Higher Education for Development (HED)
and
U.S. Agency for International Development (USAID)

"Center for Excellence in Health and Life Sciences in Liberia (CEHLS)"

September 27, 2011 – September 27, 2015

FINAL ASSOCIATE AWARD REPORT
September 2015

USAID/Liberia Associate Award
Cooperative Agreement No. AEG-A-00-05-00007-00
Associate Cooperative Agreement No. AID-669-LA-11-00001

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American Council on Education (ACE) | American Association of Community Colleges (AACC) | American Association of State Colleges and Universities (AASCU) | Association of American Universities (AAU) | National Association of Independent Colleges and Universities (NAICU) | Association of Public and Land-Grant Universities (APLU)

PARTNERSHIP INFORMATION

Lead Partner Institutions: Indiana University
Secondary Partner Institutions: University of Liberia
Region, Country: Sub-Saharan Africa, Liberia
Performance Period: *September 27, 2011 – September 27, 2015*
Funding Level: Associate Award: $3,088,251.00 and Subaward: $2,703,260.00
Proposed Cost Share: $1,675,468.00

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List of Acronyms

ACE	American Council on Education
AMD	A.M. Dogliotti School of Medicine
CEHLS	Center for Excellence in Health and Life Sciences
COST	Thomas J.R. Faulkner College of Science and Technology
CPH	Certificate of Public Health
HED	Higher Education for Development
HICD	USAID's Human and Institutional Capacity Development
IU	Indiana University
IU-SON	Indiana University School of Nursing
KNUST	Kwame Nkrumah University of Science & Technology
LSSE	Liberian Survey for Student Engagement
LBCSSE	Liberian Beginning College Survey of Student Engagement
M&E	Monitoring and Evaluation
MOH	Ministry of Health
MOU	Memorandum of Understanding
MPH	Masters in Public Health
NGO	Non-Governmental Organization
NRP	Neonatal Resuscitation Program
PhD	Doctorate Degree
RN-BSc	Bachelor of Science degree in Registered Nursing
SON	School of Nursing
TNIMA	Tubman National Institute of Medical Arts in Liberia
UL	University of Liberia
UMass	University of Massachusetts
UMMS	University of Massachusetts Medical School
USAID	United States Agency for International Development
USAID/Liberia	United States Agency for International Development/Liberia Mission
USG	United States Government

1. Executive Summary

USAID/Liberia generously provided support to The American Council on Education, Office of Higher Education for Development (ACE/HED) through a four-year, $3,088,251 Associate Award to fund a partnership between Indiana University (IU), the University of Massachusetts Medical School (UMMS) and the University of Liberia (UL) for a partnership titled: "Centre for Excellence in Health and Life Sciences in Liberia." The total award was reduced to $3,088,251 from the original negotiated ceiling level of $8,019,957 through a modification to the signed agreement between ACE and USAID/Liberia. This has resulted in reducing the sub-award amount for the partnership from $7,185,199 to $2,608,260.

2. Partnership Overview

Background
This report is for the Associate Award Agreement No. AID-669-LA-11-00001 between USAID/Liberia and the American Council on Education, Office of Higher Education for Development (ACE/HED), effective September 27, 2011 and a sub-cooperative agreement between Indiana University (IU) and ACE/HED, effective October 1, 2011.

Cognizant of the dire healthcare situation in Liberia and of higher education's unique position to make a powerful and long-lasting contribution to international development, USAID/Liberia generously provided support to ACE/HED through a four-year, $3,088,251 Associate Award for a partnership between IU, UMMS and UL titled: "Center for Excellence in Health and Life Sciences in Liberia." The U.S. university partners in this initiative include IU as lead institution (for the basic and advanced life sciences, nursing and public health), and UMMS as the secondary institution (for medical sciences education and nursing).

Goals and Vision
This collaboration represented UL's vision of rebuilding the country's diminished capacity for education in the health and life sciences. The University of Liberia's top priorities were building human capacity through faculty development programs in the health and life sciences, improving educational infrastructure, and developing articulation arrangements with other health education programs in the country. Moreover, they directly addressed the health workforce development goals of Liberia's Poverty Reduction Strategy.

The partnership was designed to lend expertise in a variety of ways from collecting and sending current textbooks in biology, chemistry, mathematics, nursing and other courses to providing six-week summer study tours for Liberian faculty in the United States. In addition, the partnership created a new, two-year Core Health and Life Science Undergraduate Program and originally planned for a joint four-year Bachelor's program in Nursing Science (BSN). Partners also worked together to improve instructional quality in introductory science courses, develop upgrades to the preclinical science curriculum at UL's Medical and Pharmacy Colleges, and modernize UL's teaching and learning resources.

Partnership Objectives
1) To improved delivery of health and life science programs at UL
2) To improved student access to education in and preparation for health and life science careers
3) To increase the status and permanence of UL as a leader in the areas of health and life science education

Collaborating Stakeholders

The CEHLS partnership worked with 19 stakeholders to further their partnership objectives including signing MOUs, collaborating on activities, donating equipment, and giving guest lectures to students and staff. The Liberian Ministry of Health and Social Welfare (MOHSW) was one of the most notable and participatory stakeholders in the CEHLS project. The MOHSW participated in multiple meetings, including strategic planning meetings and partnered with the CEHLS team on the planning and implementation of the Certificate of Public Health (CPH) program by providing employees as candidates for the initial cohort, identifying practicum sites, providing guest lectures, and actively supporting training programs, like Helping Babies Breath. The Todee Community Association, St. Paul Community Association and Careysburg Community Association all served as practicum sites for the Certificate in Public Health and its leaders worked with the CEHLS project to develop practicum outcomes.

The CEHLS stakeholders played an especially important role in FY14 and FY15 during the Ebola crisis, when the partners were forced to suspend the majority of project implementation activities and focus on strategic planning. Collaborations with the Clinton Health Access Initiative (CHAI) and MOHSW have helped strengthen academic programs for undergraduate students and determine Liberia's institutional capacity to offer adequate training in health services. CHAI has been incredibly generous with both their time and resources by actively participating in sustainability talks, sharing the findings of their Liberian healthcare gap analysis report and offering important insight into the priorities of the MOHSW.

Community Organizations:

- Careysburg Community Association
- St. Paul Community Association
- Todee Community Association

Educational Institutions:

- JFK Medical Center
- Kwame Nkrumah University of Science & Technology (KNUST)
- University of Cape Coast/Cocoa Research Institute of Ghana
- West African College of Physicians

Government:

- City of Monrovia, Department of Sanitation and Waste Management
- Liberia Institute for Biomedical Research & National Public Health
- Ministry of Health and Social Welfare (MOHSW)
- The Excellence in Higher Education for Liberian Development (EHELD)

NGOs/International Organizations:

- Clinton Health Access Initiative (CHAI)
- Community Housing Foundation
- Global Fund for AIDS, TB and Malaria
- JHpiego (previously Johns Hopkins Program for International Education in Gynecology and Obstetrics)
- Liberian Board of Nursing
- Sabre Foundation/Mission to Liberia

- Toledo Hospital
- UNICEF
- Water Quality Control Laboratory
- World Health Organization

3. Partnership Results and Performance

This section presents results and performance against the end of partnership targets. Structured around the partnership's Monitoring and Evaluation (M&E) plan, the following sub section examines the partnerships' achievements and progress in relation to the objectives, outcomes and outputs as envisioned and designed by the partners.

Achievements and Implementation Progress

Objective 1: To improved delivery of health and life science programs at UL.

Outcome 1.1: Health and life science faculty, staff and lab instructors are better qualified to prepare students in meeting workforce needs

Short-term Training

The CEHLS partnership held 40 short-term trainings between FY 2012 and FY 2015 benefiting a total of 1,135 individuals (Table 1). Activities consisted of courses, workshops, and professional trainings, all designed to strengthen the medical infrastructure of Liberia. Joint collegiate efforts among the U.S. and Liberian institutions have been paramount in establishing a foundational framework that addresses the country's growing medical institutions. Trainings have also been essential in consolidating various fields, skills, and professions to improve the delivery of health and life science programs at UL.

Among the most notable activities is the Helping Babies Breathe course, a 4-day training designed to preempt child mortality. Participating students, 50 in FY13 (25 female and 25 male) and 154 in FY14 (24 female and 130 male), were provided with information on neonatal resuscitation techniques and methods of supervising practical experiences, which all enhanced their competency in the field.

In FY15, a laboratory training of DNA separation was conducted on the Fendall campus's newly updated CEHLS laboratory space. Dr. John Berestecky and Dr. Peter Humphrey trained the 24 participants (8 female and 16 male) to use the new molecular biology laboratory equipment to analyze DNA.

UL students, faculty members and staff have also engaged in a number of professional workshops designed to improve their computer and administrative skills. Workshops included Introduction to Excel, Introduction to Data Type, Techniques for Power Point for Presentations in the Biological Sciences and the Security and Anti-virus for Life Science Faculty. In addition, female nursing students participated in leadership workshops that equipped them with the skills and knowledge to be competent practitioners.

Table 1
Short-Term Training Totals (FY12 to FY15)

FY	No.	Training Title/Description	Number of People		
			Female	Male	Total
FY 2012	1	American Academy of Pediatric Neonatal Resuscitation Program (NRP); training in material processing and cataloguing using SHELVIT; nurse leadership programs and received certificates to serve as preceptors.	17	5	22
	2	Cadaver Dissection Laboratory and Nurse Leadership and Preceptorship Training	3	10	13
FY 2013	3	LibSoft and Library Skills Training	2	7	9
	4	Physiology and Neuroscience Module	5	24	29
	5	Nurse Leadership Training	28	0	28
	6	Workshop on Policies in Nursing	28	0	28
	7	Curriculum Development I: Undergraduate Life Sciences	3	14	17
	8	Curriculum Development & Syllabi Revision II: Undergraduate Life	0	17	17
	9	Developing a Framework for Public Health Certificate	3	2	5
	10	Creating a Framework for Public Health Certificate II	3	2	5
	11	Clinical & Didactic Teaching	6	71	77
	12	UL AMD Anatomy: Cadaver Dissection Lab	33	7	40
	13	JFK/UL AMD: Radiology Overview 1st and 2nd year Med Students	59	12	71
	14	JFK/UL AMD: Radiology Overview JFK Faculty and Residents	3	5	8
	15	Helping Babies Breathe Training	25	25	50
	16	Orientation to Public Health Certificate Program & Effective Preparation of Public Health Lectures	8	10	18
	17	Microscope Techniques for the Classroom	18	2	20
	18	Anatomy: lecture to 1st year medical students	52	15	67
	19	Anatomy: Cadaver Dissection Lab for 1st year medical students	44	15	59
	20	Teaching Techniques and Resources: BIOL105	13	1	14
FY 2014	21	Test Construction and Active Learning Workshop	0	10	10
	22	Scantron Training: Using Data for Test Construction	0	10	10
	23	Nurse Leadership Training	0	20	20

	24	Helping Babies Breathe (Section I-XVII)	24	130	154
	25	Basic Computer Skills, Security and Anti-virus for Life Science Faculty	20	5	26
	26	Introduction to Microsoft Word: Features for Classroom Instruction	5	1	6
	27	Microsoft Word Templates and File Management	2	0	2
	28	Introduction to Excel	3	1	4
	29	Introduction to Data Types: Excel	2	0	2
	30	Using HINARI for research	19	11	30
	31	Techniques for Power Point for Presentations in the Biological Sciences	30	16	46
	32	Computing Basics for students in the Biological Sciences	86	31	117
FY 2015	33	Intro to Microbiology lab - Part I	1	4	5
	34	Intro to Microbiology lab - Part II	1	7	8
	35	Public Health Focus Group - Digitizing Curriculum Training 1	4	3	7
	36	Public Health Focus Group - Digitizing Curriculum Training 2	5	4	9
	37	Public Health Focus Group - Digitizing Curriculum Training 3	5	4	9
	38	Nurse New-Hire Orientation	27	0	27
	39	Instructor Training - Molecular Biology Equipment	7	15	22
	40	Lab Demonstration - DNA Separation	8	16	24
TOTAL Individuals			**602**	**532**	**1135**
TOTAL Trainings			**40**		

Long-term Training

The CEHLS project's long-term training target was to award fellowships and train eight host-country individuals (faculty and/or teaching staff, students and administrative staff) in programs for qualifications strengthening (Table 2).

Table 2
Number of Long-Term Trainings Completed (FY12 to FY15)

FY	Target	Actual
FY2012	0	0
FY2013	0	0
FY2014	8	5
FY2015	3	3
LOP Total	8	8

The fellows were selected by the UL administration from the existing College of Science and Technology and each fellow signed an agreement to return to UL to teach upon graduation. Although the project's funding was reduced in FY 2013, the partners were able to support all eight fellows and successfully achieved their overall target. Six of the CEHLS fellowship awardees completed their degrees in FY13 from Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana and the two nursing fellows completed their degrees at IU's School of Nursing (IU-SON) in FY2014 (Table 3).

Table 3
Long-term Trainings Completed (FY12 to FY15)

No.	Name	Degree	Institution	Degree Institution
1	Josephine D. Sawo	MPH Public Health	Biology Instructor (College of Science and Technology, UL)	KNUST
2	Rafael S. Ngumbu	MSC Analytical Chemistry	Chemistry Instructor (College of Science and Technology, UL)	KNUST
3	James A. S. Momoh	MSC Health Services Planning & MGT	Biology Instructor (College of Science and Technology, UL)	KNUST
4	Harris K. Momo	MSC Entomology	Entomology Instructor (College of Science and Technology, UL)	KNUST
5	Herbert K. Keih	MSC Crop Protection, Plant Pathology	Biology Instructor (College of Science and Technology, UL)	KNUST
6	G. Alpha K. Gongolee	MSC Genetics	Genetics Instructor (College of Science and Technology, UL)	KNUST
7	Ada Brown-Wraynee	Master's in Nursing Education	RN Program Director and Instructor from Tubman National Institute of Medical Arts	IU-SON
8	Cynthia Bondoe	Master's in Nursing Education	Midwifery Instructor from Tubman National Institute of Medical Arts/Newly Appointed Head of Maternity Hospital	IU-SON

Mentorship

The partnership placed an emphasis on mentoring as a practice to develop skills through two types of mentorships: short-term mentorship which lasts at least one week and less than one semester, and long-term mentorship which lasts one semester or more. The mentorship activities conducted through this partnership included co-development of lesson plans and on-going professional exchange of ideas, information, skills, and methodology. Overall the CEHLS project mentored 134 individuals and exceeded their LOP target of 36.

In FY13, mentorship opportunities were provided to 33 UL health and life sciences faculty. The mentorship programs were in high demand, and consequently the partners made arrangements to allow more faculty and staff to receive mentorship than originally planned. Mentors were able not only to accommodate more faculty member, but also to extend their stay and be available for a longer time period than anticipated.

