTA cards technology



(C) Cross-section of community-based data gathering, Buchanan, Liberia, 2013



(D) Using FTA card in specimens collection on the field



(E) A report on combinations of field research methods on Lassa fever study

Figure 4.4: Success stories of field research into rabies-like-illness and spatial pattern of Lassa fever cases among humans, Liberia, 2013

Duration of CCPZ field research mentoring is one semester. It is devoted to Systematic Epizootiology hands-on tutorials and field work in fulfillment of research project for the M.Sc. degree programme in Epizootiology and other related Master's programmes in the University of Ibadan, including Master of Veterinary Public Health, Preventive Veterinary Medicine, Epidemiology and Medical Statistics, Virology and many more.

The focus of this field study is to develop competence in research methods in endemic, emerging and neglected zoonoses surveillance. This will be achieved through a combination of professional and recreational environment, provision of hands-on practicum training on detection, prevention and containment of zoonoses, using selected hotspots of endemic and neglected zoonotic as practicum in the southern part of Nigeria and in selected countries of West Africa. The project focuses on training of manpower that will effectively understand the state-of-the-arts in zoonoses detection and control.

4.7 Conclusion

Apparently, fears⁴⁵ associated with dreaded human-animal diseases can be allayed when sociological methods are effectively harnessed into field research as available in the Systematic Epizootiology programme of the Centre for Control and Prevention of Zoonoses, University of Ibadan. The Ebola virus disease⁴⁵ epidemic, 2014 provided a typical example of what dreaded human-animal diseases could be like. The outbreak was characterized by high mortality and direct person-to-person spread through contact. Whereas, there was neither effective vaccines nor drugs of choice for treatment; the only credible solution was the use of surveillance, which combine sociological, geographic, statistical and rapid molecular laboratory detection to achieve early warning and planning for control, through community awareness promotion as panacea to avoid exposure.

The success stories in field research therefore shows the high importance, relevance, clarity, simplicity, yet novel, workable and sustainable value of a community-oriented disease surveillance education. The centre, therefore has delivered its promised mandate to improve

postgraduate programmes for surveillance of human-animal diseases in West Africa. This was actualized through the adoption of essential, competence-based elective courses for the M.Sc. Epizootiology programme at the University of Ibadan. It is expected that this new curriculum will promote itself as people would key into the opportunity and disseminate the information throughout

the West African sub-region. Systematic Epizootiology is a crucial tool in preventive medicine, used in awareness and capacity building towards the ambitious goal of "arriving at the site of an outbreak before the pathogen gets there," Thus, skills are added to identify the pattern of biological risks and how to manage the risk and keep community safe.

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INDEX

- Assay, 3
Avian influenza, 8
Avian, 3, 8
Best practice
Bio-Security Engagement 27
Cohort, 12, 29
Collaborators 3, 30
Collaboration 1, 5, 6, 9, 21, 43
Community Surveillance Advisor 26, 27, 28, 29, 30
Control and prevention, 1, 2, 4, 6, 7, 11, 12, 19, 22, 26, 27, 29, 31
Curriculum 2, 7, 8, 10, 11, 12, 13, 14, 19, 20, 22, 23, 29
Disease surveillance 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 19, 20, 21, 23, 24, 28, 29, 33
Elective curriculum 2, 14
Elective course 31, 36, 37, 42
Emerging, 1, 2, 6, 8, 9, 26, 28
Endemic, 1, 2, 6, 7, 9, 26
Environment, 2, 3, 4, 7, 9, 10, 13, 20, 22, 26, 27, 28, 30
Epidemiology 14, 33, 38, 41
Epizootiology 8, 9, 11, 12, 14, 18, 19, 21, 28, 31, 32, 34, 35, 36, 37, 38, 41, 42
Fellow 33
Fellowship, 19
Field research 2, 3, 4, 7, 9, 10, 21, 22, 29
Geo-Spatial 28
Ghana 5, 8, 15, 16, 29, 35
Geographic information system 2, 3, 4
Geospatial Information Infrastructure 4
Human 1, 2, 3, 7, 8, 9, 11, 26, 27, 30, 35
Human-animal 1, 2, 3, 4, 6, 7, 9, 10, 11, 12, 13, 14, 19, 20, 21, 23, 24, 26, 29, 30, 31, 35
Influenza, 1, 3, 8, 26
Indigenous 2, 27, 34, 36, 38
Investigators, 20
Knowledge 2, 4, 7, 14, 23, 24, 27, 30, 32, 33, 34, 36, 38
Lassa fever, 1, 3, 29
Liberia 5, 29, 32, 34, 35, 38, 39, 40
Mentor 2, 9, 28, 31, 32, 38, 41
Model, 2, 3, 4, 7, 23, 30
Molecular 2, 27, 28, 31, 34, 37, 41
Multi-disciplinary expertise, 1, 6
Neglected, 1, 6, 7, 9, 13, 26, 29
Nigeria 1, 3, 5, 8, 16, 18, 22, 26, 28, 29, 34, 35
One-Health, 16, 28, 30, 31
 Doyen 16
Open access 39
Personnel 5, 28, 29, 30
Public health, 1, 2, 3, 4, 6, 9, 10, 11, 20, 21, 23,
Rabies, 1, 3, 8, 9, 13, 26, 27, 29

Opportunities for human-animal disease surveillance in West Africa

- Research 1, 2, 3, 4, 5, 6, 7, 12, 18, 19, 22, 27, 29, 31, 33, 34, 40
- Scholar, 29
- Sierra Leone 5, 8, 15, 25, 26, 29, 35
- Sociologic 31, 32, 41
- Statistics 27, 35, 39, 41
- Swine, 3
- Systematic Epizootiology 19, 31, 33, 34, 35, 36, 37, 41
- Time-Trend 14
- Triangulation 31, 39
- Tuberculosis, 1, 8, 9, 26, 29
- United Nations 11,
- Veterinary public health, 3, 10, 11, 12, 21, 29, 30
- West Africa, 1, 2, 3, 5, 6, 7, 9, 10, 12, 19, 20, 21, 22, 23, 28, 29, 35
- Wisdom 13, 14, 21
- Zoonoses, 1, 2, 5, 6, 8, 9, 11, 12, 13, 19, 20, 21, 22, 26, 27, 28, 29
- Zoonosis 4, 6, 10, 23, 25, 26

APPENDIX

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APPENDIX

THREE-YEAR FORMATIVE REPORT CENTRE FOR CONTROL AND PREVENTION OF ZOOSES, UNIVERSITY OF IBADAN, NIGERIA, 2012-2014

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Executive Summary

The three-year support from John D. and Catherine T. MacArthur Foundation to University of Ibadan for improving post-graduate programmes for the surveillance of human-animal diseases in West Africa ends on 31st December, 2014. The project was implemented under three (3) broad headings namely: curriculum development; training, research and conferencing; and community engagement. During this period, the M.Sc. Epizootiology curriculum in the Department of Veterinary Public Health and Preventive Medicine was revised by selected sub-regional experts and stakeholders in One-Health education, practice and development. It was adopted by the department in February, 2014.

A curriculum was developed for a Certificate of Participation in Human-Animal Disease Surveillance in February, 2014. Ten trainees were enrolled into the first cohort of the Certificate Programme in September, 2014. The certificate trainees were two graduates of Sociology two Veterinary Public Health one Health Policy and Management one Epidemiology and Medical Statistics and four Doctor of Veterinary Medicine students. Twenty-three students were admitted in two cohorts into postgraduate degree programmes. First cohort comprised, 1 PhD, 6 MPhil/PhD and 5 M.Sc. (research) enrolled in October 2012. Four of the MPhil/PhD candidates passed the conversion to PhD, while 4 M.Sc. candidates successfully completed the programme and graduated in November 2014.

Ten new scientific publications emanated from the first cohort.

The second cohort comprised, 4 PhD and 7 M.Sc. Epizootiology students enrolled in September, 2014. Promotional awareness created at the Nigerian Veterinary Medical Association (NVMA) Conferences (Ado-Ekiti, 2012 and Abuja, 2013) ensured high attendance at two International Conferences organized on the project, namely Rabies in West Africa (RIWA) - December, 2012 and Improving Zoonoses Surveillance: A One-Health Approach in June - July, 2013. A training workshop for butchers was held in April, 2014, and a Learning Centre was established in Njala University, Sierra Leone, April-May, 2014. The project hosted the Nigeria Biosecurity Engagement Training Programme organized by the United States Centers for Disease Control and Prevention (CDC) in Ibadan, Nigeria, June-July, 2014. Public enlightenment about Ebola virus disease prevention (EVDP) in Oyo State, Nigeria was conducted on the platform and in support of the NVMA in August, 2014. The project team co-organized Ebola Virus Disease Town hall Discourse at the University of Ibadan, July - August 2014;

presented review papers on EVD and Rabies at Ghana Veterinary Medical Association Conference in October, 2014.

The established Centre for Control and Prevention of Zoonoses (CCPZ) programme is already providing its value through increased operational visibility, university-wide interest, participation in the surveillance and control of diseases at the human-animal-environment interfaces. Case referrals and utilization of expertise in facilitation of country-wide programmes for strengthening zoonoses education and surveillance has accorded the project national and sub-regional recognition. Nevertheless, some shortfalls were experienced within the approved project duration. These included, delay in actual programme commencement; certificate training and operations of a molecular approach to disease surveillance. In addition, some six months of industrial action in Nigerian universities and the outbreak of EVD in West Africa had impact on the project. It is upon this premise that we do seek a one-year no-cost extension in order to fully attain the project's initial set goal and objectives.

Hence, details of the progress made in the approved three years, the lessons learnt and increasing importance of the centre in teaching, research and community service delivery in West Africa are enumerated in the narrative section of this report.