The mentorship activities in FY14 provided trainings and support to AMD's cadaver program in an effort to build the capacity of the faculty to teach the anatomy courses without the assistance of visiting and adjunct faculty. These mentorship activities resulted in better organized lectures with more complete coverage, and delivered with greater confidence. The mentors also worked with the UL faculty to help develop exams that accurately and fairly represented course content.

Due to the national school closures during the Ebola outbreak in FY15, the CEHLS team was forced to change their approach to mentoring and utilized both online resources and limited in-person meetings to work on course development, including course content, classroom lectures, and lab demonstrations. Dr. Humphrey worked with six lab demonstrators during the UL closure and helped to finalize the Molecular Biology curriculum, which will be taken by 160 students in the upcoming school year. When UL reopens, this will be the first time Molecular Biology is taught and represents a significant update in their STEM curriculum. Dr. Humphrey was instrumental in setting up the new Microbiology laboratory equipment, which includes the UV-transilliuminator and microwave. Under the instruction of the mentored and trained lab demonstrators, the students will now be able to utilize this equipment to better analyze DNA.

To prepare for the sustainability of CEHLS activity in the health and life sciences at UL, IU's School of Public Health invested in advanced training for Mr. James McClain, Chair of UL's Department of Chemistry. Mr. McClain received a PhD fellowship with IU's School of Public Health in Environmental Health through funding outside of this award. Through this award, IU faculty work closely with Mr. McClain to help him prepare for independent research, laboratory management, and development of an Environmental Health program at UL upon his return.

In FY15, visiting consultants, Lovo Koliego and Moses Makor, also mentored a group of nurses at JFK during their month-long visit to Liberia. Mentoring activities included co-teaching, collaboration, co-creation of lesson plans and goals, exchange of professional information, and training recommendations/resources.

Table 4
Number of UL Health and Life Science Faculty Receiving Mentorship (FY12 to FY15)

FY	Target	Actual
FY2012	3	21
FY2013	5	33
FY2014	23	48
FY2015	5	32
LOP Total	36	134

Outcome 1.2: Health and life science students, faculty and staff have increased access to instructional resources at UL

Faculty teaching hours using new laboratory and instructional equipment

The partnership exceeded its overall target of 60 and logged 72 faculty teaching hours using new laboratory and instructional equipment (Table 5). All 72 hours were logged in FY14 through instructional trainings held within the department of Biology Laboratory and the Life Science Faculty Resource Center. Instructors were trained on use of demonstration laboratory equipment including Audio Visual equipment and microscopes necessary for BIOL 105, 106 and 111 courses. The partners originally intended to hold additional trainings in FY15 but the national school closures due to the Ebola outbreak made these planned trainings impossible.

Table 5 Number of Faculty teaching hours using new laboratory and instructional equipment (FY12 to FY15)		
FY	Target	Actual
FY2012	0	0
FY2013	20	0
FY2014	20	72
FY2015	20	0
LOP Total	60	72

Access to Health and Life Science Digital Resources

The CEHLS project purchased and installed 61 computer workstations at UL through this award (Table 6). There were a total of three desktop stations at JFK, 25 desktop stations at AMD College of Medicine Library, 15 Thin Clients stations at Fendall, and five desktop stations at Fendall. Routers and Wi-Fi have also been installed at AMD College of Medicine and Fendall's computer resource rooms. This updated equipment and technology at the computer lab and learning management system will provide improved access to books, journals and online resources through the two scholarly databases (eGranary and HINARI), when the university reopens with the necessary electrical capabilities. The computers have eGranary and Health Inter-Network Access to Research Initiative (HINARI) installed, which will provide a vital resource to UL faculty and students. In addition to the written materials and online resources, it will be possible through the use of learning management systems (LMS), an e-learning platform, for students and faculty to access video recordings of medical lectures for future classes.

The eGranary system, a digital library that stores educational resources through a local area network, is networked at both Fendall and AMD. The eGranary digital library is the most effective and lowest cost way to access over 30 million educational resources from approved websites without an internet connection. In addition to items purchased through CEHLS grant funding, UMMS has donated 45 Nikon microscopes, 62 Dell laptops, 70 boxes of medical textbooks, incubator and centrifuge for use by AMD.

Table 6 Number of Computer Terminals with Access to Digital Resource Databases (FY12 to FY15)		
FY	Target	Actual
FY2012	0	0
FY2013	25	15
FY2014	30	43
FY2015	0	3
LOP Total	43	61

New Health and Life Science Textbooks

The length of partnership target for new health and life science textbooks catalogued and shelved at UL, AMD and TNIMA was set at 25,693. The partners catalogued and shelved 18,568 textbooks purchased through the award and 7,125 textbooks donated by UMMS. All books were shipped to Liberia either through the Sabre Foundation or with a shipment from IU in the Spring of 2013.

Faculty/staff/students trained on the use of digital formats

The partnership trained 308 individuals on the use of digital formats including, Microsoft Excel, Power Point, and HINARI (Table 7). The CEHLS project greatly exceeded its length of partnership target of 70 because of an unexpectedly high demand for digital format training at UL and JFK Memorial Medical Center. UMMS presented several training sessions to medical staff, medial students and pharmacy staff on HINARI and other digital teaching and research resources to enhance teaching, clinical investigation, research and medical education.

Before the Ebola outbreak, a UL student leader, Johnny Montgomery, used the CEHLS resource room on the Fendall campus in FY14 to conduct a number of very well attended and successful trainings with his fellow students. Mr. Montgomery held trainings on the introduction to Excel & creating spreadsheets, accessing & searching HINARI, accessing HINARI & chemistry resources on the internet, access & search strategies for HINARI, and research methods, reading a paper & searching HINARI.

Table 7
Number of Faculty/ Staff/ Students Trained on the Use of Digital Formats (FY12 to FY15)

FY	Target	Actual
FY2012	0	0
FY2013	40	115
FY2014	30	193
FY2015	0	0
LOP Total	70	308

Objective 2: To improved student access to education in and preparation for health and life science careers.

Outcome 2.1: New or updated educational offerings enable students to gain skills and knowledge in health and life science programs at UL

Access to Health and Life Science Programs

The partnership only reported access students in FY 2014 due to admissions regulations in FY2012-2013 and the Ebola outbreak in FY 2015. In FY14, 159 students from underserved and/or disadvantaged groups in its health and life sciences programs accessed tertiary education programs through the CEHLS project. This figure included all new admissions to the Biological Sciences, Chemistry and Medical School. The major reason for the shortfall is the fact that a large number of students failed the test for admission to UL. Over the past few years, UL had lowered the approved admissions standards in order to accept a larger number of students. During the 2013-2014 academic year, UL did not accept any students unless they passed the admissions exams to prevent excessively large class size, high attrition rates, and low academic ability. This requirement resulted in zero admission for the 2013-14 academic year. After student protests, a compromise was arranged for the 1,400 of the students to be admitted to UL on a probationary agreement. The results of this change in policy had an especially positive influence on the Biology and Chemistry department and UL as an institution. The class sizes have gone down and new students are required to take and pass remedial Math and English courses before beginning their programs.

Experiential/Applied Learning

CEHLS supported the development of five out of six new tertiary programs that included experiential and/or applied learning for the first time, supplementing the classroom setting with real world work experience or opportunities to apply classroom knowledge to the real world (Table 8). The denominator in this indicator includes (1) Biology, (2) Chemistry, (3) Midwifery/Nursing, (4) Public Health, (5) Medicine, and (6) Pharmacy. Of those six programs, the partnership developed new applied learning opportunities for the following five courses; Biology, Chemistry, Medicine, Midwifery/Nursing and the Public Health courses. These opportunities will contribute to increasing the College of Life Science trainees' skills with practical laboratory demonstration in the classroom. New Biology and Chemistry lab courses integrated enhanced lab demonstration techniques to the updated curriculum.

The partnership developed and introduced the Certificate in Public Health practicum, which included two months of field-based practice in communities selected by the Ministry of Health. Included in the certificate of public health practicum, is the popular and very successful Helping Babies Breath training. This course requirement provides information on neonatal resuscitation and supervises practical experience that allows participants to demonstrate competency. Finally, AMD introduced its first cadaver dissection program in FY14. The cadaver dissection program was supported by the invaluable mentorship of UMMS' Drs. Gilroy and Harmon-Hines, who worked with the anatomy instructor. All five of these experiential/applied learning opportunities will significantly contribute to increasing the College of Life Science trainees' skills with practical laboratory demonstration in the classroom.

Table 8
Number of Experiential/Applied Learning (FY12 to FY15)

FY	Target	Actual
FY 2012	6/6 (100%)	0/6
FY 2013	6/6 (100%)	1/6
FY 2014	5/6 (83.3%)	3/6
FY 2015	1/6 (16.6%)	1/6
LOP Total	6/6 (100%)	5/6

Revised Curricula

The partnership developed new course content for a BSc in Midwifery and for Certificates in Public Health. Due to the need for faculty senate and board of trustee approval, there is a lag between the development and implementation of the new and revised course. The national school closures prevented the new curricula from being introduced in FY14 as planned but UL plans to implement both the Midwifery and CPH programs in the fall of 2015.

The Biology and Chemistry curricula passed the Academic Coordinating Committee on August 8, 2013. Both Biology and Chemistry were approved by the Faculty Senate in October 2013 and were implemented in the fall semester of 2013-14.

The Certificate in Public Health program (CPH) will enable mid-level health workers, i.e. nurses, mid-wives, and physician assistants to become agents of public health practices in their work communities. Upon the successful completion of the program, the graduates will be certified public health workers with specialized knowledge and skills to bridge preventive and curative health services between the health care facilities and the community. The targeted candidates are currently employees of the Ministry of Health and Social Welfare, providing health care delivery services at health facilities.

The Midwifery program will provide students an opportunity to develop skills and knowledge for improving practice based on current evidence in midwifery practices. Students will use computers to access and evaluate evidence, compare models of evidence-based practices, and develop a searchable question. The program will also advance the leadership necessary to manage groups of pregnant women and advocate for policy change to promote the health and well-being of the child-bearing women. The program will focus on important functions including communication, recognition, team building, delegation, decision-making, reporting, budgeting, problem solving, and critical thinking. There will be a discussion to change theory and methods to better implement the desired outcome and change.

Travel restrictions and the university's closure during the Ebola crisis forced the partners to redirect efforts towards activities like curricula revision. Consequently, the partners revised the following six curriculum in FY15: (1) BSc Midwifery curriculum developed with Liberian Board of Nursing and Midwifery, TNIMA, and JFK, (2) Public Health Certificate developed with Ministry of Health and TNIMA, (3) Digitized Public Health & You in Liberia training modules developed with Ministry of Health and TNIMA, (4) Biology curriculum developed with input from MOH, (5) Chemistry curriculum developed with input from MOH, and (6) Anatomy curriculum revised with input from JFK.

Table 9
Number of Curricula Revised (FY12 to FY15)

FY	Target	Actual
FY2012	3/3	0
FY2013	4/4	0
FY2014	4/4	3/4
FY2015	1/1	6/6
LOP Total	100%	9/10

Updated Syllabi

The partners invested considerable effort and resources in updating and/or revising 28 syllabi and courses with professional collaboration or based on industry practice (Table 10). Syllabi for the CPH, the Public Health & You in Liberia, the Midwifery program, the Thomas J.R. Faulkner College of Science and Technology (COST), and the A.M. Dogliotti School of Medicine (AMD) were updated. The U.S. partner institutions guided the syllabi revisions in collaboration with UL faculty partners during face-to-face visits. Faculty teams developed new learning outcomes based on best-practices and current research in the relevant fields. New instructor handbooks for the revised Biology courses were also compiled to compliment new material introduced in the revised syllabi.

Table 10
Number of Syllabi Updated (FY12 to FY15)

FY	No.	Syllabi	Curricula
FY2012 (Target = 0; Actual = 0)			
FY 2013 (Target = 10; Actual = 4)	1	Introduction to Community Health	CPH
	2	Introduction to Maternal and Child Health	CPH
	3	Disease Surveillance	CPH
	4	Introduction to Environmental Health	CPH
	5	Social and Behavioral Determinants of Health	CPH

FY 2014 (Target = 11; Actual = 12)	6	Introduction to Health Service Administration	CPH
	7	Introduction to Computer Applications	CPH
	8	Introduction to Public Health	Public Health & You in Liberia
	9	Environmental Health	Public Health & You in Liberia
	10	Epidemiology and Biostatistics	Public Health & You in Liberia
	11	Public Health Administration	Public Health & You in Liberia
	12	Behavioral, Social and Community Health	Public Health & You in Liberia
	13	Transitions Course	Midwifery
	14	Midwifery 5	Midwifery
	15	Evidence-Based Practice in Midwifery	Midwifery
	16	Capstone in Midwifery	Midwifery
FY 2015 (Target = 5; Actual = 12)	17	Administration II (Leadership and Management)	Midwifery
	18	BIOL 105	COST
	19	BIOL 106	COST
	20	BIOL 111	COST
	21	BIOL 204	COST
	22	BIOL 205	COST
	23	CHEM 100	COST
	24	CHEM 101	COST
	25	CHEM 102	COST
	26	CHEM 207	COST
	27	CHEM 208	COST
	28	Physiology	AMD
LOP Target = 27		LOP Actual = 28	

Access Policies

The partners developed two new or revised access policies related to the Remedial Biology Course for students at TNIMA and College of Science and Technology book lending policy (Table 11) over the course of this award. TNIMA revised their admission policy to increase access to their programs for students who previously would not have been accepted, by allowing these candidates to qualify for conditional acceptance. In order for these students to be fully admitted to TNIMA, they need to pass a remedial biology course of study. The CEHLS Country Director designed and taught two semesters of this remedial biology course to over 120 conditional TNIMA students.

The new College of Science and Technology book lending policy was enacted in November 2013 as a result of a meeting between the Biology Students Association, the Department of Biology and the University of Hawaii. This new policy allows students enrolled in the New Biological Sciences program to borrow textbooks and take them home. This book lending policy makes it easier for students who can't afford personal textbooks to study and consequently increase their access to the Biology program.

Table 11 Number of Access Policies (FY12 to FY15)		
FY	Target	Actual
FY2012	0	0
FY2013	4	0
FY2014	2	2
FY2015	0	0
LOP Total	6	2

Objective 3: To increase the status and permanence of UL as a leader in the areas of health and life science education.

Outcome 3.1: New linkages are established between UL's health and life science programs and other UL programs and external entities to help promote current and future collaborations

Advisory board meetings

The partners held four advisory board meetings between FY12 and FY15 and did not meet their overall target of holding eight advisory board meetings due to budget constraints and travel restrictions (Table 12). The CEHLS program team met twice in FY13, once in FY14 and once in FY15 for strategic planning. At the two meetings in FY13, the partners presented and discussed the Midwifery Degree Program, the Nurse Leadership Program, the Public Health Certificate Program, and the undergraduate core curriculum. UL experienced many disruptions during FY14 and the Ebola outbreak made it impossible to conduct the second advisory board meeting in Liberia that was planned in the second half of FY14. Travel restrictions continued to impact implementation in FY15 and in lieu of an in-person meeting, the partners held a very productive two-day video conference advisory board and strategic planning meeting on October 21-22, 2014.

Table 12 Number of Advisory Board Meetings (FY12 to FY15)		
FY	Target	Actual
FY2012	1	0
FY2013	3	2
FY2014	2	1
FY2015	2	1
LOP Total	8	4

Memorandum of Understanding (MOU) Signed

The partnership met its overall target of signing three memoranda of understanding (MOU) (Table 13). In FY12, a MOU between KNUST and UL was signed with the visit by the Chancellor of KNUST to the UL campus in August. This MOU made possible the admission of six UL fellows to KNUST. Following this MOU, the Assistant Dean of Public Health at IU visited UL in August 2012 to assess the sustainability for a bachelor's program in public health and discuss further collaborations.

During FY13, Florida International University (FLU) signed an MOU with UL regarding the appointment of the new Dean of the College of Science and Technology, Dr. Ophelia Weeks. The third MOU was signed in FY14 between IU's School of Public Health-Bloomington and UL. IU's Dean

Torabi traveled to Liberia in January 2014 and offered two fully-funded PhD fellowships to UL faculty, one in Epidemiology and one in Environmental Health. This MOU represented a contribution from IU to UL of $294,071, including out-of state tuition, stipend, and health insurance for three years per fellowship.

Table 13
Number of MOUs Signed (FY12 to FY15)

FY	Target	Actual
FY2012	0	1
FY2013	2	1
FY2014	1	1
FY2015	0	0
LOP Total	3	3

Outcome 3.2: The sustainability of UL's health and life science programs is promoted

Strategic plans developed

The CEHLS partners spent a significant amount of time considering and preparing their strategic plan. The partners first worked together to develop a concept note toward developing a strategic plan for UL's College of Health Sciences. The concept paper provided an outline for the consolidation, streamlining, and improvement of the health and life sciences at UL. The paper was then compared and contrasted to other regional documents and health programs as well as regional and international accreditation standards as it was crafted into a final plan. A two-day strategic planning discussion via video conference with CEHLS stakeholders, including IU, UL, UMMS, USAID/Liberia, CHAI consultants, and a representative from Liberia's Ministry of Education was held in October 2014. The strategic planning participants discussed a SWOT analysis (strengths, weaknesses, opportunities and threats) and revised their draft strategic plan. The final CEHLS strategic plan is attached to this report as Appendix D.

Proposal for Funding

The partnership exceeded their overall target of 6 by submitting 11 proposals between FY13 and FY15 (Table 14).

Table 14
Number of Proposals Submitted for Funding (FY12 to FY15)

FY	No.	Title
FY2013 (Target = 3; Actual = 6)	1	NIH Partnerships for Enhanced Engagement in Research (PEER) Health grant
	2	Center of Excellence for Training and Research in Water, Energy and Environmental Sciences in West and Central Africa
	3	Center for Research in Infectious Diseases (CRID)
	4	Technical Assistance and Capacity Building (TCB) Program
	5	Fulbright Specialist
	6	Fulbright Specialist Roster
FY2014 (Target = 3; Actual = 3)	7	$1M budget as a subcontract to John Snow International for a Collaborative Support for Health Systems Strengthening

		proposal. Only the portion with IU-SON and Liberian Board of Nursing Testing procedures was selected for funding but the award has been delayed indefinitely due to the Ebola crisis.
	8	$140,000 submitted to Chevron, Ltd., to fund the Certificate in Public Health scale-up over next two years. Tentatively accepted, but delayed due to Ebola outbreak. No agreement signed.
	9	A proposal for joint DNP/Business course (X575 Emerging Economies) and a nursing course (D616 Health Decision-Making and Outcomes) was submitted to IU Overseas Study Abroad committee for implementation with JFK/TNIMA in Spring 2014.
FY2015 (Target = 0; Actual = 2)	10	Proposal for additional funding submitted to USAID/Liberia, requesting additional funding for CEHLS activity.
	11	Letter of reference for Dr. Peter Humphrey to act as Ambassador to the American Society for Microbiology which would bring additional resources and opportunities for collaboration to UL.
LOP Total = 6	LOP Actual = 11	

Challenges

Absence of Renovated Laboratories at Fendall Campus: The experiential component of laboratory learning was meant to drive the changes in the science coursework and curriculum. Revisions of the curriculum were impacted by the lack of suitable facilities and consequently, the partners had to change the timeline for delivering lab equipment and training. Through this partnership, there have been significant improvements to biology laboratory facilities and computer resource rooms.

Recruitment of Visiting Professors for UL: It was challenging for the partners to identify, recruit, and send three visiting professors to UL. The partners worked closely with USAID/Liberia and HED, to address the contractual issues that contributed to the delay in implementing this component of the program. The partnership was able to find visiting professors to travel to UL to work with the Biology, Nursing and Anatomy departments.

Negotiation and Execution of Three Subaward Agreements: HED and IU entered into a subagreement and subsequently IU and UMMS entered into an agreement. At the same time, both IU and UMMS also entered into agreements with UL. This high number of subagreements between different parties took more time than anticipated to negotiate and execute. Partners utilized ACE/HED's Grants and Contracts unit to help the partners with the contracting issues they were encountering but it was still a time consuming process.

Budget Freeze and Reduction: USAID's next obligation of funding to HED was delayed by the Mission approval and consequently stalled CEHLS purchases and activities. Due to budget uncertainty and the spending freeze on certain activities, computers were not purchase for TNIMA and hiring of staff for FY14 Quarters 3 and 4 was delayed. This also caused the Advisory Board Meeting originally scheduled for March 2014 to be postponed. The subsequent travel freeze delayed the visit of Michael Reece, Dean of IU's School of Public Health and the work to be completed with the public health working group. To help remedy these issues, IU utilized funding outside of the award to support Michael Reece's travel, which was necessary to continue on the timeline for the implementation of the Public

Health certificate. IU also used funds outside of the award to fund a visit for Dean Ophelia Weeks to meet with Charles Reafsnyder and Kathleen Sobiech at the IU campus for strategic planning.

Purchase and Installation of Equipment in FY14: The delay of purchasing computer laboratory equipment for the UL AMD faculty and student computer lab was due to the sequestration of funds in the Spring and Summer 2013. The partnership originally planned to purchase the computers and install them by the first quarter of FY14. However, they were purchased in the first quarter and installed during the second and third quarters of FY14.

University of Liberia Closure: On November 25, 2013 UL closed, after several days of disruption and protests. The campus finally reopened on January 20, 2014 delaying the academic cycle. Difficulty in officially communicating with Provost Dr. Wede Brownell caused a disruption in plans for moving the BSc in Midwifery approvals through the UL faculty senate. The closure also limited Dr. Berestecky's ability to hold trainings for the life science faculty since the Fendall Campus was closed immediately. President Dennis appointed Dr. Walter Wiles as Acting Provost, charged with ushering the BSc Midwifery plans through the university approval process. Dr. Berestecky used his time in Monrovia to meet individually with faculty members and complete four instructor pamphlets to accompany the new Biology curriculum. Due to these delays, the midwifery program was unable to accept students in FY14 and again in FY15 due to the national school closures.

Ebola Outbreak and University Closures: Due to the Ebola outbreak confirmed by the WHO and CDC on March 25, 2014, many of the planned teaching trips, visits and activities were disrupted. CEHLS team continued to collaborate and work via internet communications and phone calls to maintain momentum and accomplish the majority of the activities in the FY14 and FY15 implementation plan. The UL team diligently followed up implementation of activities in Liberia and effectively communicated with their U.S. counterparts during this trying period.

The closure of the UL prevented the partners from completing a number of planned activities including in-person trainings and introducing revised syllabi. The CEHLS partners were able to work around the university closure by utilizing Dr. Humphrey and holding lab demonstrations and small trainings during the limited hours that the university was open to select UL instructors and staff.

The closure of TNIMA prevented the partners from introducing the BSc Midwifery program, a major activity planned for FY15. During the closure, the partners purchased textbooks and finalized the approvals and agreement necessary to ensure that UL and TNIMA will be fully prepared to open the BSc Midwifery program in the new academic year.

Broken Generator on Fendall Campus: The main generator supplying power to the Engineering and Natural Science buildings on the Fendall campus was inoperable for the majority of FY14 and FY15. The loss of power caused obvious disruptions to the faculty's ability to prepare and deliver lectures. During this time, the CEHLS faculty resource room sat idle, since the computers were not operable. All of the lab equipment for demonstration was also left unused during this time. The Dean of Sciences, Ophelia Weeks worked with UL to fix the generator. It was, however, inoperable. After months of back and forth between the universities, HED and USAID, the approval for a new generator was finally granted and the partners were able to purchase it before their subaward ended on June 30, 2015.

FY15 Budget Realignment and Subsequent Delays: The FY15 budget realignment and equipment approval process was long and difficult for all parties involved. The first request for generator repair was submitted to USAID/Liberia by ACE/HED on September 14, 2015. After a series of back and forth communications discussing the merit of purchasing a new generator versus repairing the existing one, the Mission requested on November 30, 2014, that ACE/HED resubmit their request to include both budget realignment and equipment repairs. On December 12, 2014, ACE/HED resubmitted their request

with a budget realignment of the associate award and equipment repairs under the Subaward. ACE/HED and the Mission exchanged a number of emails between January 2015 and March 2015 discussing what additional documents were needed to grant Mission approval, including a written request from the Subawardee (IU), three price quotes from vendors in Liberia, a letter from UL/AMD confirming that the generator would only be used for its stated purpose and an IEE amendment. ACE/HED then submitted an updated request on April 21, 2015, requesting approval for budget realignment and the purchase of a new generator. On May 20, 2015, the Mission granted conditional approval of the generator purchase, pending the approval and submission of a Health, Safety and Occupational Hazard Plan and AMD's concurrence in writing that the Sea View dormitory building would not be connected to the new generator. ACE/HED submitted the Safety plan and the AMD letter on May 27, 2015, which was received and approved by the AOR on June 1, 2015.

The CEHLS partners began working immediately after receiving approval to complete the remaining Public Health & You training, install the generator, and obtain the supplies and equipment needed to complete the computer resource room at Fendall. Unfortunately, the budget approval delay forced the partners to cancel some of their planned travel to Liberia, like UMMS' Rick Rabe's trip to AMD to work on the computer resource room. Despite the tight timeline, the CEHLS partners were able to purchase and install the generator by the close of the Subaward agreement on June 30, 2015.

Lack of IT Support: As described in the SWOT analysis of the College of Health and Life Sciences (CHLS) Strategic Plan and the close-out narrative, the lack of connectivity for students and faculty still inhibits use of the online journals, such as HINARI. In addition, the lack of full-time, skilled IT consultants for the department are deficient and contribute to the prolonged technical issues in the computer resource room. In the modified FY15 budget, the partners included equipment recommended by USAID technical advisor Kelvin Beh, which was purchased and supplied to the university before June 30th, 2015.

Irregular Academic Calendar: Dean of the AMD College of Medicine, Vuyu Golakai, re-opened the school in April, 2015 but only for 6 weeks of review and final exams. Due to this limited opening of the university, the partners were unable to travel and complete many of their planned activities with UL students and faculty.

Lessons Learned

Importance of Clear Partnership Management: The partners found that it was critically important for IU and UL to identify and hire a partnership Country Director to work with the project at UL. This position is essential to moving initiatives along and following up locally with faculty and staff. Without this assistance on the ground, the planning and implementation of activities is a much more cumbersome and time consuming task.

Standard M&E Reporting Processes: The exercise in developing M&E plans was both educational and crucial in preparing clear plans to track the partnership's progress. However, the changes in indicators and M&E templates were very challenging. There is also a need to align the M&E plan templates and indicators that are instituted by HED to respond to the new USAID standard indicators with those that are developed at the Mission level. The PRIME reporting system instituted by HED allowed for better data collection, analysis and verification. The partners held monthly conference calls involving all partners (UL, IU, UMMS), USAID and HED to help facilitate timely discussion on progress of implementation, which proved important in facilitating communication, troubleshooting challenges and creating common understanding on challenges and progress of implementation. Continuous engagement and communication between HED and IU/UL partners provided guidance on

issues such as developing monitoring and evaluation plans, budget utilization and realignment, and project travel.

Cadaver Dissection Program: In May 2012, Dr. Anne Gilroy from UMMS introduced the cadaver dissection program. The program included mentorship of UL AMD faculty Dr. Anthony Quayee, as well as teaching sessions to 1st and 2nd year UL AMD medical students. The cadaver dissection program continued in September 2012, May 2013 and September 2013. UMMS and UL AMD faculty have learnt that the cadaver dissection program was extremely well received by medical students and faculty and provides a holistic view of anatomy for medical students as well as an experiential learning opportunity. Dr. Gilroy worked with Dr. Hines (UMMS), Dr. Quayee (AMD), and Dean Golakai (AMD) to help integrate this learning opportunity into the UL AMD Anatomy curriculum in order to benefit future medical student classes. This collaborative curricula development process was very success and one which the partners hope to emulate on future projects.

Visiting Specialists: In order to build the consensus necessary for implementation of a new certificate or diploma program, the partners found that it was important to have a CEHLS visiting specialists in Monrovia, Liberia. The partners made significantly greater progress when a visiting specialist was working in person with the CEHLS team of consultants at UL.

Best Practices, **Designing Instruction for Workforce Development**: The partnership invested great effort to create a curriculum that is directly related to the Liberia's workforce development needs in the health and life sciences. Through the leadership provided by the new Dean of Science and two CEHLS visiting specialists, the UL faculty working groups successfully completed revisions of the curriculum, focused on what is achievable, applicable, and relevant. The design and content of these revised syllabi represent many hours of consultation with the Liberian MOHSW, regional experts, and international consultants to ensure best practices in the discipline.

Local Capacity Development through the Partnership: The partnership has empowered their beneficiaries to be leaders and utilized them to both teach short-term trainings and assist in department development. A prime example of this practice is the way in which the nursing fellows took leadership roles in the CPH program and the BSc Midwifery planning, respectively. Through the mentorship of Dr. Berestecky, the CEHLS visiting biology specialist, John Montgomery, a student, was encouraged to take on a leadership role in the Fendall faculty resource room's textbook distribution program. Mr. Montgomery worked with the CEHLS country director to manage the faculty resource room and track usage reporting data.

Need for Expanded Institutionalization: The partnership had relied heavily on one main contact within the university's administration and when that individual, Dr. Wede Brownell, was subsequently removed from her post as Provost it resulted in significant delays in plans to move the BSc Midwifery approvals through the UL faculty senate. After Dr. Brownell's departure, IU had difficulty finding another individual with the same institutional knowledge of the partnership and the status of the proposal approval. As a result, the partnership recognized the need to have multiple advocates within the institution for collaborating on new initiatives.