NARRATIVE REPORT

Project Goal

To improve postgraduate programmes for surveillance of human-animal diseases in West Africa, through the development of CCPZ certificate programme curriculum and systematic review of Masters of Science in Epizootiology curriculum in the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan: The centre was to facilitate such review and curriculum development by selected sub-regional experts and stakeholders in One-Health education, practice and development, through regional stakeholders' meetings and workshops. The revised and developed curricula would be suitable for training of physicians, veterinarians, epidemiologists, public health workers, agriculturists, statisticians, educators, economists, pathologists, parasitologists, microbio-

logists, geographers, sociologists, extension workers and artists in human-animal disease surveillance in West Africa.

Project Objectives

The principal objectives of this project are as stated below:

1. Epizootiology Curricula

- Review existing M.Sc. Epizootiology curriculum by selected sub-regional experts and stakeholders in One-Health education;
- Adoption of revised M.Sc. curriculum by the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan, for approval by the Postgraduate School;
- Development and adoption of a curriculum for CCPZ certificate training programme in human-animal disease surveillance;
- Credit transfer on certificate and postgraduate programmes to Njala Learning Centre.

2. Training and Research

- Enrol participants from multi-disciplinary backgrounds into Certificate Training Programme in Human-Animal Disease Surveillance in University of Ibadan, Nigeria and Njala University, Sierra Leone;
- Award CCPZ Postgraduate Fellowship to students across West Africa admitted into MPhil/PhD or PhD programmes at the University of Ibadan;
- Award CCPZ Postgraduate Scholarship to students across West Africa admitted into Master of Science programme in Epizootiology at the University of Ibadan;
- Sponsor Postgraduate Research Students on zoonoses-related fieldwork in West Africa, and human-animal disease surveillance studies across the various disciplines at the University of Ibadan

- Build and strengthen laboratory competence for detection and diagnosis of human-animal diseases in surveillance;
- Development of best practice instructional materials and auto-tutorial documentaries on human-animal diseases and their surveillance modes in West Africa;
- Publishing of research findings in peer-reviewed journals.

3. Community Engagement

- Engender international and sub-regional network of CCPZ with academic institutions, associations and agencies in promotional awareness activities about human-animal diseases;
- Anchor training programmes and international conferences, engaging professionals from diverse disciplines in bio-security and human-animal disease surveillance;
- Foster best practice approaches to

community service delivery in the prevention and control of zoonoses in selected hotspots of West Africa;

- Provide prevention support response and systems for control and prevention of zoonoses, through jingles in sub-regional campaigns and workshops;
- Build and network regional capacity for higher education in zoonoses investigation, addressing the obvious gender gap in the available manpower.

• PROJECT IMPLEMENTATION

All activities implemented in the three-year project life were under the control of the MacArthur Foundation Grant Implementation Committee, to ensure its compliance with essential regulations and provisions of the University in accordance with the terms of the MacArthur grant.

Ten major activities were implemented, including (i) review and adoption of

M.Sc. Epizootiology curriculum and development of a Certificate Programme in Human-Animal Disease Surveillance, moderated by a Sub-Committee on Curriculum Review; (ii) Hosting of international conferences on one-health education, practice and development in West Africa; (iii) Establishment of Learning Centre in Njala University, Sierra Leone; (iv) Enrolment and mentoring of first and second cohorts of graduate students in field-based observational research methods in human-animal disease surveillance; (v) Laboratory capacity building in geospatial analysis, molecular biology and audio-visual aids; (vi) Sub-regional awareness promotion of training programmes and services available at CCPZ among professional associations; (vii) Community engagement, sensitization and training for butchers, hunters, bush-meat sellers and town hall discourse about Ebola Virus Disease and other human-animal diseases; (viii) Hosting of Nigeria Bio-security Engage-

ment Training Programme of the United States Centers for Disease Control and Prevention (CDC), June-July, 2014; (ix) Development of best practice instructional materials for certificate and postgraduate programmes; and (x) Publishing of scientific papers in peer-reviewed journals, and refereed conferences proceedings.

Largely, implemented activities covered all aspects of the approved project. Significant is the achievements made in mentoring doctoral (PhD, MPhil-PhD) fellows, laboratory capacity built, publications and collaborations with stakeholders in government and the private sectors, including the Nigerian Federal Ministry of Health, the Liberian Ministry of Health and Social Welfare, the Liberian Ministry of Agriculture, Rabies in West Africa (RIWA) Network, the World Health Organization Country Office in Nigeria, the United States CDC, through its Nigeria Country Office and Atlanta Georgia, especially in disease

surveillance training and fieldwork in West Africa. The achievements have created a robust platform for sustaining the improvements in training programmes for human-animal disease surveillance in West Africa.

KEY ACTIVITIES IMPLEMENTED

- 1) *Revision of M.Sc. Epizootiology Curriculum and Development of Certificate Curriculum in Human-Animal Disease Surveillance*

The review of Master of Science in Epizootiology curriculum involved global, regional, national and University of Ibadan experts on the programme and academic leaders from start to the end. Major contributions made on needed additions and subtractions from the then utilized curriculum were developed into full peer-reviewed papers and published under the authorships of individual leader and experts. Eight lead papers in this regard were published in the journal *Epizootiology and Animal Health* in

West Africa, volume 9, number 1, January-June, 2013. In addition, the revised curriculum was prepared into the University of Ibadan template, and adopted by the Department of Veterinary Public Health and Preventive Medicine. The essential ingredients that were added to improve the curriculum was a set of courses that could translate the then single (3 credits) course in Advanced Epizootiology into an operational Systematic Epizootiology with modules in (i) Geospatial information infrastructure and Services (GIIS) in human-animal disease surveillance (3 credits); (ii) Harnessing Indigenous Knowledge and Practices for human-animal disease surveillance in West Africa (2 credits - required); (iii) Molecular Epizootiology approach and techniques in human-animal disease surveillance; (iv) Project Monitoring and Evaluation in Human-Animal Disease Control (2 credits - required); (v) Statistical Methods in Disease Modelling (2 credits - elective, emphasising statistical approaches and

hands-on time-trend modelling, descriptive and categorical analysis of data, spatial and linear regression methods). These five modular courses were designated Systematic Epizootiology I-V. Curriculum review workshop organized was moderated by a Sub-Committee with terms of reference to work with the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan to ensure a consensus programme that adds global best practice value to the M.Sc. Epizootiology curriculum. The revised curriculum was adopted by the department for approval by Board of the Postgraduate School of the University of Ibadan.

In addition, the Sub-Committee developed Certificate Curriculum for Human-Animal Disease Surveillance (CHADS) based on inclusive learning that could be completed in one (1) month only. The new certificate curriculum was adopted at stakeholders meeting in February, 2014. surveillance curriculum in West Africa. The conference and workshop were held 4-7 December, 2012. The forum provided expert review of rabies, global and regional best practices

2) Hosting of International Conferences on One-Health Education, Practice and Development

The CCPZ team jointly organized Rabies in West Africa (RIWA) conference with the Federal Ministry of Health, Abuja, Nigeria, and a strategic workshop to review human-animal disease in its passive, active and predictive surveillance. Rabies surveillance, research and education were prioritized with the emergence of a strategic partnership to improve rabies surveillance in West Africa. RIWA network was an original and unique template of one-health partnership for education, practice and development. Significant success was achieved at the conference with commitments towards collaborative human-animal disease surveillance linking academia, government and private practitioners. RIWA network contributed to the review and development of M.Sc. curriculum and the Certificate Programme of CCPZ for Zoonoses Surveillance. Selected lead papers from the conference have been published in a peer-review journal.

The second conference of the centre was held June 30 – July 3, 2014 with global

participation on Improving Zoonoses Surveillance in West Africa: the One-Health Approach. Global, regional and national experts and leaders again attended the conference at the University of Ibadan, which was far larger in attendance than the first conference. One-Health Nigeria communiqué was endorsed and circulated.

3) Establishment of Learning Centre in Njala University, Sierra Leone

CCPZ Principal Investigator visited Prof. Felixina Jonsyn-Ellis, the Deputy Vice-Chancellor, Njala University, Sierra Leone and Dr. Saidu Kanu, the Head, Department of Animal Science of the University on 24 April, 2013 to evaluate procedures for setting-up a Learning Centre at Njala. A plan was developed for commencement of the Learning Centre. As a follow-up on the plans, Njala University Administration provided a lecture room within the Department of Animal Science on the University campus, which was renovated and equipped between 30th April and 13 May 2014, for permanent use as CCPZ Learning Centre. In all, sixteen (16) desks and chairs, one desktop and a laptop computer, an LCD projector, its screen

and accessories, a printer, a scanner, a photocopier and two standing fans were installed. In addition, sign posts by the main road, in front of the Learning Centre were fixed. Other items provided include, wall displays about zoonoses certificate programme, floor cover (linoleum) and window-blinds. Internal connectivity with the University Wi-Fi links was provided. The facility was handed over to Professor Abu Sesay (Vice-Chancellor), along with the Head, Department of Animal Science and other faculty and staff of the department. Present at the event was the Associate Programme Officer, MacArthur Liaison Office, University of Ibadan (Mr. Oyewale) and the Project Monitoring and Evaluation Consultant, CCPZ (Mrs. Bamke Okunribido). CCPZ Administration is to recruit an Associate Programme Officer, who will man the Learning Centre and coordinate the operation of its Certificate Credit Transfer programme between the University of Ibadan and Njala University through the Head of the Department of Animal Science. The unprecedented epidemic of Ebola Virus Disease shortly after the set-up of the centre interrupted the process.