Best Practices on Ebola Outbreak: The health environment in Liberia was extremely unpredictable in FY14 and FY15 and required flexibility while maintaining goals for project deliverables. Due to the outbreak of the Ebola virus, the MOHSW sought out the expertise of CPH students and the Biology Student Association to support the outbreak response. The CPH students were appointed "trainers of trainers" and worked with communities in Monrovia to teach local volunteers about the symptoms, transmission and prevention methods of Ebola. The "trainers of trainers" project was very successful not only because it empowered the CPH students but also because it allowed non-professional community members to spread awareness and debunk many of the dangerous misinformation about Ebola. Although

this request from the MOHSW illustrated how well the students were positioned for mobilization at a time of crisis, it was equally important to stay on track to achieve the original goals of the practicum. Partners were able to reconfigure a few weeks of the practicum to achieve both of these goals.

Seeking Opportunities for Further Funding: The partners experience with this award's frequent changes in budget and funding uncertainty taught them the value and necessity of strategic planning and seeking outside funding opportunities. Consequently, the partners worked on several major proposal and capitalized on the opportunity to speak with donors face to face and utilized that time to come up with creative solutions to funding limitations. It is the hope of the partnership that many of these discussions will have an impact on improving institutional capacity at UL, improving teaching and learning, enhancing laboratory equipment and renovation of the Fendall campus in beyond the end of this award.

Monthly Conference Calls: HED established monthly conference calls involving UL, IU, UMMS, and USAID/Liberia. The calls facilitated timely discussions and troubleshooting challenges in support of success in implementation, as well as creating common understanding on challenges and issues related to implementation. Continuous engagement and communication between HED and IU/UL partners, as well as USAID/Liberia has provided guidance on issues such as developing monitoring and evaluation plans, budget utilization and realignment, faculty/staff travel, and meeting organizations.

Local capacity development through the partnership: The CEHLS partnership has graduated four fellows with advanced degrees; two MPH students who received their degrees from KNUST and two MSN students who received their degrees from IU School of Nursing. The fellows have returned to teaching at UL and TNIMA and taken leadership roles in the CPH program and BSc Midwifery planning, respectively. Their commitment to the university development and understanding of its shortcomings has been an invaluable resource.

Need for digitized resources: The partners have experienced a number of delays and difficulties with gathering data and confirming details due to UL's paper based filing system. Tasks like reporting on baseline data and gathering background details and institutional records for strategic planning has been labor-intensive and time consuming process for the partners. UL recognizes the need to digitize its institutional records to make that data more readily available to potential stakeholders and partners.

Need for new financial management system and increase in research administration at UL: UL struggled with its financial management system throughout the partnership, particularly in processing invoices and maintaining financial records. There has been no improvement of financial management during the four-years of the CEHLS and the partners hope to secure additional resources to develop this important department of the university. In order to independently manage research and grant funding, UL needs to increase their internal research administration capacity.

4. Sustainability

The CEHLS partnership in collaboration with MOH, CHAI, TNIMA and the Ministry of Education has worked tirelessly to prepare a strategic plan for the management and development of a new College of Health and Life Sciences at UL for 2016 to 2021 (attached in its entirety as Appendix D). Through an environmental scan, the partners have highlighted the major gaps in their current healthcare training system and addressed both the strengths and weaknesses of their current programs at COST, AMD, TNIMA and Student Services. This plan requires an investment of $7,550,000 over the next three years to maintain a college that develops qualified graduates capable of delivering healthcare services that satisfy national need for sustainability, quality healthcare and self-reliance in education, training and skills transfer.

5. Success Stories

Benefits of the IU Nursing Fellowship

Cynthia Bondoe and Ada Brown-Wraynee are nurse faculty members at Tubman National Institute of Medical Arts (TNIMA) in Liberia. With years of experience between them, they were identified as leaders in their field and accepted into Indiana University's School of Nursing (IUSON) Master's Degree program. Upon earning their advanced degrees, the two nurses will return as faculty at TNIMA and contribute to project goals for better qualified faculty to prepare students in meeting workforce needs.

Cynthia and Ada arrived in the cold month of January and adjusted well to the snowy commute to school and the demands studying. In addition to consulting with Dr. Mary Beth Riner continuously on articulation plans for the BSN to be offered at UL, during the first year of their program project funds supported their training to complete the American Academy of Pediatric Neonatal Resuscitation Program (NRP) instructor course and are now certified as NRP providers/instructors.

The nurses also attended the National League for Nursing (NLN) 2012 Education Summit in Anaheim, California where they networked with international nurse educators. There are project funds in year 2 to support a similar nurse leadership conference in Monrovia, which will use the NLN model of collaboration and professional development to strengthen efforts of the Liberian Nursing Board on a regional level.

Cynthia has this to say about her opportunity to pursue a master's degree: "My studies at IU have increased my knowledge and skills in the areas of teaching, evidence-based practice related to nursing theory, research and clinical practices. I have also gained skills in the demonstration of Neonatal Resuscitation and helping babies breathe. The usage and importance of simulation lab have added more value to my skills. Navigating the [online IU portal for students] was another improvement for me and the exposure of was all very new to me. Now I can comfortably use these aspects of technology with less assistance. Personally, I feel that the past semesters have been excellent for me. Initially it was very challenging trying to adjust to the climate and to the studies. But with the help of everyone's effort I overcame these challenges. Thanks for the continue support."

Faculty Training Breathes New Life into Liberia's Public Nursing Program

Liberia has a high neonatal mortality rate and the need for improved prenatal and postnatal health care is a matter of life and death. Through the rebuilding of the health education system following years of conflict, the nation can steadily move closer to having reliable and efficient health care services, a cornerstone for a thriving society. In support of the increased national awareness to this major health issue, two Liberian nurses, Cynthia Bondoe and Ada Brown-Wraynee, are among the educators embracing new methodologies to change lives.

Under a USAID-funded and Higher Education for Development-managed partnership among Indiana University (IU), University of Massachusetts Medical School, University of Liberia, and Tubman National Institute of Medical Arts (TNIMA) in Liberia, Cynthia and Ada were accepted into Indiana University's School of Nursing to obtain their master's degrees. "I really could not have pursued the master's degree in Liberia because this type of program and the needed resources and technology do not exist in Liberia," said Cynthia, who has been a nurse educator since 2000. "My studies at IU have increased my knowledge and skills in the areas of teaching, evidence-based practice related to nursing theory, research and clinical practices." Since the completion of their coursework, both Cynthia and Ada have returned to TNIMA to finish research and practicum experience and contribute to the implementation of a new midwifery degree.

"With Ada and Cynthia's master's education in nursing, the University of Liberia will be prepared to offer the first publically available baccalaureate nursing and midwifery programs, said Dr. Mary Beth Riner of IU. TNIMA boasts more than 333 students, of which 115 are nursing students and 63 are midwifery students enrolled currently in a three-year certificate degree. Due to the partnership's efforts, beginning October 2014, the 63 midwifery students and others will have an opportunity to earn a four-year Bachelor of Science Midwifery degree for the first time from public institutions TNIMA and the University of Liberia.

Creating an articulation plan and developing the curriculum were among the initial steps toward building the midwifery degree. Ada and Cynthia worked with Mary Beth to develop the following courses: Transition to Baccalaureate Midwifery; Administration (Leadership and Management) II; Capstone Midwifery; Evidence Based Practice in Midwifery; and Midwifery V. "To date, the education of faculty has primarily used an apprenticeship approach where faculty members learn from other faculty and teach as they were taught as a student," said Mary Beth. "Due to the opportunity to complete a master's in nursing education at Indiana University, Ada and Cynthia, will be among the first nurse/midwife educators to be educated outside the country and exposed to new pedagogies."

In addition, Cynthia and Ada completed an American Academy of Pediatric Neonatal Resuscitation Program instructor course and were trained as trainers in the Helping Babies Breathe (HHB) technique. "Because of this partnership, we are presently conducting trainings in HHB with TNIMA physician's assistants, professional nurses, senior midwifery students, and nursing and midwifery staff at the John F. Kennedy Medical Center in an effort to reduce infant and neonatal mortalities in Liberia," said Cynthia. "I have gained skills in the demonstration of neonatal resuscitation and helping babies breathe."

As part of the U.S. and Liberia partners continue to invest in strengthening nurse leadership in Monrovia, they plan to adapt the National League for Nursing model of collaboration and professional development to benefit the Liberian Nursing Board on a regional level.

30th American Association of Clinical Anatomist

In July 2013, Dr. Anne Gilroy from UMMS, presented a poster at the annual meeting for the American Association of Clinical Anatomists in Colorado, USA. Dr. Gilroy has been to Liberia several times and has worked closely with Drs. Golakai and Quayee in revitalizing the anatomy teaching program at UL AMD. Dr. Gilroy presented a poster titled "Collaborative revitalization of the anatomy teaching program in post-conflict Liberia" which was co-authored by Dr. Anthony Quayee (UL AMD), Dr. Vuyu Golakai (UL AMD) and Dr. Katherine Luzuriaga (UMMS). The poster was well-received and garnered a lot of interest from clinical anatomists who were interested in getting involved with the clinical and didactic teaching taking place at UL AMD because of the new anatomy program. The conference was a great opportunity for CEHLS activities to be presented to the general public and provided a platform for building future partnerships with other US higher education institutions.

Invitation to join the Women in Public Service Project

In June 2013, the University of Massachusetts was invited to join the inaugural public university initiative of the Women in Public Service Project, a program that was developed by former Secretary of State Hillary Clinton to promote women leadership in the public sector. As a partner in CEHLS, UMass Medical School Office of Global Health invited Dr. Bernice Dahn, Chief Medical Officer and Deputy Health Minister of Liberia, Dr. Wede Brownell, Provost and VP of Academic Affairs at UL and Dr. Ophelia Weeks, Dean of UL School of Science and Technology as participants and panelist for the WPSP conference held in Lowell, Massachusetts. The participation in WPSP brought publicity to the activities of the CEHLS grant and highlighted the importance of the Ministry of Health and Social Welfare and the University of Liberia's women leadership in the success and the progress of the project.

Public Health Students Take Action

The first cohort of ten students in the new Certificate in Public Health (CPH) program visited the Soniwein Health Clinic to gain experience in community preventative health and were inspired to action when they saw the conditions surrounding the clinic. The public health students were shocked to see that in an area adjacent to the clinic, sat the largest garbage collection site in all of Monrovia. The students were particularly interested in water and sanitation in the community and were alarmed to find the hand pump within the health center unfit for drinking due to the underground pollution from the garbage. "The garbage had completely engulfed the clinic and made the hand-pump in the clinic unfit for use by the midwives for deliveries. The flies from the garbage swarms the patients while they are in the clinic," lamented the Officer in charge (OIC) of the clinic.

The first cohort of CPH program students: George Wanyan, Rita Gartei, Bofa Veronica Jallah, Tamba Borbor, Allen Gbenein (kneeling), Watta Borbor, Rebecca Robinson, Ruth Harris, Jeremiah Pewi (2014)

CPH Program Director, Dr. Mosoka Fallah and one of the instructors, Mr. Thomas Momo, joined the students and the hospital to review the intensity of the hazard and strategize solutions to the problem. They decided to hold a community forum with key stakeholders to discuss the best options. The lead administrator for the clinic sent out invitations through the marketing association, the community leaders and the CPH students invited the Monrovia City Corporation (MCC) and the Montserrado County Health team.

CPH Preceptor, Thomas Momo, conducts a community health survey and discusses waste and sanitation with community member (2014)

All key stakeholders were able to attend the meeting, and were glad that the CPH students were drawing attention to the problem as well as working on solutions. "We have been trying to solve this garbage problem, but it seems to defy every solution. We thank you for bringing all parties together to find a solution," commended the representative from MCC who was directly responsible for the city garbage removal. A letter was drafted on behalf of the community requesting removal of the waste. The letter was delivered to MCC and the garbage subsequently removed. The results of the community mobilization had yielded instantaneous results. The Public Health initiative had finally began to solve a problem that the community thought defied a solution. Follow-up visits to the clinic and the garbage site was incredible, as the entire area remained cleared.

The CPH, launched in October 2013, is a collaboration between the Ministry of Health and Social Welfare, the JFK Medical Center, and the Center for Excellence in Health Sciences at University of Liberia/Tubman National Institute of Arts. The first cohort of students finished coursework in January 2014 in five of the core public health competencies and are now at practicum sites throughout Monrovia. Since the outbreak of the Ebola virus, the students have been mobilized as "Trainers of Trainers" and are seen as valuable bridge between health care facilities and the communities they serve.

Biology Student Takes the Lead

The head of University of Liberia's Biology Student Association, Johnny Sokleh Montgomery, first met CEHLS visiting biology specialist, Dr. John Berestecky, during a department meeting to discuss the

distribution and utilization of books donated by the Sabre Foundation through the CEHLS grant. Johnny remembers Dr. Berestecky asking him for his ideas on how to accomplish the daunting task of managing hundreds of books for up to 2,000 life science students. “Dr. Berestecky thought my opinion was brilliant and he then asked me to ‘run with it,’” Johnny recalls.


Johnny Montgomery with University of Liberia lab instructors (2014)

The result was the development and adoption of the Textbook Distribution Policy, managed by Johnny through the CEHLS Faculty Resource room on the Fendall campus. Since then, Johnny has taken a leadership role, working alongside CEHLS Country Director, Mrs. Ansahta Garnett, in the day to day management of the Faculty Resource Room, offering support to faculty by developing grade books on Excel, and tracking usage data for reporting.

Johnny appreciates his experience as a student volunteer for CEHLS and credits Mrs. Garnett for giving him room to explore his ideas, talents and capabilities. In addition to managing the logistics, Johnny uses his opportunities to interact with faculty and students to conduct surveys and informal meetings to evaluate the CEHLS activity within the Biology department. Input from these meetings is used to plan for trainings and make adjustments to existing procedures.

Johnny’s real dream is to bring about positive change to those around him. To this end, he “loves to volunteer with CEHLS, and will continue to volunteer wherever people are concerned about the wellbeing of others.” Johnny hopes to bring that spirit with him when he graduates and moves into his career, preferably in the field of Neuroscience.

Johnny Montgomery is a Registered General Nurse by profession, licensed to practice in Ghana and Liberia holding a Diploma in Nursing from the University of Ghana through its satellite college; Narh-Bita College; School of Allied Health Sciences – School of Nursing, currently a Sophomore (2nd Year) Student of the University of Liberia in the Thomas J. R. Faulkner College of Science and Technology; Department of Biology reading Biology as Major and Chemistry as a minor. Mr. Montgomery also is a Volunteer Executive Committee In-Charge, Projects, Programs, Advisement and Development (P^{2}AD), BIOSA, Volunteer Staff In-Charge, Projects, Programs, Advisement and Development (P^{2}AD), Department of Biology (DoB), Volunteer Staff and Member, 3-Member Advisory, Implementation and Supervisory Team, CEHLS – UL, Volunteer Staff In-Charge, Projects, Programs, Advisement and Development (P^{2}AD), TJRF COST.