4) Enrolment and mentoring of the first and second cohorts of postgraduate students

Twenty-three (23) students were admitted in two cohorts under the postgraduate fellowship/ scholarship programme. They were enrolled thus: 1 PhD, 6 MPhil/PhD and 5 M.Sc. (research) in October 2012. The first cohort comprised seven Nigerians, two Liberians, two Ghanaian and one Sierra Leonean; while the second cohort (4 PhD and 7 M.Sc. Epizootiology students) enrolled in September, 2014, comprised nine Nigerians and two Liberians. Four (4) of the MPhil/PhD candidates converted to PhD, while four M.Sc. candidates successfully completed the programme and graduated in November 2014. The Principal Investigator of this Project together with first cohort students (two Liberians on MPhil/PhD and two Nigerians on Masters programme) conducted field and laboratory studies in Liberia, held meeting with the President, Cuttington University, Liberia, Dr. Henrique Tokpa at his office on 22 April, 2013. The meeting deliberated on the progress made by Liberian student beneficiaries of the MacArthur funded project and strengthening of collaboration between the two Unive-

rsities (Cuttington University, Liberia and the University of Ibadan, Nigeria in disease surveillance at the human-animal-environment interfaces.

The President, Cuttington University wrote and endorsed an official correspondence to the Honourable Minister of Health and Social Welfare and the Minister of Agriculture (Liberia) on the educational programme for improving human-animal disease surveillance in West Africa. He indicated the commencement of joint fieldwork. On the strength of the official correspondence and an application for ethical approval by the Liberia Biomedical Research Institute's Ethical Review Board to enable the disease surveillance in Liberia. The ministries granted immediate approvals. An ethical approval was later granted (Appendix 1).

The four students on fieldwork in disease surveillance to Liberia completed their studies, presented post-field seminars and submitted a project report and dissertation for M.Sc. and MPhil-PhD conversion to PhD to the Department of Veterinary Public Health and Preventive Medicine and to the Centre for Control and Prevention of Zoonoses, University

of Ibadan. The students were subsequently examined by internal and external examiners to the University of Ibadan. They were all, successful, in the top of all their classes in the Department of Veterinary Public Health and Preventive Medicine. Five scientific papers from these studies have been accepted in peer-reviewed journals. One is fully published in ELSEVIER's *Spatial and Spatiotemporal Epidemiology* (<http://authors.elsevier.com/a/1Q3Vy6gwSr-YL5>), four (4) are under preparation for issues in *Annals of African Medicine* and *African Journal of Medicine and Medical Sciences*.

Dr. B.O. Emikpe, a Co-Principal Investigator at CCPZ lead field study visits of four (4) other students in the first cohort to the University of Ghana and the Central Veterinary Laboratory, Accra, Ghana in May-September, 2013. These students on CCPZ scholarship were Dr. Babalola Temilade (Female: MPhil/PhD Fellow, Nigerian), Dr. Adeola Oluwagbemga (Male: MPhil/PhD Fellow, Nigerian) Dr. Theophilus Odoom (Male: Ghanaian, MSc) and Dr. Theophilus Jarikre (Male: MSc, Nigerian). The four students on visit to Ghana completed their studies,

presented post-field seminar and submitted official project reports/dissertation for M.Sc. and MPhil-PhD conversion to PhD to the Departments of Veterinary Public Health and Preventive Medicine, Veterinary Pathology, Veterinary Microbiology and Parasitology, and to the Centre for Control and Prevention of Zoonoses, University of Ibadan. Four scientific papers have been submitted to peer-review journals with one already in print on Bulgarian Journal of Veterinary Medicine. Three of the first cohort of students, including two Ghanaians and one Nigerian were yet to successfully complete their programmes. One Sierra Leonean did not pursue his programme.

5) *Laboratory capacity building in geospatial analysis, molecular biology and audio-visual aids*

Three critical laboratories were established to build relevant capacities for disease surveillance education, namely in geospatial analysis, molecular biology and audio-visual techniques. While a surgeon is known by an operating theatre, a physician is known by an in-patient or out-patient clinic, an anatomist is known by a dissection room,

an epidemiologist/epizootiologist is known by a disease surveillance pavilion (where development of maps and the exhibition of pattern of diseases are available), and a public health physician/veterinarian is known by a community-based primary health care programme. Disease mapping and spatio-temporal analysis at CCPZ fills a critical gap in teaching, research and community service. The laboratory has eight desktop computers (workstations) and a server (on a desktop). A local wireless network provides interconnectivity for lending ArcGIS 10.1 laboratory License (Environmental Systems Research Institute, Redlands California) on the University of Ibadan web-server for 32 concurrent users. The Geospatial Information Infrastructure at CCPZ operates effectively, providing education in contemporary use of Information and Communication Technologies (ICT) for disease surveillance to postgraduate and professional students in the University of Ibadan, and in support of effective planning towards the control and prevention of diseases in the sub-region.

The CCPZ's molecular biology laboratory is a bio-safety Level II facility, installed

with capability for conventional polymerase-chain-reaction (PCR), protein and genome electro-phoreses, digital documentation system, cold storage at low and ultra-low levels; and capable of extraction and preservation of genome, and detection of antigen-antibody by Enzyme-linked Immunosorbent Assay (ELISA). The laboratory was installed in August-September, 2014. At the same period, an audio-visual suite was set-up with high definition video cameras and accessories.

The facility is for producing documentaries and auto-tutorial instructional materials both for on-campus use in UI and distant learning in NU, Sierra Leone, ensuring that the epidemiological surveillance operations of the centre contributes to national and sub-region solutions that would address the public health challenges in Nigeria and West Africa.

The facility strategically bridges a gap in strengthening the certificate and graduate training instructional materials development of the centre, and its community engagement programmes.

- 6) *Sub-regional awareness promotion of training programmes and services available at CCPZ among professional associations*

Two professional association conferences in Nigeria (Nigerian Veterinary Medical Association, Ekiti, 2012; Abuja, 2013) and in Ghana (Ghana Veterinary Medical Association Congress, 2014 and the concurrent second RIWA Conference) were attended, and at which an exhibition stand was mounted and manned by project personnel to promote its up-coming activities, training programmes, and opportunities available at the University of Ibadan Centre for Control and Prevention of Zoonoses. In particular, the awareness promotion offered opportunity to present and build interests of members of the Nigerian Veterinary Medical Association (NVMA) towards the Rabies in West Africa (RIWA) conference, scheduled for December, 2012 at the University of Ibadan. In addition, the One-Health Conference scheduled for June-July 2013 again at the University of Ibadan was promoted. CCPZ information hand-bills were distributed and an exhibition of achievements of the centre was displayed at the Ghana

Veterinary Medical Association (GVMA) Conference 2014. In addition, the journal, *Epizootiology and Animal Health in West Africa* volume 9, issue 1 was distributed at the GVMA Accra 2014 because it contained eight scientific papers related to M.Sc. Epizootiology curriculum review at the University of Ibadan, and selected from the first RIWA Conference, 2012. The impact of this publication distributed was obvious at the second RIWA Conference.

The papers presented at the second RIWA conference, Ghana 2014, were officially agreed to be peer-reviewed for possible publication in the journal *Epizootiology and Animal Health in West Africa* volume 10, issue 2. CCPZ donated conference bags and writing pens to the GVMA and educational materials, including an LCD projector, meat inspection aprons, a pen drive and jotters to each of the two Veterinary Schools in Ghana (University of Ghana and Kwame Nkrumah University of Science and Technology Veterinary Schools).

- 7) *Community engagement, sensitization and training for butchers, hunters, bush-meat sellers and town hall discourse about Ebola Virus Disease and other human-animal diseases*

On 29 April, 2014 CCPZ organized and conducted one-day sensitization workshop for butchers and women involved in the processing and sales of meat at slaughter facilities in Oyo State, Nigeria. There were seventy three (73) participants at the workshop. The resource persons were drawn from the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan, the Oyo State Ministries Health and Agriculture, and two Head Butchers. The workshop was coordinated by Dr. Simeon I.B. Cadmus (Co-Principal Investigator, CCPZ and Head of Veterinary Public Health Unit at the University of Ibadan) and Professor G.A.T. Ogundipe, Head of the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan. Mrs. Abokede, a Matron from the

Ministry of Health led a discourse on the butcher's health. The training was chaired by Professor M.O. Oyeyemi, the Dean of Veterinary Medicine, University of Ibadan, and Professor R.A. Oderinde, the MacArthur Grant Liaison Officer, University of Ibadan were in attendance. The discourse focused on zoonotic worms, bacteria and viruses: promoting personal and public safety in handling animal and their processing for food.

On 20th July, 2014 following the outbreaks of EVD in Guinea, Liberia and Sierra Leone, CCPZ Co-Principal Investigator, Dr. A.B. Ayinmode developed a set of 3-minute jingles for community sensitization about EVD, its cause, clinical signs and mode of transmission for airing on radio. It was produced in English, Yoruba, Pidgin English and Hausa. The jingles were assessed by communications and technical experts and adjudged as catchy and highly informative. On 21 August, 2014 a town-hall discourse on EVD was held at the Trenchard Hall, University of Ibadan to sensitize the community about the deadly disease, with focus on institutional preparedness in preventing outbreak on campus and necessary measures to contain it in an event of

outbreak on campus. Attendance at the forum was compulsory for students, faculty and staff. The event was chaired by the Vice-Chancellor and anchored by CCPZ and the Office of International Programmes, University of Ibadan. CCPZ jingles were approved by the Vice-Chancellor for use on the University Radio (Diamond FM) and auditioned daily.

On 10th September, 2014 the NVMA Oyo State Branch held a one-day sensitization workshop for hunters, bush-meat sellers and veterinarians in the state about risks and prevention of Ebola virus disease. The Principal Investigator, CCPZ was invited to present the History, Geography and socio-economic impact of the disease in Nigeria and West Africa. The power-point presentation by Dr. B.O. Olugasa was acknowledged well researched, efficiently delivered to the target audience in English and the local Yoruba language. The attendance was about two hundred persons. The power-point presentation was shared on Nigerian Veterinary Medical Association mail-group by the General Secretary of the association.

8) *Hosting of Nigeria Bio-security Engagement Training Programme of the United States Centres for Disease Control and Prevention (CDC), June-July, 2014*

On 27 November, 2013, a delegation from the United States Department of State, Bio-security Engagement Programme, visited Professor Julius A. Okojie, Executive Secretary, National Universities Commission (NUC), Nigeria, on modalities for building the capacity of laboratory scientists in Nigeria, to monitor, detect and conduct early detection and diagnoses of dangerous zoonotic pathogens in Nigeria (NUC Bulletin Vol. 8, No. 24, 2 December 2013). Dr. Modupe Osinubi, of Rabies Programme, CDC Atlanta and spokesperson of the delegation, subsequently corresponded by email to the Vice-Chancellor, University of Ibadan (UI) between 12 and 19 December, 2013, requesting him to support scientists from UI to attend the training, representing scientists from the south-west Nigeria at the training. However, the Vice-Chancellor, University of Ibadan assented and committed CCPZ project team to work with the CDC-BEP team to facilitate and host the training in Nigeria.

The CDC-BEP after national evaluation, selected Ibadan as the training venue for the programme. CCPZ made provision for both suitable laboratories and equipments which included, the Nigerian Institute of Science Laboratory Technology (NISLT), Samonda, Ibadan for microscopy, Real-Time Polymerase Chain Reaction and direct immunohistochemistry procedures; the Bio-Science Centre, International Institute for Tropical Agriculture (IITA), Ibadan for molecular sequencing; and endorsed Material Transfer Agreement (MTA) with the Institute for Lassa fever Research and Training, Irrua Teaching Hospital, Irrua, Edo State; for Lassa fever antigens and reagents for use in the training in Ibadan. Thus, the training utilized molecular diagnostic procedures that were non-dangerous yet efficient in the surveillance of viral pathogens and ensured the security of samples as opposed to culturing method.

The 120 participants at the training were drawn from relevant institutions including universities across the country, the Federal Ministries of Health and Agriculture as well as teaching hospitals and other research institutes. The training ended with the presentation of

certificates to participants and resource persons. In appreciation of the Centre's successful hosting of the training programme, donation of forty (40) laboratory equipments which included recently developed Direct Rapid Immunohistochemistry Test (dRIT) kit by the CDC for rapid diagnosis and screening of suspected rabies samples, smart gel electrophoresis kits and research materials were made to the CCPZ. The donated items have been published in the University of Ibadan Official bulletin No. 3450 of November 2014 page 2. The Principal Investigator of the Centre was presented with a certificate of appreciation by the CDC (see attachment). The training was directly related to the networking, capacity building and training objectives of CCPZ.

9) *Development of best practice instructional materials for certificate programme*

Instructional materials on best global practices adapted to the sub-region are being compiled for use in the CCPZ Certificate training programme on

Human-Animal Disease Surveillance. The instructional materials are being systematically reviewed by CCPZ academic board. The materials include data profile created from zoonoses surveillance in West Africa and others being profiled by the Epi-informatics unit of CCPZ. Three dataprofiles being reviewed are: (1) UI-CU Liberia Lassa fever Observation Data Profile, 2008-2012. (2) UI-CU Liberia Rabies-like-illness Observation Data Profile, 2008-2012 and (3) UI-CU Liberia Tuberculosis Observation Data Profile, 2008-2012. These would be used in the M.Sc. Epizootiology and certificate programmes. Video recording of laboratory procedures in molecular diagnoses including PCR, gene sequencing and serology by CCPZ faculty and collaborators, including the CDC Bio-security Engagement team (approved for use in CCPZ certificate and M.Sc. trainings) are equally scheduled for review. Auto-tutorial instructional materials on standard operation in disease surveillance are scheduled for production at CCPZ following review of established institutional modules applicable to the sub-region, into DVDs and compacts disks for transfer to

Learning Centre, Njala University, Sierra Leone. Jingles on Ebola Virus Disease (EVD) and a movie on "Stop Rabies" documentaries are to be used as tutorials in community engagement.

10) *Publication of scientific papers in high impact journals, sub-regional peer-reviewed journals, and presentation of papers at international conferences*

CCPZ support of postgraduate programmes in the 3-year project period has resulted in the mapping, risk assessment, forecasting and improved methods of research and teaching in Human-Animal Disease Surveillance in West Africa. This information has been published in international and sub-regional peer-reviewed journals. In all, twenty six (26) publications have been made in peer-review journals and shared with faculties in the University of Ibadan and collaborating Institutions in West Africa. These include eight (8) papers published in *Epizootiology and Animal Health in West Africa*, one in *Spatial and Spatio-temporal Epidemiology* (ELSEVIER: <http://authors.elsevier.com/a/1Q3Vy6gwSr-YL5>), four (4) others are published in various other journals with human-animal disease

surveillance coverage. One is published in refereed conference proceedings. Two (2) are published in *Annals of African Medicine* and ten (10) are accepted for a Supplement in *African Journal of Medicine and Medical Sciences* respectively. Some of these publications are freely accessible to students and faculty in the sub-region on the CCPZ webpage, University of Ibadan. A summary of all publications within the three-year project period is provided in the logic frame of activity below.

REALIZATION OF OBJECTIVES

A significant progress was made in realization of the set objectives as summarized in the logical framework below. Curriculum review for M.Sc. Epizootiology programme and development of modules for Certificate training, being fundamental to improving postgraduate programmes for zoonoses surveillance have been achieved. The second objective was mentoring, teaching and research in zoonoses surveillance, in which first and second cohorts of postgraduate students were admitted for training in novel scientific applications in sub-regional

field investigations. The third major objective was to engage the community in best practice approaches to disease surveillance at the human-animal-environment interfaces. The CCPZ research unit on geo-spatial analysis have realized this objective in the forecasting of case pattern of priority zoonoses (rabies, Lassa fever and Tuberculosis) through inclusive learning framework. The programme developed and published time-trend models to forecast cases of two viral zoonoses (rabies and Lassa fever) (Jomah *et al.*, 2014; Olugasa *et al.*, 2014 a and b; 2015 a and b). The case patterns showed striking similarity with the pattern of spread and magnitude of Ebola virus disease, 2014 outbreak in Liberia. This achievement underscored the exactness of what a graduate student should be able to do by attending the revised postgraduate programme in M.Sc. Epizootiology and the Certificate of Participation in zoonoses surveillance (Olugasa and Fasunla, 2013) at the University of Ibadan CCPZ. We are excited about the utmost relevance of the

surveillance skills to be attained in the new curricula. Thus, a zoonosis pavilion for community engagement (Olugasa, 2014) online is being created to use forecasts and maps of local communities to show hospitals that will be seeing new cases of specific diseases in years ahead.

SIGNIFICANT ACHIEVEMENTS

The accuracy of revised and new curricula contents to ensure needed critical manpower for addressing the public health challenge in the sub-region was considered a novel and significant achievement in the three-year period. The development and adoption of these curricula marked the emergence of more effective and efficient human-animal disease surveillance certification and postgraduate programme in West Africa, with hub at the University of Ibadan, Nigeria. The timely conversion of four MPhil-PhD students to full PhD (two Liberians, two Nigerians), the set-up of a Learning Centre in Sierra Leone, graduation of four of the first cohort of students mentored on MSc/MVPH programme at the University of Ibadan (with best performance in their academic

programmes), with high quality publications from their projects and hosting of Nigeria Bio-security Engagement Programme were all notable achievements in the three-year period.

The CCPZ used time-trend modeling to predict that the status of Lassa fever (LF) in Liberia called for prioritization of its control intervention prior to the EVD epidemic. To the best of our knowledge, CCPZ was first sub-regional educational institution to apply a standardized approach to predict the trend of LF in Liberia (Open access on *Annals of African Medicine* 14(2), 2015). Model toolkit was developed for time-trend analysis and prediction of case pattern of Lassa fever and later for rabies in Liberia. These tools may aid strategic planning and preparedness for these diseases. These were landmark achievements of the programme that would outlive the three-year funding of the programme. Being a crucial tool in preventive medicine, CCPZ was positioned for capacity building toward the ambitious aim of "arriving at the site of an outbreak before the pathogen." These were achieved because of the quality of primary and secondary data available for modelling from cooperation sustained

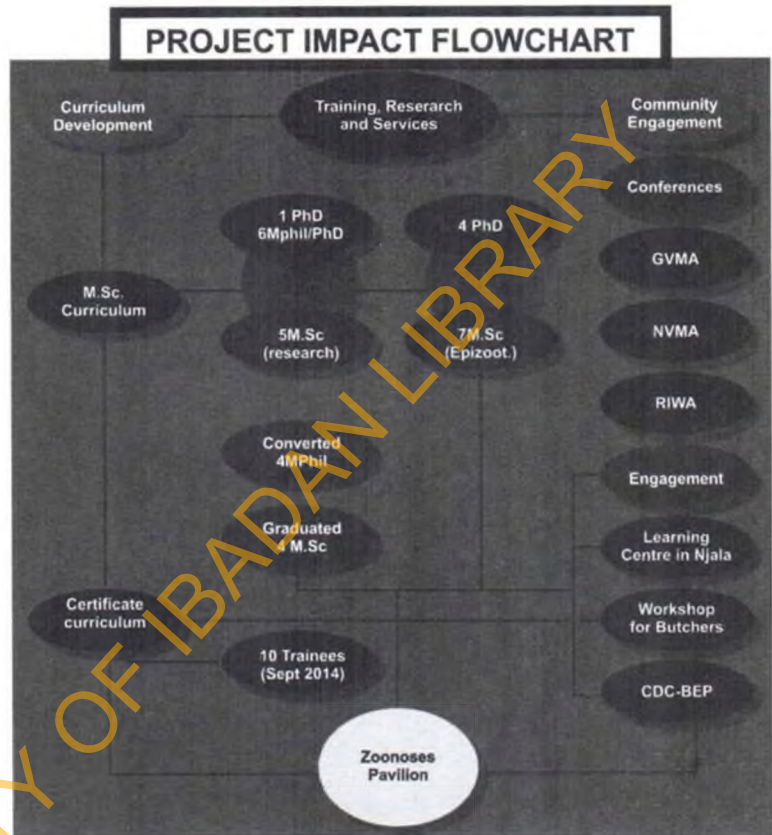
with partner institutions across West Africa.