University of Liberia Upgrades Molecular Biology and Microbiology Laboratories

The University of Liberia (UL) introduced its first Microbiology lab in March 2015 and made substantial updates to their Molecular Biology lab with the addition of a UV-transilluminator and microwave. UL Professor, Dr. Peter Humphrey and Visiting Biology Specialist, Dr. John Berestecky trained UL faculty in the set-up and maintenance of equipment, use of the transilluminator and microwave, and how to conduct DNA analysis and interpret results.

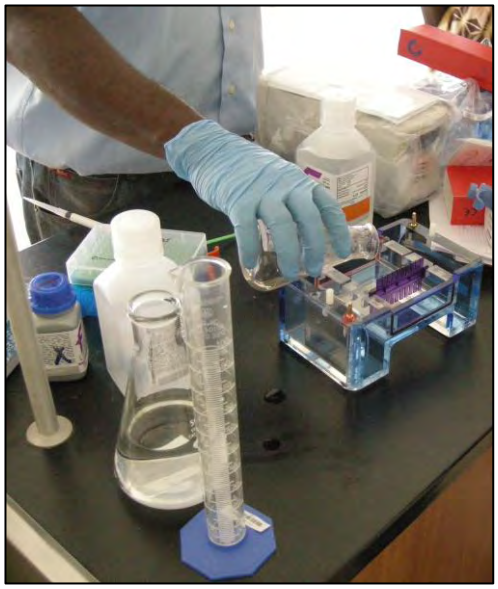
Although the equipment used and the techniques practiced at these workshops are standard at any U.S. and European college and many high schools, they are a novelty at the University of Liberia. Practicing the laboratory methods made possible with this equipment and supplies is essential to the education and training of anyone studying modern biology. Dr. Berestecky and Dr. Humphrey introduced a number of practices for Microbiology and Molecular Biology utilizing their new equipment, the UV-transilluminator and microwave.

DNA samples being prepared for analysis with the UV-Transilluminator University of Liberia (March 2014)

The transilluminator allows the user to view and analyze DNA. DNA is the basis for study in molecular science but impossible to view without this equipment because it is colorless. Future students and faculty will now be able to view DNA by first staining it with a gel and then exposing the stained sample to a UVB light source in the transilluminator. The transilluminator will cause the DNA to fluoresce and become visible, allowing the viewing to study its structure.

The microwave although commonplace in many U.S. homes, is used for quick and effective heating of all substances in the laboratory. In the absence of Bunsen burners or hot plates, the microwave will be used in molecular biology to make gels to study DNA.

These new practices will be introduced to Molecular Biology and Microbiology students in the fall of 2015 when the University of Liberia fall semester beings. The insights into the scientific process gained with this new equipment will allow students and faculty to see and practice firsthand how modern scientific inquiry is conducted. These skills are essential to the training of any biology student and the laboratories will be an invaluable resource as the university educates a new generation of health care workers, epidemiologists, research biologists and laboratory professionals that will rise to meet the challenges of Liberia in the post-Ebola era.



Dr. Peter Humphrey demonstrates how to use the UV-Transilluminator to analyze DNA (University of Liberia, March 2015)

6. Appendices

Appendix A: CEHLS Indicator Targets and Actuals

HED/LMEP Indicators	LOP Target	FY12 Actual	FY13 Actual	FY14 Actual	FY15 Actual	Final LOP
HED STANDARD 1 (Training-Short Term): Number of host-country individuals (faculty and/or teaching staff, students, and administrative/other staff) affiliated with the host-country institution who completed short-term training programs	383	35	562	427	111	1135

HED STANDARD 2 (Custom 2): Number of scholarships awarded to UL health and life sciences faculty or staff to obtain advanced degrees	8	0	0	5	3	8
3.2.2-42 (Training-Long Term Faculty Enrollment): Number of host-country institution faculty and/or teaching staff who enrolled in long-term training programs for qualifications strengthening	8	8	0	0	0	8
HED STANDARD 4 (Training-Long Term Completed): Number of host-country individuals (faculty and/or teaching staff, students, and administrative/other staff) affiliated with the host-country institution who completed long-term training programs for qualifications strengthening	8	0	0	5	3	8
HED 1.1.1;.1 (Custom 3): Number of UL health and life science faculty receiving mentorship	36	21	33	48	32	134
HED 1.5 (Custom 5): Number of faculty teaching hours using new laboratory and instructional equipment	60	0	0	72	0	72
HED 1.7 (Custom 6): Number of computer terminals with access to digital resource database	43	0	15	43	3	61
HED 1.8 (Custom 7): Number of faculty/staff/students trained on the use of digital formats	70	0	115	193	0	308
HED 1.9 (Custom 8): Number of new books catalogued and shelved at UL, AMD, and TNIMA	25,693	11,000	7,568	0	0	18,568 purchased & 7,125 donated
3.2.2-36 (Access-Students): Number of individuals from underserved and/or disadvantaged groups accessing tertiary education programs	4,525	0	455	159	0	614
3.2.2-33 (Experiential/Applied Learning): Percent of tertiary education programs supported through the partnership that include for the first time experiential and/or applied learning opportunities	100% (FY12: 6/6, FY13: 6/6, FY14: 5/6, FY15: 1/6)	0% (0/6)	16.6% (1/6)	50% (3/6)	16.6% (1/6)	83.3% (5/6)
3.2.2-36 (Curricula-New and/or Revised): Percent of curricula newly developed and/or revised with private and/or public sector employers' input or on the basis of market research	100% (FY12: 3/3, FY13: 4/4, FY14: 4/4, FY15: 1/1)	100% (2/2)	0% (0)	75% (3/4)	100% (6/6)	90% (9/10)

HED 1.10 (Custom 9): Number of syllabi and courses newly developed, updated and/or revised with professional collaboration or based on industry practice	27	0	4	12	12	28
STANDARD (Access-Policies): Number of new or improved policies and/or procedures that support increased access of underserved and/or disadvantaged groups to tertiary education programs	6	4	0	2	0	6
HED 1.11 (Custom 10): Number of local, regional, and international organizations collaborating on CEHLS activities	6	6	8	14	6	34
HED 1.12 (Custom 11): Number of advisory board meetings to discuss CEHLS planning and implementation	8	0	2	1	1	4
HED 1.13 (Custom 12): Number of MOUs signed	3	1	1	1	0	3
HED 1.14 (Custom 13): Number of strategic plans developed for long term sustainability	1 final	0	1 draft	1 draft	1 final	1 final
HED 1.15 (Custom 14): Number of proposals submitted for funding	6	0	6	3	2	11

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APPENDIX B ATTACHED AS SEPARATE DOCUMENT

Appendix C: Certificate of Public Health Curriculum

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APPENDIX C ATTACHED AS SEPARATE DOCUMENT

Appendix D: CEHLS Strategic Plan

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USAID
FROM THE AMERICAN PEOPLE

HED
Higher Education for Development

Center for Excellence in Health and Life Sciences

FINAL Report

October 1, 2011 – June 30, 2015

Subaward Agreement: HED018-9749-LBR-11-01

Submitted: July 31, 2015

INDIANA UNIVERSITY
UNIVERSITY OF LIBERIA
TNIMA
Tubman National Institute of Medical Arts
University of Massachusetts Medical School
UMASS

Contents

Abbreviations

AMDCM	A.M. Dogliotti College of Medicine
BSc	Bachelor of Science
CEHLS	Center for Excellence in Health and Life Sciences
CHV	Community Health Volunteer
CHW	Community Health Worker
CoHLS	College of Health and Life Sciences
CoST	College of Science & Technology
CDC	Center for Disease Control
CPD	Continuing professional development
CPH	Certificate in Public Health
GME	Graduate Medical Education
HCID	Human Capacity Infrastructure Development
HED	Higher Education for Development
IU	Indiana University
JFKMC	John F. Kennedy Medical Center
MOH	Ministry of Health
MSc	Master of Science
PhD	Doctor of Philosophy
PH&Y	Public Health & You
PI	Principal Investigator
TNIMA	Tubman National Institute of Medical Arts
UL	University of Liberia
UMMS	University of Massachusetts Medical School
USAID	United States Agency for International Development

Executive Summary

Overview:
The Center of Excellence in Health and Life Sciences (CEHLS) project was a four-year, $3 million activity funded by the United States Agency for International Development (USAID) and implemented by Higher Education for Development (HED) to support an academic partnership between the University of Liberia (UL), Indiana University (IU) and the University of Massachussets Medical School (UMMS). The major project goal was to build capacity in academic and research programs at UL that address a national shortage of health care workers through the development of new and enhanced programs in biology, public health, midwifery, and pre-clinical science training in medicine and pharmacy. The partnership activity supports Liberia's urgent need for healthcare workers and public health professionals who can address the country's health challenges and aligned with the health workforce development goals of Liberia's Poverty Reduction Strategy.

Life of Project: 2011-2015

Goal: Build capacity in academic and research programs that address a national shortage of health care workers through the development of new programs in biology, public health, midwifery, and enhanced biology, chemistry and pre-clinical science training in medicine and pharmacy.

Objectives:
The partnership focused on improving instructional quality in introductory courses, upgrading preclinical science curricula, and increasing access to teaching and learning resources, as well as developing faculty, staff and students through tailored training and mentoring. Major objectives were to:

a) Improve delivery of health and life science programs at UL
b) Improve UL student access to education in and preparation for health and life science careers
c) Increase the status and permanence of UL as a leader in the areas of health and life science education

Major Accomplishments:

- Developed a strategic plan for project sustainability under a new **College of Health and Life Sciences** at UL based on capacity analysis of supply and demand side workforce needs in collaboration with Liberian Ministry of Health and Clinton Health Access Initiative;
- Developed a new Certificate in Public Health for working professionals;
- Realigned and revised 19 core life science curriculum, with professional collaboration and based on latest health industry practice;
- Digitized public health curriculum with Liberian case studies for in-service training opportunities;
- Updated teaching methodology to include experiential and applied learning in Biology, Chemistry, Midwifery/Nursing, Public Health, Medicine, and Pharmacy;
- Re-established cadaver dissection program at the medical school;
- Provided short term training to 600 faculty, staff and clinicians in the areas of anatomy, Helping Babies Breathe, laboratory pedagogy, and public health instruction;
- Provided long term training for 8 UL instructors in public health, nursing education, and applied sciences;
- Established two new resource facilities at UL with a total of 35 computer workstations;
- Increased library holdings by 25 thousand books and reference materials in Medicine, Biology, Nursing, Public Health, and General Education;
- Improved infrastructure in support of education and learning, including new laboratory equipment, new generator, and installation of a learning management system (Moodle) at medical school.
- Leveraged funding for 3 fully funded PhD fellowships at IU's School of Public Health; World Bank funding for new Graduate Medical Education Program for Liberian Physicians through the Liberian Post-Graduate Medical Council; Paul G. Allen Foundation funding for continued support for Ebola relief; and
- Recruited Chief of Pediatrics at JFK Medical Center

I. PARTNERSHIP OVERVIEW

Liberia College was founded in 1856 and inaugurated on January, 1862.The First President of Liberia, Joseph Jenkins Roberts, began the operation of Liberia College after it was inaugurated. Liberia College from its founding until its incorporation as the University of Liberia (UL) has made a significant contribution to the social, economic, cultural and educational life of the Republic. The University is by far the largest provider of life science education in Liberia and runs the only medical school in the country, A.M. Dogliotti College of Medicine (AMDCM). Significant investment in the area of health and life science program thus promises to yield significant results towards meeting national goals for workforce development.

The Tubman National Institute of Medical Arts (TNIMA) was established in 1945 through the effort and cooperation of the Liberia National Public Health Service, now the Ministry of Health (MOH), and the United States Public Health Mission. In 1945, two existing programs for the training of nurses, namely professional and practical nursing, were merged and offered through the John F. Kennedy Medical Center (JFKMC). The union was named TNIMA, after the incumbent President of Liberia, William V.S. Tubman. TNIMA provides the only publicly-operated nursing and midwifery programs.

Charles Reafsnyder presents President Sirleaf with a plaque to commemorate her visit to IU. 2008

In May 2008, Indiana University awarded an honorary doctorate to President Ellen Sirleaf in recognition of her contributions to African democracy and development. President Sirleaf's visit and her presentations at several public events galvanized interest in assisting Liberia's development among a broad array of faculty, staff, and Trustees of IU. Accompanying Dr. Sirleaf on the visit was Dr. Emmet Dennis (Dean, University College, Rutgers, and Chair of the UL Board of Trustees). In subsequent meetings involving Dr. Sirleaf, IU's President, Michael McRobbie and other senior faculty and administrators pledged to expand its program of assistance to the University of Liberia.

As a result, IU provided funding for a Needs Assessment visit to UL by four IU faculty and staff, including Charles Reafsnyder, IU's Associate Vice President for International Research and Development. The assessment at UL and TNIMA identified overwhelming obstacles in delivering educational programming. These included: (1) a shortage of faculty with advanced degrees combined with ill-prepared students; (2) the near absence of applied health and life science courses in the curriculum; (3) little or no coordination between the life sciences curriculum and the country's other tertiary institutions; (4) a gender imbalance in life science enrollments; (5) inadequate facilities and teaching methods; and (6) and a shortage of text and reference materials to support classroom teaching.

Reafsnyder and Dennis at Fendall, November 2008

Among the many outcomes of the visit was a draft proposal to HEDs competition for a $50,000 collaborative planning grant with UL to address the obstacles identified during the needs assessment. This proposal ultimately lead to successful funding of the CEHLS program under the direction of Dr. Emmet Dennis, then newly elected President, UL, and Walter Wiles, Vice President for Institutional Development at UL.

Cognizant of the dire healthcare situation in Liberia after civil crisis and of higher education's unique position to make a powerful and long lasting contribution to Liberia's national development, the partnership goals addressed the identified obstacles by focusing on instructional quality in introductory courses, upgrading preclinical science curricula, and increasing access to teaching and learning resources. In summary, the overarching objectives of the partnership were to:

1) Improve delivery of health and life science programs at UL;
2) Improve UL student access to education in and preparation for health and life science careers; and

3) Increase the status and permanence of UL as a leader in the areas of health and life science education.

CEHLS Partners, Monrovia City Hall, March 2012

On March 26, 2012, the UL marked the official launch for the CEHLS partnership project. The Center, initially funded by a USAID/HED award worth $7.2 million over four years, focused on enhancing the capacity of the health workforce in Liberia through an academic partnership between UL, IU and UMMS.