IMPACT OF GRANT

The impact of the CCPZ has been noticeable in the following areas.

1. There is significant increase in enrolment for M.Sc. Epizootiology programme in the University of Ibadan. In the 2013/2014 academic session, an unprecedented 9 candidates were admitted into the programme in the Department of Veterinary Public Health and Preventive Medicine as opposed to two or less in previous sessions.
2. An increase in number of applications, admissions and enrolment of West African postgraduate students into postgraduate programmes for surveillance of human-animal diseases was recorded in the 2012/2013 academic session at the University of Ibadan. This trend was sustained in the 2013/2014 academic session as recorded in the applications made for admission.

3. University-wide attitudinal change towards the use of maps in guiding collaboration in disease surveillance studies has been reflected in background diversity of individuals expressing interest in the certificate training programme for disease surveillance from outside the Faculty of Veterinary Medicine;
4. University of Ibadan CCPZ becoming an attractive destination for doctoral students and research scientists from Europe and the Americas that are visiting West Africa to



conduct research and seeking collaboration on human-animal diseases.

EVALUATION OF IMPLEMENTATION

Schedule of Activities and Expenditures

During the third year of this project, the Project Team engaged the direct involvement of the resident specialist/consultant in Project Monitoring and

Evaluation to facilitate the prompt set-up of the up till then delayed establishment of the Learning Centre in Sierra Leone's Njala University. The learning centre was effectively set-up and made ready for use in May, 2014. There were obvious improvements in performance during the third year in all the scheduled activities of the programme and expenditures compared to achievements in previous years.

The outbreak of Ebola virus disease, a zoonosis in West Africa, while within the catchment of diseases at the human-animal-environment interfaces, was a level-4 biosafety disease, beyond the planned activities of this programme. This event necessitated a careful and deliberate revision of movements to-and-from affected countries to ensure safety rules for students, staff and faculty. On air and online approaches to community participation in research and services towards control of the disease was adopted. This might have accounted for additional delays in fully accomplishing the set objectives. On this basis, we seek a one-year no-cost extension.

Evaluation of Overall Targets

The activities of the programme have generally been significantly accomplished. The programme has made notable impact on the West African community with increased operational visibility in its three years of operation. The project

holds increasing role and importance in the event of EVD epidemic in West Africa, underscoring the public health vulnerability of the region. The Programme Team has won the confidence of major stakeholders in the sub-region.

Key Lessons Learnt and Next Step

The Programme Team's resilience in all aspects of managing collaboration across the sub-region is a major lesson learnt that would continue to make the project successful. While a shortfall in set objectives were recorded, the centre has clearly actualized the critical platform and direction for improvement in postgraduate programmes for human-animal disease surveillance as itemized in the logical framework herewith provided.

The next steps include providing and disseminating resource materials for skills building, recruiting and training manpower for zoonoses surveillance and

control in the sub-region. By operationalizing the flexible certificate programme, made accessible to desk and field officers, laboratory technicians, academic and researchers, through summer and online courses on current trends in zoonoses surveillance and control, the Programme Team hope to sustain its educational impact beyond the funding window of the MacArthur Foundation. This therefore necessitates a need for a no-cost extension of the project.

Conclusion

The activities of the programme have generally been significantly implemented. The programme is making notable impact in Nigeria and communities within West Africa with increased operational visibility in its three years of operation. The project holds increasing role and importance in the event of both current and prospective EVD epidemics in higher education for science and service integration. The Programme

Team has won the confidence of its major stakeholders in the sub-region. The present stage of implementation has clearly and significantly positioned the programme as novel and crucial.

The requested one-year no-cost extension funding window provided by the John D. and Catherine T. MacArthur Foundation will enable the programme team to efficiently optimize operations necessary for ensuring an indelible and sustainable continuity of the robust contributions to improvement of postgraduate programmes for surveillance of human-animal diseases in West Africa. The programme will consolidate its sub-regional position in four key areas viz; delivery of permanent best practice instructional materials, map design and sharing, forecast service delivery, as well as an online data exchange that shall optimize the use of the short course Certificate Programme in West Africa.

Instructional materials based on sub-regional data generated and data profile

created will be compiled for use in certificate and postgraduate programmes; detailed and prepared as worked examples in the textbook on Systematic Epizootiology. The textbook will integrate instructional materials for use in both certificate and postgraduate curricula in zoonoses surveillance. Annually harnessed and generated zoonotic data-profile and thematic maps would be used for case pattern prediction service at CCPZ. The results being shared and freely accessible as community service for engagement of health authorities in targeted responses. Maps will be uploaded and hosted on an internet-based One-Health pavilion (CCPZ-ESRI licensed server) with accessibility to students, faculty and collaborators in West Africa. The online zoonoses pavilion will publish materials into mobile (hand-held) android phone applications to supplement means of communication such as telephones in syndromic surveillance, augment data update and capture of zoonotic disease case patterns.

In summary, in 2015 the Centre will provide and disseminate resource materials for skills building, recruiting and training manpower for zoonoses surveillance and control in the sub-region. The programme will consolidate capacity built through operationalization of the flexible summer and online certificate courses on current trends in zoonoses surveillance and control, made accessible to desk and field officers, laboratory technicians, academics and researchers.

The programme intends to sustain its educational impact beyond the funding window of the MacArthur Foundation and achieve its key goals by embarking on the following in response to priority diseases at the human-animal-environment interfaces, including EVD control promotion in West Africa:

1. Intensify awareness campaign at community level for EVD eradication through the production of high impact audio-visual materials;
2. Train Community Surveillance Advisors (CSAs) specifically for EVD case identification, reporting and net-

working between affected communities, Ministries of Health/Agriculture and partner agencies;

3. Designate more Surveillance Posts within Nigeria, Ghana, Liberia and Sierra Leone, where CCPZ has collaborators and Learning Centres for field operations.
4. Strengthen community engagement through citizen science approach in zoonoses surveillance and promotion of the One-Health pavilion as a model for postgraduate and certificate training in human-animal diseases in West Africa.

A certificate short course in zoonoses surveillance is a priority attention for CCPZ-CSAs, who shall include University Faculty, community members and healthcare career professionals. These would search and identify specific

zoonoses risk factors and cases, report to the respective local surveillance posts at the community level and records obtained are relayed to CCPZ geodatabase administrator for editing, verification and possible authorization into the zoonoses pavilion. Each CSA shall be trained and supported with biosafety logistics for inclusive referral system in zoonoses surveillance. It is hoped that near-real-time incidence and/or prevalence of zoonotic diseases occurring in communities in the sub-region would be captured on feedbacks from identified Community Surveillance Advisors. A periodic advisory reports shall be produced from the Certificate Training Programme and CSAs data profile for public health engagement. A one-health approach model for passive, active and predictive surveillance would have been established for early warning system and targeted response by health authorities.



Figure 1: CCPZ hosted the CDC organized Nigeria Bio-security Engagement Training Programme, in Ibadan, Oyo State, Nigeria from 25 June to 3 July, 2014



Figure 2: Registration desk at the Nigeria Bio-security Engagement Training Programme, Conference Centre, University of Ibadan, 25 June to 3 July, 2014



Figure 3: Group photograph at the closing session of the second International Conference and One-Health Exposition of the CCPZ, held 30 June -3 July 2013, Trenchard Hall, University of Ibadan, Ibadan, Nigeria



Figure 4: (L-R) The Chief-Medical Director, University College Hospital, Ibadan, President, Nigerian Academy of Sciences, Principal Investigator of MEPIN, Epizootiology Consultant, CCPZ PI and three Co-PIs at 2nd Annual Conference of CCPZ, July 3, 2013.



Figure 5: President, Nigerian Academy of Sciences, Deputy Vice-Chancellor (Administration), Deputy Vice-Chancellor (Academic), University Librarian, Deans of Veterinary Medicine and Public Health (UI), Director-General, Nigerian Institute of Science Laboratory Technology, NVRI staff, CCPZ PI, Co-PI and dignitaries at Opening of 2nd Annual Conference & One-Health Exposition, 30 June–3 July, 2013.



Figure 6: Field research session conducted by a CCPZ Scholar, Dr. Eugene Odigie, investigating case-pattern and knowledge of Lassa fever in a small town of Nimba County, north-central Liberia, April – May, 2014

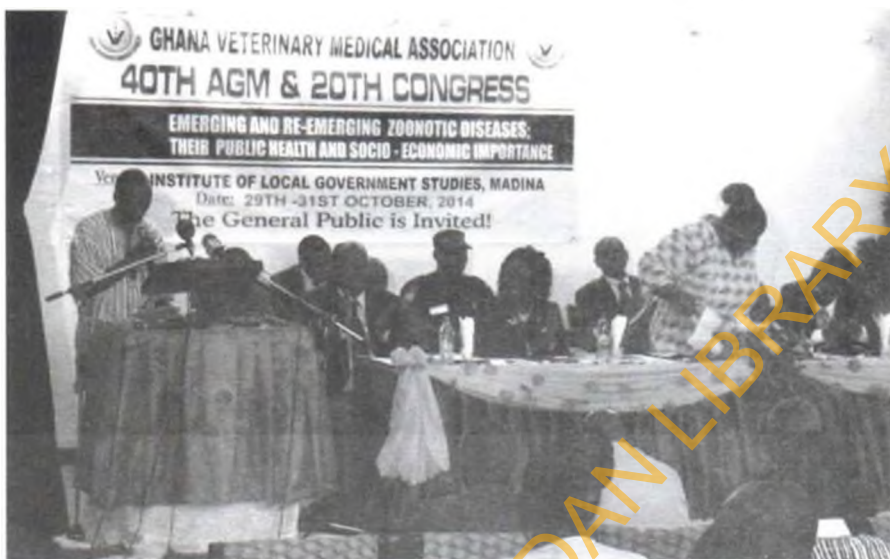


Figure 7: Honourable Minister of Agriculture, Dr. Agyeman Peku at opening session of Ghana Veterinary Medical Association's 40th Annual General Meeting and 20th Congress with 2nd Rabies in West Africa (RIWA) Conference, Accra, Ghana, October 2014



Figure 8: Group photo at the opening session, Ghana Veterinary Medical Association Annual Conference, attended by the Principal Investigator, CCPZ, Dr. B.O. Emikpe, Co-Principal Investigator and Mr. Emeka Odiaka, Associate Programme Officer, who manned the CCPZ Boot. Epizootiology and Animal Health in West Africa is the yellow book held by two participants (RIWA delegates) on the front row, right side.