Dr. Deborah Harmon-Hines, UMMS, and Dr. Anthony Quayee, AMDCM, with students. October 2013

Partnering with UMMS was a natural fit for accomplishing CEHLS objectives at the medical school due to their long-established ties to AMDCM and its teaching hospital, JFKMC. Through HEARTT (Health Education and Relief Through Teaching), a well-established collaboration led by Dr.Adamah Sirleaf, many UMMS residents, faculty, and staff contributed their skills to developing medical practice in Liberia. Katherine Luzuriaga, Professor of Pediatrics and Molecular Medicine and Vice Provost of Clinical and Translational Science and Global Health served as the Principal Investigator (PI) and Chief Medical Liaison for the CEHLS project. Drs. Deborah Harmon-Hines and Anne Gilroy mentored faculty in Anatomy, resulting in the first cadaver dissection program to be offered at AMDCM in over 20 years. Drs. Peter Griggs and Julie Jonassen provided medical student lectures and mentored faculty in Physiology. James Comes and Elaine Martin served as consultants for library projects at the AMDCM. Extensive nurse leadership training was conducted by Donna Gallagher, Co-Director Office of Global Health at UMMS. Mr. Rick Rabe

and Dr. Julie Jonassen worked with Mr. Jappah to install the electronic learning management system at AM Dogliotti

Charles Reafsnyder served as the US Institution's PI on the project until his retirement from IU in June, 2014. David Zaret, Vice President for International Affairs served as PI until the project end; Keithanne Mockaitis, Associate Scientist, served as Biology consultant during the core life science curriculum revision; Michael Reece, Associate Dean, School of Public Health was lead consultant on public health planning and initiatives; and Mary Beth Riner, Associate Dean for Global Affairs, School of Nursing, led the nursing/midwifery curriculum development as well as conducting multiple trainings on assessment and leadership.

Dean Golakai at CEHLS reception for fellows, August 2011

Emmet Dennis was appointed President of UL shortly after his May 2008 visit to IU and served as the African Institution's PI. Dr. Dennis is Professor Emeritus of Cell Biology and Neurosciences, Rutgers University, and received his MSc in Biology from IU. This put him in a uniquely advantageous position to leverage additional fellowships from IU's School of Public Health and Graduate School.

Dr. Dennis convinced an accomplished surgeon practicing in Botswana, Dr. Vuyu Golakai, to return to his native land to become Dean of the medical school. Under the direction of DeanGolakai , AMDCM graduated a class of thirty-eight in December, 2013 in sharp contrast to the numbers from 2011, when the school only had the capacity to graduate a class of four. Another colleague, Ophelia Weeks, Associate Professor of Neuroscience, Florida International University, returned to her native Liberia to serve as Dean of the College of Science & Technology.

Many faculty and staff at IU, UL, and UMMS as well as independent consultants contributed greatly to the success of the partnership. Ansahta Garnett served as CEHLS Country Director, using her professional background in student affairs and academic credentials in biology to provide a comprehensive approach to program management in all areas. Mrs. Garnett was able to foster relationships with dedicated students and junior staff at UL in order to support CEHLS activity. Most notably, Johnny Montgomery, Robert Griffiths, and project assistant, Lawrence Fumbah made great contributions.

Specialty consultants John Berestecky, Mosoka Fallah, and Peter Humphrey were invaluable to achieving project goals in Biology and Public Health. Each provided passion and expertise needed to invigorate the instructors and staff. Fortunately, each one of these PhD specialists remain committed to furthering workforce development opportunities in health and life sciences at UL and continue to look for collaborative research and teaching support for UL.

Members of the Certificate in Public Health working group, July 2013

Dr. Fallah contributed to the development and implementation of the Certificate in Public Health (CPH) program under the direction of Walter Wiles and in partnership with many at the MOH and TNIMA. Key contributors in addition to CEHLS partners included: Hon. Tolbert Nyenswah, David Logan, Dr. Saye Dahn Baawo, Vera Mussah, Dr. Scott-McDonald, Munah Tarpeh, Sarah Kollie, Thomas Momo, James Sorsor, Tamba Boima, Varwo Gbassie, Cecelia Flomo, Helen Suah and Tia Gongloe.

HED and USAID provided invaluable input and direction during the CEHLS project. Teshome Alemneh served as the Program Officer during the entirety of the project while Kine Lidell, Allison Schrachter and Sarah Yasyerli served as Program Assistants. Julia Richards, Randolph Augustine and later Ben Zinner represented USAID/Liberia. Ben Zinner in particular was the partnership's effective liaison and advocate in Monrovia.

The following sections describe the major activities of CEHLS and provide suggestions for sustainable progress in the area of health and life science education at UL organized by discipline/academic unit: medical education at AMDCM, undergraduate studies in Life Sciences, clinical and academic training at TNIMA, and cross-cutting activities in Public Health. The accomplishments speak to the strength and collegiality of the partnership which will continue to bear fruit through institutional commitments, professional relationships, and research collaboration that will be sustained for years to come. Additional details on project activity, such as trip reports, training descriptions, collaborators, etc., can be found in the annex.

IIa. PARTNERSHIP RESULTS: AMD COLLEGE OF MEDICINE (AMDCM)

AMDCM is a critical unit that is responsible for responding to the country's need for an increase in medical doctors. The pre-clinical science curriculum of the university's medical and pharmacy colleges were strengthened under the CEHLS project. Immediate attention was given to reinstating the cadaver dissection program, unavailable to medical school students since 1990. Dean Vuyu Golakai worked with Dr. Luzuriaga and UMMS faculty were instrumental in the strengthening of AMDCM.

Dean Vuyu Golakai meets with Dr. Harmon-Hines, October 2013

Under the direction of Dean Vuyu Golakai, AMDCM graduated a class of thirty-eight in December, 2013. The number of graduates was in sharp contrast to the numbers from 2011, when the school only had the capacity to graduate a class of four. One important step in building the program was the recruitment of qualified instructors in the core disciplines. Two doctors supported by the CEHLS grant made a great impact on the school.

AMDCM students during lecture, 2010

Drs. Roseda Marshall, Head of Pediatrics, and Michael Kiiza Kikubaire, Associate Professor of Surgery and Senior Consultant Surgeon at JFK Hospital, contributed greatly to the advancement of research, graduate programing, and the establishment of the Liberia College of Physicians and Surgeons, launched in October 2013. Dr. Marshall was also instrumental in designing and gaining support for a Graduate Medical Education (GME) program in Pediatrics, in collaboration with Dr. Stephen Kennedy (UL-Pacific Institute for Research and Evaluation), Ministry of Health and Social Welfare, and World Bank. Plans are in place to continue to develop GME programs in Medicine, Surgery, and OB-GYN. UMMS has led the coalition of academic medical centers to support these efforts and to identify and recruit Liberian, West African, and US faculty and has received $7.5M from the Paul G. Allen Family Foundation to continue these and other efforts in the Ebola and post-Ebola environment.

CEHLS also facilitated the provision of instructional support from two full-time faculty appointees; mentoring by visiting faculty; increased access to print and electronic instructional resources through establishment of a computer lab and the installation of an electronic learning system; and rebuilding the medical library. Below is a summary of results.

In order to **improve delivery of instruction (objective 1),** and ensure that **instructors and staff are better qualified to prepare students in meeting workforce needs (outcome 1.1),** partners engaged in the following **short-term professional development, curriculum planning, and training in use/maintenance of laboratory equipment (output 1.1.1):**

Students conducting cadaver dissection, September 2012

- ✓ **29** instructors, staff and students trained in Physiology and Neuroscience Modules
- ✓ **30** instructors trained in use of digital resources such as HINARI
- ✓ **9** library staff trained in materials processing and cataloging using SHELVIT!; LibSoft and library skills training; and use and maintenance of printers and laptops
- ✓ **77** 3rd and 4th year medical students trained on supervision of clerkship and didactic teaching of medical school exams
- ✓ **59** medical students trained in cadaver dissection (a total of 22, 3-4 hours sessions)
- ✓ **25** 3rd and 4th year medical students and **5** clinical residents trained in reading radiology scans

Additional visiting consultation activity included co-creation of lesson plans, co-teaching, and various forms of collaboration as part of a mentoring program. **The following instructors and staff at AMDCM were mentored by UMMS visiting faculty and professionals (output 1.1.3):**

- ✓ Dr. Quayee (Anatomoy) mentored under UMMS

Library trainings, October 2011

professor, Deborah Harmon Hines

- ✓ Drs. Quayee and Kamara (Anatomy) mentored in cadaver dissection under UMMS professor, Dr. Anne Gilroy
- ✓ Medical students mentored by Drs. Marshall and Kiiza totaling 2.5 years full support under CEHLS project
- ✓ **16** library staff mentored under James Comes and Elaine Martin

In order to improve teaching and learning, CEHLS supported an **increase access to instructional resources (outcome 1.2)** at AMDCM. The partnership provided **access to and training in digital resources for instructors, students and clinicians (output 1.2.2)** in the following ways**:**

- ✓ Establishment of computer lab with 25 workstations at AMDCM with Wi-Fi access and the Moodle learning system
- ✓ Access to shared anatomy website on the UMMS library website for exchange of resources and ideas throughout the year
- ✓ Installation of eGranary digital library on the computer lab station network providing 30 million educational resources from approved websites without an internet connection
- ✓ Application for access to Health InterNetwork Access to Research Initiative (HINARI prepared, submitted and accepted
- ✓ Introduction of automated cataloging and circulation system, use of patron records for circulation
- ✓ Installation of new 150 KVA generator to power AMDCM classrooms, library, and computer resource room

The new generator will power classrooms and computer lab at AMDCM. June 2015

In addition, **new library holdings** at AMDCM increased by 11,103 items catalogued and shelved under the direction and mentorship of UMMS librarians **(output 1.2.3)**.

The **updated educational offerings at AMDCM enable students to gain skills and knowledge (outcome 2.1).** During UMMS faculty visits to AMDCM, partners **implemented curriculum revision and professional trainings (output 2.1.2)** as well as establishing **new policies and procedures presented to the faculty senate for approval (output 2.1.4):**

- ✓ Establishment of the Anatomy dissection program through a collaborative process between Dean Golakai, Drs. Quayee and Kamara (AMDMC) and Dr. Anne Gilroy (UMMS) consisting of an integrated program of lectures, dissection, imaging and clinical applications with both written and practical exams;
- ✓ Increased access to the library under new policy to expand hours; and
- ✓ Improved access to textbooks through establishment of lending library through the Dean's office.

At the end of the project, partners identified these goals and **key areas for sustainability** of CEHLS initiatives at AMDCM:

- ➢ The long-term goal for the cadaver program is to acquire up to 6 cadavers in the anatomy lab so that students can be fully engaged in the dissection experience. This will require further faculty development through mentoring and long-term training.
- ➢ Radiologic and clinically applied anatomy, critical components of any medical anatomy course, are discussed in the course portfolio but thus far have not been incorporated into the active curriculum. In a focus group of 3rd year medical students, radiology was cited as one area in which they felt least prepared for their clinical rotations (Gilroy, Trip Report, 2012).
- ➢ Integrating visiting faculty into the established curricula of the AMDCM such that they can supplement the course content as well as be available to support and mentor Liberian faculty at appropriate points in the semester: a goal of 2 faculty visitors per semester for each of the first year courses. At present there is a critical need for teaching faculty in many areas, including Anatomy, Biochemistry, and Physiology.
- ➢ Continue efforts to train library staff on basic computer skills; clarify staff roles to optimize productivity.
- ➢ Effective evaluation of students and faculty. The University council is currently studying a proposal for evaluation procedures that will allow two---way evaluations between students and faculty (including visiting faculty) as well as evaluation of the new curriculum.

Strategic plans for AMDCM include progressive increases in the number of students graduating each year. This will require an increase in faculty capacity, but also a greater pool of

qualified candidates ready for a rigorous curriculum. UL's College of Science and Technology (CoST) is Liberia's largest provider of public instruction in the life sciences and is poised to make a significant contribution in supplying AMDCM with qualified applicants. To realize these outcomes, much investment must be made in strengthening curriculum content, delivery, and instruction. The following section details CEHLS contribution to these efforts.

IIb. PARTNERSHIP RESULTS: UNDERGRADUATE LIFE SCIENCES

Faculty, staff and students of UL's College of Science and Technology (CoST) received tailored training and mentoring programs, improving their skills to prepare and train the next generation of Liberia's health care workforce and researchers. Participants were exposed to new techniques and skills which will help them identify and conduct problem-solving research to effect community solutions to Liberia's most pressing development problems.

Under the direction of Dean Ophelia Weeks and contributions of time, talent and suggestions from UL instructors and visiting specialists, much progress has been made towards updating the foundation of the core life science competencies to match 21st century science standards. Dr. Keithanne Mockaitis (IU), in collaboration with Dr. Timothy Kie and Mary Matei (UL), laid the groundwork for reconfiguration of the 300 and 400 level courses into specialized tracks. After the new curriculum framework was established, individual courses and syllabi were updated and revised. Drs. John Berestecky and Peter Humphrey (University of Hawaii/Kapi'olani Community College and UL, respectively) led the revision process and mentored UL instructors in order to prepare them to teach the new curriculum. Dr. Mosoka Fallah, visiting public health specialist, and Ansahta Garnett, CEHLS country director, also made important contributions.

The following section highlights partnership activity within the undergraduate life sciences. Additional information can be found in the annex.

UL instructors train on use of new laboratory equipment. April 2015

To **improve delivery of instruction (objective 1),** and ensure that **instructors and staff are better qualified to prepare students in meeting workforce needs (outcome 1.1),** partners engaged in the following **short-term professional development, curriculum**

planning, and training in use/maintenance of laboratory equipment (output 1.1.1):

- ✓ **290*** individuals trained in curriculum revisions, use of instructional resources in the classroom, laboratory maintenance, and computer literacy (*number includes individuals participating in multiple trainings)
- ✓ **10** courses revised for undergraduate biology and chemistry curriculum, including new courses in public health, cell and molecular biology, and applied laboratory courses for first and second year Biology majors.

In order to boost the number of instructors with advanced degrees and identified by UL as a key area for sustainability for building long-term teaching capacity, **six Life Science instructors receive advanced training from a regional institution (output 1.1.2):**

- ✓ **6** instructors earned MSc degrees from Kwame Nkrumah University of Science & Technology, Ghana in: Genetics, Plant Sciences, Applied Chemistry, Entomology, Public Health Administration, and Public Health Education, returned to UL to teach

In addition to short-term trainings for skills-based tasks, CEHLS partners initiated a **mentoring program for CoST instructors, staff and students** in order to exchange tacit professional knowledge through co-teaching, co-development of lesson plans, and other professional collaboration **(output 1.1.3):**

UL instructors practice DNA separation for the inaugural Microbiology course to be offer at UL. March 2015

- ✓ **24** biology instructors and lab demonstrators received on-going mentorship from Drs. Berestecky (visiting consultant) and Humphrey (UL) in: use, maintenance and storage of equipment; co-development of lesson plans; on-going professional exchange of ideas, information, skills and methodology through development of instructor guides and social media platforms

None of UL's laboratories escaped destruction during the civil war. As a result, there were no applied biology laboratory offerings in the curriculum before the CEHLS project. Through the partnership, UL was able to **increase access to**

laboratory equipment for undergraduate core curriculum and train instructors, students, and staff on its use and maintenance (outcome 1.2 and output 1.2.1):

- ✓ Through the CEHLS project, ***$60,000+*** worth of laboratory and instructional equipment was purchased and shipped to support revised curricula. Equipment included demonstration material for introducing molecular biology into the curriculum, lab demonstration stations, audio-visual equipment, printer, microscopes, and supporting lab supplies such as pipettes, mixers, centrifuge, tubes, etc.
- ✓ **2,287** UL students enrolled in undergraduate biology and chemistry programs received ***61 hours*** of applied laboratory demonstrations

In order to enhance use of instructional resources in the curriculum, The CEHLS project provided instructors with access **to and training in digital resources (output 1.2.2):**

Instructors participate in basic computer skills for classroom management and instruction. October 2013

- ✓ CEHLS established a faculty resource room with **20 computer workstations**
- ✓ Installaed eGranary to access over 30 million educational resources from approved websites without an internet connection
- ✓ Purchased routers and data sticks to access wifi
- ✓ Trained **193** instructors and students on basic computer, presentation, and spreadsheet skills

On November 18, 2013, UL marked the official opening of the Faculty Resource Room in the Natural Sciences building on the Fendall campus. The room renovation was spearheaded by CEHLS to support improved research and instructional capacity for the life sciences. In addition to the resource room, life science instructors now have access to demonstration tables, microscopes, and AV equipment to support new biology curriculum, which was updated and revised by UL instructors in collaboration with CEHLS visiting specialist, Dr. John Berestecky, and approved for use by the Faculty Senate and Board of Trustees in Summer 2013.

UL received **new textbooks in life sciences (output 1.2.3),** updated texts for existing courses and

adopted texts for new offerings**, increasing the** library holdings by more than 17,000 volumes. Furthermore, CEHLS developed and adopted textbook lending program to facilitate access to course readings.

In order to **improve student access to education in and preparation for health and life science careers (objective 2),** UL needed to provide **new and updated educational offerings enable students to gain skills and knowledge needed for MOH demand (outcome 2.1).** Thus, CEHLS partners embarked on the labor-intensive task of **curriculum revisions for new and updated undergraduate programs to align with workforce needs specific to Liberia (output 2.1.2):**

- ✓ **CEHLS partners developed new undergraduate biology scope and sequence** which moves away from descriptive study of plants and animals and replacing it with curriculum based on molecular, integrative, cross-disciplinary approach to biology. The new program emphasizes conceptual and experimental problem solving (from Curriculum Revision Proposal, approved June 2013).
- ✓ **Partners organized** 300 and 400 level courses into five pathways: Medical Sciences; Plant Sciences; Microbiology; Environmental Sciences; and Science Education
- ✓ **Partners developed 10 new and revised courses**: BIOL 105 (Freshman Biology); BIOL 106 (Sophomore Biology); BIOL 111 (Freshman Biology Lab); BIOL 204 Molecular Biology; BIOL 205 Biology of Public Health; CHEM 100 (Freshman Chemistry); CHEM 101; CHEM 102; CHEM 207 Fundamentals of Environmental Chemistry; CHEM 208 Environmental Mitigation & Technology
- ✓ The undergraduate life sciences program adopted new Biology and Chemistry textbooks and laboratory guide to support updated curriculum.

New policies and procedures presented for approval (output 2.1.4) help to ensure sustainability**:**

- ✓ Approval for new biology and chemistry scope and sequence
- ✓ New book lending procedures

At the end of the partnership, stakeholders identified these **key areas for sustainability** of CEHLS initiatives (additional strategies are outlined in more detail within the *College of Health and Life Sciences Strategic Plan,)***:**

- Faculty development: liaise with the Ministry of Foreign Affairs to establish a creative strategy for recruiting science and engineering faculty (nationals, expatriate nationals and expatriates) regionally, and beyond to obtain a 1:50 faculty-student ratio and a full-time to part-time ratio of 4:1;
- Strengthen offerings in BSc Biology tracks especially Environmental Science; Public Health; Microbiology; and Medical Science, introduce Public Health track;
- Develop remedial programs for life sciences programs, adopt policies on conditional acceptance into the program;
- Establish Summer Start bridging programs for Life Science majors as a foundation for Biology Honors program;
- Once renovations are made to the Natural Science building, two additional laboratories can be equipped for upper division biology courses including the laboratory components of Bio 204 Microscopy with Applications to Microbiology; B301 Medical Microbiology; B305 Advanced Techniques in Molecular Biology; B312 Microbiology of Food and Water; Bio 309-310 Biochemistry; Bio 405 Clinical Laboratory Techniques; B408 Genetics and Genomics; and
- Increase internal research capacity, including effective administrative support for grants administration, faculty publications, and proposal submission.

IIc. PARTNERSHIP RESULTS: TUBMAN NATIONAL INSTITUTE OF MEDICAL ARTS (TNIMA)

Together, UL and TNIMA represent Liberia's only public institutions responsible for training allied health workers, including professional nurses and midwives. CEHLS partners sought to capitalize on the strengths of both institutions to advance publically available nursing and midwifery education in the Liberia since UL is the largest provider of baccalaureate and graduate degrees in the health and life sciences and TNIMA is the arm of the nation's teaching hospital, John F. Kennedy Memorial Medical Center (JFKMC).

The articulation plan between UL and JFKMC/TNIMA to offer a Bachelor of Science (BSc) in Midwifery (BScMW) and Nursing is the first of its kind in Liberia. The plan is a formal agreement between the two institutions to accept credits that can be transferred and applied towards a bachelor's degree. This framework provides a blueprint for further training opportunities between the institutions to meet the needs for a qualified healthcare delivery workforce in the country, most notably for the

Physician's Assistants (PAs) and Environmental Health Technicians, two cadres of workers particularly needed during the Ebola crisis.

The CEHLS partners implemented a comprehensive approach to affecting **improved delivery of instruction (objective 1)** at TNIMA which supported training for students and instructors at TNIMA, as well as clinicians at JFKMC. The overarching goals were to develop leaders in both the academic and clinical side of nursing/midwifery through mentorship, leadership training, and advanced study for key instructors.

To ensure that **instructors and staff are better qualified to prepare students in meeting workforce needs (outcome 1.1),** the following **short-term professional development (output 1.1.1), mentoring (output 1.1.3), and advanced training (output 1.1.2) took place:**

- ✓ **315*** students, instructors and clinicians trained in Helping Babies Breathe® technique, nurse leadership skills, test construction, active learning methodology in the classroom, and curriculum development (*number includes individuals participating in multiple trainings)
- ✓ **96** students and clinicians acquired advanced skills during *Nurse Leadership Training programs*, topics included: teamwork, communication and conflict resolution, developing leadership goals, values in nursing leadership, empowerment, and continuing education/professional development
- ✓ **2** instructors from TNIMA earned advanced degrees in **Nursing Education from Indiana University's School of Nursing**, returned to teach and direct the Maternity Hospital unit at JFK and Phoebe Hospital. One of the fellows will serve as the Director for the new BSc Midwifery degree program. Research collaboration between the two universities resulted in an **original research publication**: Bondoe, C., Brown Wraynee, A., Riner, M. Allam, R. & Stephenson, E. (2014). Helping babies breathe: Providing an evidence-based education intervention at a tertiary referral hospital in Liberia. *Journal of Nursing Education and Practice*; 4(9).

Cynthia Bondoe and Ada Brown-Wraynee train nurses, midwives, and students in the Helping Babies Breathe technique. March 2014

- ✓ **16** TNIMA instructors received long-term mentorship including co-teaching; co-development of lesson plans; and professional exchange of ideas, skills, and knowledge

Two TNIMA instructors on the IU Bloomington campus. October 2012

At the beginning of the CEHLS project, there were no BSc degree programs in Midwifery or Nursing in Liberia, despite a regional focus on increasing academic credentials in these fields. Thus, CEHLS partners sought to capitalize on the strengths of both UL and TNIMA to advance publically available education in the Liberia. The agreement developed through the CEHLS project represents the first articulation plan between UL and JFKMC/TNIMA, which represents a formal agreement between the two institutions to accept credits that can be transferred and applied toward a BScM or BScN. It further identifies academic course work that will meet bachelor's degree requirements at UL to **improved student access to education in and preparation for health and life science careers (objective 2)** through **new educational offerings that enable students to gain skills and knowledge (outcome 2.1) to align with workforce needs (output 2.1.2).** Specifically**:**

- ✓ **5** new courses developed for BSc MW program: Transition to Baccalaureate Midwifery; Administration & Leadership in Midwifery Practice; Capstone in Midwifery; Evidence-Based Practice in Midwifery; Midwifery V
- ✓ Articulation plan for BSc Midwifery (BScMW) program to be offered jointly by UL and TNIMA drafted and signed, aligned with harmonized curriculum adopted by the Liberian Board of Nursing and Midwifery and designed in collaboration with stakeholders from MOH/JFK/TNIMA/Liberian Board of Nursing and Midwifery (LBNM).

Despite the close of the CEHLS project, IU and UMMS are actively collaborating with TNIMA in these **key areas for sustainability** through internal funding and the Paul G. Allen Foundation grant (UMMS):

- Support for implementation and sustainability of the BSc Midwifery/Nursing programs through administrative personnel, instructional support, additional fellowships, simulation equipment and training in the use of the equipment.

Clinicians complete Nurse Leadership Training. October 2011

- Agreement with the MOH to continue Helping Babies Breathe® trainings for health care workforce
- Continuation of the Nurse Leadership Program

IId. PARTNERSHIP RESULTS: PUBLIC HEALTH

While Liberia's Poverty Reduction Strategy calls for the increased use of Community Health Workers (CHWs) or Community Health Volunteers (CHVs) in rural areas, public health education and community practice is in its infancy. There are currently no programs in existence to provide public health training for mid-level health workers as a nexus between the health facility and the community. In addition to this gap, there are no four-year undergraduate degree programs in public health in the country. Public health as a discipline is manifest in only two programs:

- Cuttington University has offered a Master of Public Health degree since 2004. However, the need for health care workers in rural catchment areas trained in public health exceeds graduation rate.
- The UL School of Medicine requires six public health courses as part of its medical science curriculum, including Introduction to Public Health and Community Medicine, and Disease

Control and Prevention. Graduates of the medical school, however, are physicians who will focus on primary health care rather than preventive public health programs.

CEHLS partners designed the Certificate in Public Health (CPH) curriculum to fill the existing training gap for mid-level healthcare workers to confront the weakened health care system in Liberia. The CPH is a result of public health working group (PHWG) discussions, convened at the request of UL and MOH, to strategize workforce development solutions focused on preventative services. The PHWG brought together leaders from CEHLS, MOH, and TNIMA, as well as stakeholders from the NGO and professional communities.

Healthcare workers enrolled in the CPH program were trained in the following competencies, which align with MOH strategic objectives for workforce development:

- Monitor health status to identify community health problems
- Diagnose and investigate health problems and health hazards in the community
- Mobilize community partnerships to identify and solve health problems
- Enforce laws and regulations that protect health and ensure safety
- Evaluate effectiveness, accessibility, and quality of personal and population-based health services
- Oversee data collection for disease monitoring by interfacing with CHVs
- Research for new insights and innovative solutions to health problems
- Network with other CPH graduates for problem solving, professional development and mentoring

In addition to the CPH, CEHLS consultants spearheaded efforts to infuse public health skills, themes, and case studies into the existing curriculum at UL. Below is a summary of accomplishments (see annex for graduation ceremony presentation).

Dr. Fallah teaches public health to CPH students. November 2013

Before the CEHLS project, none of UL's undergraduate life science instructors had advanced degrees in public health. In order to **improve delivery of instruction (objective 1),** UL identified the need to have **instructors that**

were better qualified to prepare students in meeting workforce needs (outcome 1.1). Seeing public health as a cross-cutting discipline relevant to all of Liberia's National Development Goals, CEHLS partners developed a comprehensive approach to addressing the lack of existing capacity in this area. **Instructors were awarded scholarships to obtain advanced degrees (output 1.1.2) and mentored by visiting faculty (output 1.1.3):**

A CPH student conducts a community needs assessment. February 2014

- ✓ **2** UL instructors obtained advanced degrees in Public Health from Kwame Nkrumah University of Science & Technology, Kumasi, Ghana, return to teach at UL.
- ✓ **9** instructors mentored by Dr. Mosoka Fallah, visiting public health specialist, mentoring activities included co-designing CPH syllabi, incorporating instructional resources into the curriculum, co-teaching, assessment strategies, and practicum supervision.

CPH students collaborated with CHV to conduct community needs assessments. February 2014

In addition, **new and updated educational offerings were established to enable students to gain skills and knowledge aligned with workforce needs (outcome 2.1, output 2.2.1, output 2.2.1) and UL offered a new certificate program that developed skills to meet health workforce priority needs (output 2.1.1, output 2.1.4):**

- ✓ Certificate in Public Health (CPH) curriculum developed and approved by UL and MOH
- ✓ **10** MOH employees complete CPH program which includes 3-months of classroom instruction, an internship experience, and field training focused on the following skills: conducting community health surveys; mobilizing community health teams for maternal care, sanitation, and childhood disease; and monitoring for chronic illness in communities

- ✓ **7 new course**s for the CPH are developed using with stakeholder input: Introduction to Community Health; Introduction to Maternal and Child Health; Disease Surveillance; Intro to Environmental Health; Social and Behavioral Determinants of Health; Intro to Health Administration; and Intro to Computer Applications in Public Health
- ✓ **5 digitized Public Health & You in Liberia courses** with case studies from CPH practicum for delivery in off-campus settings : Introduction to Public Health in Liberia; Environmental Health in Liberia; Epidemiology and Biostatistics; Public Health Administration; Behavioral, Social and Community Health

In order for the public health initiatives to continue, CEHLS partners identified the following **key areas for sustainability:**

- Support for scaling up CPH program: continued partnership with MOH to design and develop training based on demand
- Support for Public Health tract in the UL undergraduate program: faculty funding and curriculum development
- CPH curriculum guides national curriculum for community health workers, feedback into UL and TNIMA academic units in health-related fields: use of digitized curriculum for introductory courses and professional development for MOH

First cohort of 10 MOH employees completes the CPH training. April 2015

III. CHALLENGES

<u>October 1, 2011-September 30, 2012 (FY12):</u> Negotiation and execution of three subagreements, absence of renovated labs at Fendall Campus, recruitment of visiting professors for UL, and purchasing equipment for laboratories were cited as major challenges that partners faced during the implementation of partnership programs in FY12. These are further described in Table 1.