Table I: LOGICAL FRAMEWORK OF ACTIVITIES

S/N	ACTIVITY	EXPECTED OUTCOME	OUTCOME INDICATOR / TARGET		MEANS OF VERIFICATION
			PROPOSED	ACHIEVED	
1.	Leadership visits and meeting with collaborating departments and Institutions	<ul style="list-style-type: none"> Partnership between local and international Institutions strengthened. Exchange visits conducted by staff and student of the Centre and collaborating Institutions, including Njala University, Sierra Leone, Cuttington University, Liberia, University of Ghana, Accra and University of Ibadan. Built teaching, research and mentoring capacity for the Centre. Managed collaboration between partner higher institutions and government agencies in West Africa. 	<ul style="list-style-type: none"> Three (3) MOUs to be signed with the three collaborating Universities in West Africa. Three Letters of Agreement (LoA) to be signed with three Governmental Ministries of Health and Agriculture Develop a teaching capacity of about 25 lecturers including lecturers from the international collaboration Institutions. Two (2) joint teaching and mentoring of postgraduate students on research visit to Sierra Leone, Liberia, Ghana and Nigeria per academic session. Set up a Learning Centre in Njala University, Sierra Leone 	<ul style="list-style-type: none"> Three (3) MOUs signed with three collaborating Universities in West Africa, namely Cuttington University, University of Ghana and Njala University, Sierra Leone. Four Letters of Agreement (LoA) signed with three Governmental Ministries of Health and Agriculture in West Africa, namely Federal Ministry of Health, Abuja, Nigeria; Ministry of Agriculture, Liberia; Ministry of Health and Social Welfare, Liberia; Central Veterinary Laboratory, Accra, Ghana. Two Letters of Agreement signed with newly emerging multidisciplinary non-governmental bodies, namely "One-Health". Nigeria and RIWA (Rabies in West Africa) network. Two (2) joint teaching and mentoring of ten (10) postgraduate students on research visits to Liberia, Ghana, northern and/or southern Nigeria. Teaching capacity of 25 lecturers drawn from the University of Ibadan (12), University of Ghana (2), Njala University (3), Cuttington University (2), Ministries of Health (3) and Agriculture (3) in Nigeria, Ghana, Liberia and Sierra Leone. Learning Centre of 16-sitter capacity with multimedia projector, internet 	<p>Endorsed MOUs are available at the Office of International Programmes (OIP), UI and at CCPZ Secretariat.</p> <p>Endorsed LOAs available at CCPZ Secretariat</p> <p>Postgraduate students and faculties on research visit to Nigeria hosted by CCPZ are published in Links Newsletter of the Office of International Programmes, University of Ibadan, as follows:</p> <ul style="list-style-type: none"> Volume 9, September-December, 2012 [Doctoral candidate at University of Wisconsin, Madison, USA Presents seminar in UI. On page 9 -10]; Liberian Professor hosted to a reception on completion of a short training programme in UI. On page 5-6. <p>Action photos of meetings held at the Federal Ministry of Health, Abuja, Nigeria are available at CCPZ secretariat and provided in the Appendix to this report</p> <p>Scientific publications from research reports on studies in Liberia and Ghana are available in CCPZ Secretariat, on CCPZ publications webpage, UI website, and respective journal web links. Action photos of CCPZ PI's with the President, Cuttington University, Liberia, Deputy Vice-Chancellor, Njala University, Sierra Leone and CCPZ Co-PI with the Head of Central Veterinary Laboratory, Accra, Ghana are available at the CCPZ secretariat</p> <p>Njala University acknowledgement of Learning Centre established and action photo album are available at the CCPZ secretariat</p>

				<p>connectivity and instructional materials was established in Njala University, Sierra Leone.</p> <ul style="list-style-type: none"> Agreement memorandum with the United State Centres for Disease Control and Prevention to host and facilitate the Nigeria Biosecurity Engagement Training Programme Material Transfer Agreement (MTA) signed between the Centre and Institute for Lassa fever Research and Training, Irrua Teaching Hospital, Irrua, Edo State, Nigeria. Material Transfer Agreement (MTA) is being developed with Singapore University, facilitated by the CDC Conference and instructional materials donations to Ghana Veterinary Medical Association and Universities 	<p>Agreement and endorsed certificate of appreciation from the CDC available at the CCPZ secretariat</p> <p>Donation of forty (40) laboratory equipments and research materials from the CDC to CCPZ available on the University of Ibadan bulletin No. 3450 of 03 November 2014 page 2</p> <p>Material Transfer Agreement available at the CCPZ secretariat</p> <p>Material Transfer Agreement available at the CCPZ secretariat</p> <p>Ghana Conference book of abstracts, action photo album and letters of acknowledgement from Ghana Veterinary Medical Association, University of Ghana and Kwame Nkruma University of Science and Technology, Ghana available at the secretariat.</p>
S/N	ACTIVITY	EXPECTED OUTCOME	OUTCOME INDICATOR / TARGET		MEANS OF VERIFICATION
			PROPOSED	ACHIEVED	
2.	Curriculum Review	<ul style="list-style-type: none"> MSc Epizootiology Curriculum revised at the University of Ibadan. Certificate Programme in Human-Animal Disease Surveillance developed. Supported credit transfer from University of Ibadan to Njala University, Sierra Leone. 	<ul style="list-style-type: none"> To revise the existing MSc Epizootiology curriculum To develop a curriculum on Certificate in Human-Animal Disease Surveillance CCPZ to operate credit transfer programme to Njala University for certificate training in Human-Animal Disease Surveillance. 	<ul style="list-style-type: none"> Existing MSc Epizootiology curriculum was revised between December 5, 2012 and June 12, 2013. Department of Veterinary Public Health and Preventive Medicine adopted revised curriculum in February 2014 Revised MSc Epizootiology curriculum is at the Postgraduate School, UI for board approval. 	<ul style="list-style-type: none"> OIP Newsletter: A report on curriculum review workshop by CCPZ on Human-Animal Disease Surveillance at the University of Ibadan was published in Links Newsletter of the Office of International Programmes, University of Ibadan, as follows: <ul style="list-style-type: none"> Volume 9, September-December, 2012 [UI hosts first international conference on Rabies in West Africa. On page 7 - 8]; <p>Working documents, video recordings, and published review papers on MSc Epizootiology curriculum are available at CCPZ Secretariat.</p> <p>Revised curriculum available in CCPZ prospectus and at the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan.</p>

S/N	ACTIVITY	EXPECTED OUTCOME	OUTCOME INDICATOR / TARGET		MEANS OF VERIFICATION
			PROPOSED	ACHIEVED	
				<ul style="list-style-type: none"> Certificate of Participation in Human-Animal Disease Surveillance in West Africa was developed and adopted by stakeholders in West Africa in February 2014. Certificate programme is ready for annual advertisement, selection of trainees, enrolment and training Ten trainees on Human-Animal Disease Surveillance were enrolled in the first cohort of certificate programmes 	<p>Developed curriculum for Certificate in Human-Animal Disease Surveillance available in CCPZ prospectus</p> <p>Revised MSc Epizootiologu curriculum available at the Postgraduate School, UI.</p> <p>Revised curricula available in CCPZ Prospectus at the Secretariat.</p> <p>Enrolled trainees on Human-Animal Disease Surveillance certification programme are currently on training at the Centre;</p>
3.	Teaching and mentoring of postgraduate students in Human-Animal Disease surveillance.	<ul style="list-style-type: none"> Weekly seminars presented Fieldwork conducted in Ghana, Liberia, Sierra Leone and Nigeria Distant Learning Centre established in Sierra Leone Strengthened laboratory capacity for research and development in Human-Animal Disease Surveillance Epi-Informatics Laboratory established and operational Molecular Biology and Diagnostic Laboratories established and operational Audio-visual laboratory established and operational Data sets captured, analyzed and profiled Impactful Scientific Conferences Conducted 	<ul style="list-style-type: none"> To hold weekly seminar presentation (12 seminars in a semester) engaging Postgraduate Students on CCPZ Scholarship/Fellowship To conduct two field trips per semester to West African countries on Human-Animal Disease investigation To offer data analysis support at Epi-informatics Laboratory To offer diagnostic support at Molecular biology Laboratory To develop instructional materials at the Audio-visual Laboratory To present 5 scientific papers at conferences and published in peer-reviewed journals To engage the community in public health promotion awareness programmes 	<ul style="list-style-type: none"> Twenty five (25) seminar presentations delivered to engage Postgraduate Students and the community on Human-Animal Disease Surveillance in West Africa in the approved three years Two field trips per student (21) to Liberia, Ghana or within Nigeria on hands-on mentoring in Lassa fever, rabies, brucellosis, tuberculosis and other Human-Animal Disease investigation Learning Centre coordinator took delivery of facility to enroll trainees, but truncated by Ebola Virus Disease epidemic of international concern in Sierra Leone in June 2014; Data profile and analysis in remote sensing, GIS mapping and time-trend modeling at the Epi-informatics Laboratory students and faculty beyond CCPZ Immuno-histochemistry diagnosis using Direct Rapid Immunohistochemistry Test (dRIT) kit donated by the 	<p>Scientific seminar presentations of faculty and students before and after field trips are available in the CCPZ Epi-informatics Resource Room.</p> <p>Flight tickets of each student and faculty on field trip to Liberia, Ghana and Sierra Leone are available at CCPZ secretariat. Data profile captured on field surveillance in Liberia and Ghana are available at the Epi-Informatics Resource Room at CCPZ.</p> <p>Learning Centre facility documents available at the CCPZ secretariat</p> <p>A peer-reviewed paper published on Lassa fever Surveillance available for free download at weblink http://authors.elsevier.com/a/1Q3Vy6gwSr-YL5 Power-Point presentation at GEOVET 2013 available on the weblink - www.rvc.ac.uk/News/media/GEOVET-presentations/16-Olugasa.ppt</p> <p>Project reports submitted by MVPH scholar beneficiary available at CCPZ and at Department of Veterinary Public Health and Preventive Medicine, University of Ibadan</p>

		<ul style="list-style-type: none"> High impact publications produced 		<ul style="list-style-type: none"> Model certificate programme by CDC (funded by the USAID) but hosted/facilitated by CCPZ trained One hundred and twenty (120) participants drawn from Human-Animal Disease Surveillance institutions in Nigeria, certified in the CDC Nigerian Biosecurity Engagement training programme in June-July 2014. Production of a 48-minute documentary titled "Stop Rabies" in DVD in English and French. Centre produced a jingle on how to prevent Ebola virus disease, aired daily on the University of Ibadan Diamond FM radio for 2-3 minutes. CCPZ scholars, fellows and faculty presented scientific papers at international conferences (8) and submitted ten (10) papers for publication in peer-reviewed journals 	<p>Certificate of Attendance at conferences, action photo albums, video recordings and instructional materials of certificate training programmes are available at CCPZ Epi-Informatics resource room.</p> <p>Jingles available on DVD at the CCPZ were previewed by media experts and academics adjudged as highly informative and educative documentaries for use in public health education outreach programmes - July-September 2014.</p> <p>(i) Lead poisoning in Northern Nigeria, Nanjing, China, ISAH 2013 (ii) Use of small ruminants as sentinel for Lead detection in Zamfara, Nigeria, 2nd CCPZ Conference, Ibadan, 2013; (iii) Spatio-temporal pattern of Lassa fever in Grand Bassa, Liberia, 2nd CCPZ conference, Ibadan, 2013; (iv) The rubber plantation environment and Lassa fever epidemics in Liberia: a spatial regression, GEOVET 2013, London, UK (v) The Centre for Control and Prevention of Zoonoses at the University of Ibadan: Improving postgraduate programmes for surveillance of human-animal diseases in West Africa, Chicago, IL 2013 (vi) four papers on Ebola Virus Disease (1), Rabies in Liberia (1), Brucellosis in Ghana (1), rabies in Ghana (1) were presented at the Ghana Veterinary Medical Association Conference (vii) Peer-reviewed papers in Annals of African Medicine is available at http://www.annalsafmed.org/aheadofprint.asp</p>
4.	Organization of International Conferences.	<ul style="list-style-type: none"> One-Health Issues Exposed Multidisciplinary experts attended Students participated Nigeria One-Health network established 	<ul style="list-style-type: none"> To hold annual One-Health conference with scientific presentations, expositions and roundtable for networking; To ensure that professionals from at least 6 disciplines attend and participate in CCPZ conference; 	<ul style="list-style-type: none"> Held a conference in December 2012 and one in June-July, 2013 with presentations on One-Health collaboration to improve human-animal disease surveillance in West Africa; Professionals from over nine (9) disciplines participated in each conference in 2012 and 2013; 	<p>Attendance sheet, Book of Abstracts, photographs and video documentation of conferences are available at CCPZ.</p> <p>Action photographs are attached in Appendix II</p> <ul style="list-style-type: none"> UIVC's Special Newsletter <p>A report on first annual conference of the CCPZ on human-animal disease surveillance in West Africa</p>

		<ul style="list-style-type: none"> West African network established North-South network established Sub-regional review of curriculum published Communique Issued Government-private partnership established 	<ul style="list-style-type: none"> To promote active students participation in conferences; To promote an agenda for "One-Health" network in Nigeria; To promote "One-Health" collaboration in West African; To promote paper presentations from developed and developing countries, ensuring North-South networking; To publish proceedings of conference presentations; To release a communique at the end of each conference. 	<ul style="list-style-type: none"> Active participation of postgraduate students with about 20 presentations; Rabies in West Africa (RIWA) One-Health roundtable and networking; A multidisciplinary roundtable that endorsed "One-Health-Nigeria" Memorandum; Three (3) lead scientific papers from North America or Europe were presented at each of the 2012 and 2013 conferences of the CCPZ; RIWA papers (16) were published in Epizootiology and Animal Health in West Africa volume 9 (1 & 2) Conference Communique Issued Actualized government-private partnership in West Africa. North-South networking actualized; Selected papers (20) from second CCPZ Conference accepted for publication in a supplementary volume of African Journal of Medicine, June 2014. 	<p>held at the University of Ibadan was published in Links Newsletter of the Office of International Programmes, University of Ibadan, as follows:</p> <ul style="list-style-type: none"> Volume 9, September-December, 2012 [UI hosts first international conference Rabies in West Africa, On page 7 - 8]; <p>A report on the second annual conference of CCPZ held at the University of Ibadan was published in Links Newsletter of the Office of International Programmes, University of Ibadan, as follows:</p> <ul style="list-style-type: none"> Volume 10, May-August, 2012 [UI hosts second international conference on Improving human-animal disease surveillance in West Africa: One-Health Approach. On page 7 - 8]; <p>Published in two (2) National Newspapers</p> <ul style="list-style-type: none"> Volume 9 (1 & 2) of Epizootiology and Animal Health in West Africa available at CCPZ secretariat
S/N	ACTIVITY	EXPECTED OUTCOME	OUTCOME INDICATOR / TARGET		MEANS OF VERIFICATION
			PROPOSED	ACHIEVED	
5.	Postgraduate Admission, Scholarship, Fellowship awards and collaborations.	<ul style="list-style-type: none"> Five (5) PhD candidates admitted and mentored from the target countries of Sierra Leone 1, Liberia 1, Ghana 1, Nigeria 2 over 3 academic sessions of 2011/2012, 2012/2013 and 2013/2014; A total of 30 students admitted into the revised MSc. Epizootiology programme over two academic sessions in the 2011/2012 and 2012/2013. 	<ul style="list-style-type: none"> To admit 5 PhD students from West Africa; To admit 15 students in each of the first two years of the project into the revised MSc. Epizootiology programme; To balance gender in admission with seven (7) female and 8 male candidates drawn from Sierra Leone, Liberia, Ghana and Nigeria in the 2011/2012 and 2012/2013 academic sessions respectively. 	<ul style="list-style-type: none"> Eight (8) MPhil/PhD or PhD applicants were offered admission; Only six (6) accepted and enrolled for the programme in 2012/2013; First cohort of six (6) MPhil/PhD and one (1) PhD candidates respectively were admitted and mentored from the target countries of Ghana (1), Liberia (2) Nigeria (2) and Sierra Leone (1) in the 2011/2012 academic session; Second cohort of fellows which comprised of the four (4) MPhil/PhD candidates who successfully converted were admitted and mentored from Liberia (2) and Nigeria (2) respectively in the 2012/2013 academic session; First cohort of five (5) students on 	<ul style="list-style-type: none"> Copies of admission letters are available at the Postgraduate School, University of Ibadan and at the CCPZ Secretariat; Acceptance Letter endorsed by each of the admitted students are available at the Postgraduate School, UI and at the CCPZ Secretariat; Receipts of Tuition Paid to UI Postgraduate School are available at the Postgraduate School and at CCPZ; Board of Postgraduate School approval of the MPhil/PhD conversion results of the four (4) CCPZ fellows, effective August 2014 available at CCPZ, Department of Veterinary Public Health

				<p>research phase on M.Sc. Epizootiology and related programmes from Ghana (1) and Nigeria (4) respectively were partially sponsored during the 2012/2013 academic session;</p> <ul style="list-style-type: none"> Second cohort of seven (7) candidates from Nigeria (7) were sponsored, enrolled and admitted in the M.Sc. Epizootiology programme for 2013/2014 academic session; A total of twenty three (23): female 9, Male 14 over the approved three years; PhD = 3 Nigerian, 2 Liberian MPhil/PhD = 1 Ghanaian, 2 Liberian, 2 Nigerian, 1 Sierra Leonean M.Sc. = 1 Ghanaian, 11 Nigerian 	<p>and Preventive Medicine, University of Ibadan;</p> <ul style="list-style-type: none"> Enrolment course forms for 2012/ 2013 for each student is available at CCPZ. Institutional approval, receipts of tuition paid to UI Postgraduates School are available at the Postgraduate School and CCPZ for the 2013/2014 academic session available at CCPZ, Department of Veterinary Public Health and Preventive Medicine, University of Ibadan; Admitted candidates on the M.Sc. Epizootiology programme currently on training available at CCPZ, Department of Veterinary Public Health and Preventive Medicine, University of Ibadan.
S/N	ACTIVITY	EXPECTED OUTCOME	OUTCOME INDICATOR / TARGET		MEANS OF VERIFICATION
			PROPOSED	ACHIEVED	
6.	Scientific publication	<ul style="list-style-type: none"> Papers published in International (high-impact) Peer-reviewed journals Papers published in leading sub-regional journal Papers published in leading Nigerian national Journals 	<ul style="list-style-type: none"> High-impact international journal Sub-regional journal OIP Newsletters UI Special Newsletter National Newspapers 	<ul style="list-style-type: none"> Olugasa BO, Dogba JB, Nykoi JD, Ogunro BN, Odigie EA, Ojo JF, Taiwo T, Kamara A, Mulbah CK and Fasunla AJ (2014). The rubber plantation environment and Lassa fever epidemics in Liberia, 2008-2012: A spatial regression. <i>Spatial and Spatio-temporal Epidemiology</i> 11:163-174. Olugasa BO and Dogba JB. (2015) Mapping of Lassa fever cases in post-conflict Liberia, 2008-2012: A descriptive and categorical analysis of age, gender and seasonal pattern. <i>Annals of African Medicine</i>. [Accepted 24 Jul 2014 – under issue preparation] Olugasa BO, Odigie EA, Lawani M and Ojo JF (2015) Development of a time-trend model for analyzing and predicting case pattern of Lassa fever epidemics in Liberia, 2013-2017. <i>Annals of African Medicine</i>. [Accepted 14 Jul 2014– under issue preparation] 	<p>Published paper available on ELSEVIER Spatial and Spatio-temporal Epidemiology website at http://authors.elsevier.com/a/1Q3Vy6gwSr-YL5 E-copy and hard copy of paper available at CCPZ Secretariat, University of Ibadan.</p> <p>Copies of accepted paper under issue preparation formatted proof for journal Volume 14(2) available at the CCPZ Secretariat, University of Ibadan, and listed on webpage of <i>Annals of African Medicine</i> at http://www.annalsafmed.org/aheadofprint.asp</p> <p>Copies of accepted paper under issue preparation formatted proof for journal Volume 14(2) available at the CCPZ Secretariat, University of Ibadan, and listed on webpage of <i>Annals of African Medicine</i> at http://www.annalsafmed.org/aheadofprint.asp</p>

				<ul style="list-style-type: none"> • Olugasa BO and Fasunla AJ (2013) Rabies surveillance programme and CCPZ inclusive learning model for addressing one-health educational challenge in West Africa. <i>Epizootiology and Animal Health in West Africa</i>. 9(1): 38-51 • Olugasa BO (2014). The geospatial information infrastructure at the Centre for Control and Prevention of Zoonoses, University of Ibadan, Nigeria: an emerging and sustainable one-health pavilion. <i>African Journal of Medicine and Medical Sciences</i>. [Accepted July 2014] • Adesiji, Y.O, Oloke, J.K, Emikpe, B.O, Coker, A.O (2014). <i>Aerobacter</i> as an Emerging opportunistic food borne pathogen: A review of Literature. <i>African Journal of Medicine and Medical sciences</i> • Jagun A.T., Olopade J.O. and Taiwo V.O. (2013) Evaluation of heavy metal level in sheep and goat exposed to lead toxicity in Bagega, Zamfara State, Nigeria. Proceedings of the 16th International Congress on Animal Hygiene, May 5-9, 2013 Nanjing, China. 360-361 • Jarikre TA, Emikpe BO, Folitse RD, Odoom TK, Fuseini A and Shaibu E. (2014) Prevalence of Brucellosis in small ruminants in three regions of Ghana. <i>Bulgarian Journal of Veterinary Medicine</i> • Dogba JB, Cadmus SIB and Olugasa BO (2014). Mapping of <i>Mycobacterium tuberculosis</i> cases in post-conflict Liberia, 2008-2012: A descriptive and categorical analysis of age, gender and seasonal pattern. <i>African Journal of Medicine and Medical Sciences</i>. [accepted July 2014]. 	<p>Copies of VARE Epizootiology and Animal Health Volume 9(1) that published selected papers from Epizootiology Curriculum Review and International Conference on Rabies in West Africa (RIWA) is available at CCPZ Secretariat, the Federal Ministry of Health, Abuja, Nigeria and at World Health Organization, Country Office, Abuja, Nigeria.</p> <p>Copies of accepted papers from International Conference on One-Health Approach to Zoonoses Surveillance for publication in African Journal of Medicine and Medical Sciences is available at CCPZ Secretariat.</p> <p>Copy of publication and CD of conference proceedings available at CCPZ Secretariat. Paper available online at www.isah-soc.org/documents/2013/Proceeding_2013.pdf</p> <p>Copy of paper available at CCPZ Secretariat and online at http://tru.uni-sz.bg/bjvm/bjvm.htm</p> <p>Reviewers report and Acceptance for publication available online on journal of Veterinary Medicine at the weblink http://dx.doi.org/10.1155/2014/923561</p> <p>Copies of accepted papers from International Conference on One-Health Approach to Zoonoses Surveillance for publication in African Journal of Medicine and Medical Sciences is available at CCPZ Secretariat.</p>
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| <ul style="list-style-type: none"> • Olugasa BO, Okeke OS and Ishola OO (2014). Geographic access to street food sources for dogs and its association with spatial pattern of animal bite injuries in Enugu, Nigeria, 2005-2011. African Journal of Medicine and Medical Sciences. [accepted 30 Jul 2014] | <p>Copies of accepted papers from International Conference on One-Health Approach to Zoonoses Surveillance for publication in African Journal of Medicine and Medical Sciences is available at CCPZ Secretariat.</p> |
| <ul style="list-style-type: none"> • Jomah ND, Ojo JF Odigie AE and Olugasa BO (2014) Development of a time-trend model for analyzing and predicting case pattern of rabies-like illness in Liberia, 2013-2017. African Journal of Medicine and Medical Sciences. [accepted July 2014] | <p>Copies of accepted papers from International Conference on One-Health Approach to Zoonoses Surveillance for publication in African Journal of Medicine and Medical Sciences is available at CCPZ Secretariat.</p> |
| <ul style="list-style-type: none"> • Folitse RD, Onoku-Agyemang T, Emikpe BO, Efarefe OD, Atawalna J. (2014). One-health delivery of veterinary education: the case of Kwame Nkrumah University of Science and Technology, School of Veterinary Medicine. African Journal of Medicine and Medical sciences Special Edition | <p>Copies of VAREP Epizootiology and Animal Health in West Africa Volume 9(1) that published 8 selected papers from CCPZ Epizootiology Curriculum Review and 1st International Conference on Rabies in West Africa (RIWA) is available at CCPZ Secretariat, the Federal Ministry of Health, Abuja, Nigeria and at World Health Organization, Country Office, Abuja, Nigeria.</p> |
| <ul style="list-style-type: none"> • Aledipe OD, Uwalaka EC, Akinseye VO and Cadmus SIB (2014): Gastrointestinal helminthes in slaughter cattle in Ibadan, south-western Nigeria. Journal of Veterinary Medicine. ID 923561 | <p>Same as above</p> |
| <ul style="list-style-type: none"> • Esuruoso GO (2013) Systematic epizootiology: foretaste of a legacy to preventive veterinary medicine in Ibadan, Nigeria. Epizootiology and Animal Health in West Africa. 9: 15-21 | <p>Same as above</p> |
| <ul style="list-style-type: none"> • Russell H (2013) Emergence of Rabies in West Africa strategic partnership to improve the surveillance and control of a neglected zoonosis. Epizootiology and Animal Health in West Africa. 9(1): 5-7 | <p>Same as above</p> |
| <ul style="list-style-type: none"> • Tekki IS, Okewole PA, Ekong SP, Kumbish P, Shamaki D and Ahmed MS (2013) Control of rabies and rabies related viruses in Nigeria: perspectives from the National Veterinary Research Institute, Vom, Nigeria. Epizootiology and Animal Health in West Africa. 9(1): | <p>Same as above</p> |

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				<ul style="list-style-type: none"> • Wahab B (2013) Indigenous knowledge and practices associated with rabies in Oyo state, Nigeria: imperative for global health training at the University of Ibadan. <i>Epizootiology and Animal Health in West Africa</i>. 9(1): 59-69 • Beran G (2013) Rabies elimination as a one-health model for the tropics. <i>Epizootiology and Animal Health in West Africa</i>. 9(1): 8-10 • Meslin X-F (2013) Human and dog rabies control: regional and global perspectives. <i>Epizootiology and Animal Health in West Africa</i>. 9(1): 2-4 • Olugasa BO, Emikpe BO, Oluwayelu DO, Cadmus SIB, Ayinmode AB and Oluwale OE (2012). Field evaluation of immunogenicity of five commercial vaccines against Newcastle disease in poultry in Ibadan, Nigeria. <i>Nigerian Veterinary Journal</i>. 33 (2) 475-482 • Olugasa BO, Ijagbone IF and Esuruoso GO (2012) It is over three decades of graduate education in Epizootiology at the University of Ibadan, Nigeria (1975-2011): is there a need to revise the curriculum? <i>Pan African Medical Journal</i>. 12.70: 1-8 • Olugasa BO, Oluwayelu DO, Ayinmode AB, Emikpe BO, Ijagbone IF and Cadmus SIB (2011). Epizootiology in contemporary global health: making a difference in the health of people in West Africa. <i>Nigerian Journal of Epidemiology</i> 1(1): 35-42. 	<p>Same as above</p> <p>Same as above</p> <p>Same as above</p> <p>Hard copy of paper and the journal volume available at CCPZ Secretariat and online at the weblink - http://www.ajol.info/index.php/nv/article/view/85744</p> <p>Paper and e-copy of article available at CCPZ Secretariat and online at journal weblink http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3450932/</p> <p>Hard copy of article and entire volume of journal where it was published is available at CCPZ Secretariat.</p>

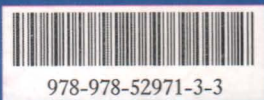
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