Table 1: FY12 Implementation Challenges		
Challenges	**Impact**	**Action Taken**
Absence of renovated labs at Fendall Campus	The experiential component of laboratory learning was meant to drive the changes in the science coursework and curriculum. Revisions of curriculum will therefore be impacted and partners also will have to change the timeline for delivering lab equipment and training.	Partners reconfigured laboratory purchases based on existing capacity, including AV technology for demonstrations and instructional resources with virtual laboratory exercises.
Recruitment of visiting professors for UL	It was challenging to identify, recruit, and send three visiting professors to UL since faculty members would need a buy-out for existing courses.	Working closely with USAID/Liberia and HED, partners were able to address the contractual issues that contributed to the delay in implementing this component of the program. By FY13, Drs. John Berestecky and Mosoka Fallah were hired as long-term visiting consultants on the project.
Negotiation and execution of three subagreements	HED and IU entered into a subagreement and subsequently IU and UMMS entered into an agreement. At the same time, both IU and UMMS also entered into agreements with UL. This high number of subagreements between different parties took time to negotiate and execute.	Partners involved the HED Grants and Contracts unit which helped the partners with the contracting issues they were encountering.
Purchasing equipment for laboratories	It has put the partnership behind schedule for laboratory deliverables and all associated program activity, including trainings for instructors and student access to instructional resources.	The partnerships consulted with partners at UL as well as consultants from regional institutions (Dr. Takrama, University of Cape Coast/Cocoa Research Institute of Ghana) and have a plan for purchasing, delivering, storing, and using temporary lab equipment until the Science building at Fendall Campus is renovated.

October 1, 2012-September 30, 2013 (FY13): This fiscal year was marked by a budget freeze and subsequent reduction of award amount (from $7.2M to $2.6M). The first half of the fiscal year was spent rebudgeting, reworking implementation plans, and securing outside funding to move forward with travel plans. See Table 2 for details.

Table 2: FY13 Implementation Challenges		
Challenges	**Impact**	**Action Taken**
Purchase and installation of laboratory equipment	Due to sequestration of funds during the spring and summer of 2013, the purchase of computer equipment for the UL AMD faculty and student was delayed.	Rather than installing them by the first quarter of FY14, they were purchased in the first quarter and installed during the second and third quarters of FY14.
Budget freeze and reduction	Computer purchases were delayed as well as staff hiring for Q3 and 4 at AMDCM. Advisory Board meeting postponed due to freeze on travel. Many equipment purchases were removed from the budget (see Annex 5 for list of equipment that removed from the reduced budget).	IU provided funding for Michael Reece to visit in order to move forward with plans for the Certificate in Public Health. IU also supported a visit to Indiana for Dean Ophelia Wees to meet with CEHLS PI and project staff (Charles Reafsnyder and Kathleen Sobiech)

October 1, 2013-September 30, 2014 (FY14): Student protests and campus disruptions made consistent progress on project deliverables difficult during the first half of FY14. The Ebola outbreak was announced on March 25, 2014 and escalated throughout the second-half of FY14. President Sirleaf declared a State of Emergency on August 7, 2014. A Level 3 travel warning through CDC began on July 31, 2014 and was in effect until May 13, 2015. See Table 3 for details.

Table 3: FY14 Implementation Challenges		
Challenges	**Impact**	**Action Taken**
University of Liberia closure On November 25, 2013 UL closed, after several days of disruption and protests. The campus finally reopened on January 20, 2014 delaying the academic cycle.	Difficulty in officially communicating with Provost Dr. Wede Brownell caused a disruption in plans for moving the BSc in Midwifery approvals through the UL faculty senate. Dr. Brownell was subsequently removed from her position at the university in a very public and disruptive event. The closure also limited Dr. Berestecky's ability to hold trainings for the life science faculty since the Fendall Campus was closed immediately	President Dennis appointed Dr. Walter Wiles as Acting Provost, charged with ushering the BSc Midwifery plans through the university approval process. Dr. Berestecky used his time in Monrovia to meet individually with faculty members and complete four instructor pamphlets to accompany the new Biology curriculum.

Broken generator on Fendall campus The main generator supplying power to the Engineering and Natural Science buildings on the Fendall campus was inoperable for six weeks during the semester (first week of February until March 24, 2014).	The loss of power caused obvious disruptions to the faculty's ability to prepare and deliver lectures. During this time, the CEHLS faculty resource room sat idle, since the computers were not operable. All of the lab equipment for demonstration was also left unused during this time.	Ophelia Weeks worked with UL to fix the generator. The partnership was discouraged from buying a small generator because there isn't anyone to maintain it, purchase the fuel, or keep it secure. The partnership was discouraged from buying a larger air conditioning unit for the computer resource room because of the load increase on the existing generator. In addition, the partnership needs an air conditioner for the lab supply room where there are microscopes at risk of molding.
Ebola outbreak-WHO officially declared the outbreak on March 25, 2014	CPH students, preceptors, and instructors were selected by the MOH to train with the WHO to implement community awareness programs and training of the trainers for Ebola protocol in the clinics. They conducted outreach to over 2,300 people in communities from February-May, 2014. See Annex 8 for presentation of CPH accomplishments.	CEHLS team continued to collaborate and work via internet communications and phone calls to maintain momentum and accomplish the majority of the activities in the FY14 implementation plan. CPH graduation was delayed until April 17, 2015.

October 1, 2014-June 30, 2015 (FY15): Relief from Ebola was not in sight at the beginning of FY14. Partners attempted to assemble for an Advisory Board Meeting on the IU-Bloomington campus, but plans for visitors from the West African region were not approved due to confusion surrounding Ebola protocol in clinical care settings in the US (the news about the first case of Ebola in the US had just appeared on September 30, 2014 so attention was heightened). Partners instead scheduled meetings via video-conference but were not able to meet again as a group before the end of the partnership since CDC's Level 3 travel threat was not downgraded until May 13, 2015.

Table 4: FY15 Implementation Challenges

Challenges	Impact	Action Taken
Continuation of Ebola Outbreak. CDC level 3 travel warning not downgraded until May 13, 2015	Partners at IU could not budget for travel until the warning level was downgraded.	Strategic planning was held via video-conferencing and weekly phone calls. Representatives from Clinton Health Access Initiative and HED came to Bloomington to connect. The US Embassy in Monrovia hosted UL partners for video-conferencing.

Budget realignment not approved until June 2, 2015	This gave us only 28 days to complete the remaining Public Health & You training, install the generator, and obtain the supplies and equipment needed to complete the computer resource room at Fendall. Rick Rabe, from UMMS, was unable to go to Monrovia to work on the AMD computer resource room since there was no generator to power the room.	IU purchasing department fast- tracked the equipment purchase and the rest of the items were purchased in Monrovia to cut-out delivery time. Fortunately our country director, Yna Garnett, and the CEHLS student volunteer, Johnny Montgomery, were able to complete everything by June 30th. UMMS funded a trip for Rick Rabe to follow-up with any computer lab issues.
Lack of IT support	As described in the SWOT analysis of the College of Health and Life Sciences (CHLS) Strategic Plan and the close-out narrative, lack of connectivity for for students and faculty still inhibits use of the online journals, such as HINARI. In addition, the lack of full-time, skilled IT consultants for the department are lacking and contributed to the prolonged technical issues in the computer resource room.	In the modified budget, the partners included equipment recommended by USAID technical advisor Kelvin Beh. The equipment was purchased and supplied to the university before June 30th.
Irregular academic calendar	Dean of the AMD College of Medicine, Vuyu Golakai, re-opened the school in April, but only for 6- weeks of review and final exams. Thus, he did not want UMMS faculty to come during that period.	Dean Golakai traveled to UMMS instead. Conducted strategic planning meetings with UMMS partners.

IV. SUSTAINABILITY

Many important human capacity and institutional development (HCID) goals at UL in support of a sustainable health services delivery system in Liberia remain to be accomplished. Administrative and financial support for the *CoHLS Strategic Plan* is one mechanism for streamlining the process of continued HCID activity, leverage funding from USAID's planned investment in renovation of CoST facilities, CDC investment in public health training, and other various health systems strengthening activity under the MOH. During the past four years, UL partners have pursued linkages with the health and life science programs at other African universities, local, regional and international agencies and associations and stakeholders in the private sector to re-establish its relevance as a training institution and ensure sustainability. In addition to the keys to sustainability within each academic unit, below is a summary of sustainability efforts at the institutional-level.

During the project development, CEHLS partners identified several ways to **increase status and permanence of UL as a leader in the areas of health and life science education (objective 3)** in addition to the improvements in **educational offerings (objective 1)** and **improved student access (objective 2).** These components include new linkages to promote collaboration (outcome 3.1), establishment of an Advisory Board (3.3.1), pursuit of Memorandums of Understandings with other institutions (3.1.2) and

new proposals submitted for funding (3.2.1). Partners were able to accomplish the following activities aimed at sustainability:

- ✓ Strategic linkages and collaborative activity with **24** local, regional, and international organizations related to CEHLS activity: e.g. MOH, JFKMC, Liberian Board of Nursing and Midwifery, City of Monrovia Department of Sanitation and Waste Management, EHELD (USAID), Careysburg, Todee, and St. Paul Community Associations, University of Ghana, Kwame Nkrumah University of Science and Technology, UNICEF, Jhipego, Clinton Health Access Initiative, see Annex for complete list
- ✓ Establishment of **CEHLS Advisory Board**
- ✓ **4 advisory board meetings** during the CEHLS project with multiple governmental and non-governmental organizations represented
- ✓ **3 MOU**s signed between UL and higher-education institutions to support CEHLS activity
- ✓ **11 external proposals** submitted to support CEHLS activity
- ✓ **1 Strategic Plan** for the College of Health and Life Sciences developed and submitted to outside funding agencies

Partners recommend that UL support continuation of these **key efforts to ensure sustainability of CEHLS activity:**

- ✓ Support for Career Lab (Annex 9)
- ✓ Support for Office of Research Administration with highly trained staff to support project development, submission, and management
- ✓ Support for capacity development in UL's Finance Department
- ✓ Continuation of bi-annual advisory board meetings specific to health and life science programming

V. CONCLUSION

The MOH in its document, Investment Plan for Building a Resilient Health System 2015-2021, has highlighted the need for improved communication between training institutions and MOH to better supply a Liberian healthcare workforce capable of providing "safe, quality Essential Packages of Health Services."[1] A high-priority investment area under this plan is to ensure that pre-service education is not

[1] Ministry of Health, Government of Liberia. (May, 2015). Investment Plan for Building a Resilient Health System 2015-2021, v12, unpublished.

only increased, but is needs-based, resulting in a robust system able to withstand public health emergencies, day-to-day demand, and preventative services. To meet these goals, great investment must be made to human capacity development within the MOH as well as within the training institutions.

Currently, UL and TNIMA still face overwhelming obstacles in providing students the foundational knowledge and skills essential for entry into professional health services. These include:

(1) Students who are unprepared for a rigorous science curriculum;
(2) A shortage of instructors with advanced degrees;
(3) Inability to compensate instructors appropriately;
(4) Lack of updated and applied health and life science courses;
(5) Inadequate support for facilities management and professional development;
(6) A shortage of text, reference, and instructional material/technology to support classroom teaching;
(7) A gender imbalance in life science enrollments; and
(8) Little coordination between the life sciences curriculum and the country's other tertiary institutions;

In addition, there is a lack of administrative resources to serve as a foundation for strong academic programs. Immediate priorities for improvement include: (1) developing a reliable and independently auditable financial management system in order to improve efficiency, accountability, and grants administration; (2) connectivity to the internet across all campuses; (3) introduction of a digital management system for student records, bursar accounts, data management and regulation of learning environment (5) adequate IT access and support for administrative and academic endeavors; (4) and professional development for staff.

Because life science education relies heavily upon the concepts and skills learned through laboratory instruction, achieving many of the key health care workforce goals depends upon access to appropriate facilities and technology. The facilities in UL's Natural Sciences building are woefully inadequate even though the undergraduate programs will form the foundation for all branches of the healthcare workforce. The basic mechanical and electrical systems in the building no longer function. There is no building-wide power supply (electrical wiring and lighting are in need of replacement) and no

hot and cold running water, gas or supply systems for Bunsen burners, cold rooms for storage of chemicals, or lockable storage cabinets for chemicals and supplies.

In addition, teaching laboratories lack the most basic equipment and supplies needed for instruction. The requisite chemicals, specimens, and standard equipment such as autoclaves, chemical hoods, scales, freezers, thermal cyclers and safety equipment are lacking, and there are few technology resources available to help augment instruction such as a local area network, laptops and projectors. Improving the physical infrastructure of labs and teaching venues is essential to improving the UL's capacity to contribute to the country's health care workforce.

Realignment of the health and life sciences within UL, under leadership of a Vice President for Health Sciences and supported by various deans, will position CoHLS to use its human, financial, and physical resources more efficiently and effectively to reach HCID goals. Despite the transformative impact of CEHLS activity, important HCID goals at UL in support of a sustainable health services delivery system in Liberia remain to be accomplished. The *CoHLS Strategic Plan* is a framework for moving UL forward in its pursuit of:

> *"an educational institution of excellence, striving to operate by the highest standards of accredited scholarship and professionalism, mandated and dedicated to promoting evidence-based practice, community outreach and social welfare services, as well as research and scientific enquiry necessary to enhance successful pursuit of national reconstruction, development and nation-building."* **-CoHLS Strategic Plan Organizational Principles**

The strategic plan was developed by an Executive Working committee from UL, in partnership with IU and UMMS, in order to provide a concerted approach to the management and development of a new College of Health and Life Sciences at the University of Liberia. Plans put forth the document require an investment of **$7,550,000** over the next (3) years (in addition to infrastructure costs).

Annex: List of Contents

1. Success Stories
2. Curricula and Courses Developed
3. Short-term Training
4. College of Health and Life Sciences Strategic Plan
5. Items Removed from Reduced Budget
6. Partnership Proposals Submitted
7. List of Collaborators
8. CPH Presentation
9. Career Lab Proposal

University of Liberia

College of Health and Life Sciences

Strategic Plan

2016-2021

This strategic plan has been developed by the Executive Working committee from University of Liberia, in partnership with Indiana University and University of Massachusetts Medical School, in order to provide a concerted approach to the management and development of a new College of Health and Life Sciences at the University of Liberia.

Dr. Walter Wiles, Chair, Executive Committee
Dr. Vuyu Golakai, Co-Chair Executive Committee

Note: Plans put forth in this document require an investment of $7,550,000 over the next (3) years.

Abbreviations

AMDCM	A.M. Dogliotti College of Medicine
CEHLS	Center for Excellence in Health and Life Sciences
CoHLS	College of Health and Life Sciences
CoST	College of Science & Technology
CPD	Continuing professional development
CPH	Certificate in Public Health
GME	Graduate Medical Education
HCID	Human Capacity and Infrastructure Development
HCP	Health care professional
HED	Higher Education for Development
IU	Indiana University
JFKMC	John F. Kennedy Medical Center
MOH	Ministry of Health
TNIMA	Tubman National Institute of Medical Arts
UL	University of Liberia
UMMS	University of Massachusetts Medical School
USAID	United States Agency for International Development

I. BACKGROUND STATEMENT

Liberia College was founded in 1856 and inaugurated on January, 1862.The First President of Liberia, Joseph Roberts, began the operation of Liberia College after it was inaugurated. Liberia College from its founding until its incorporation as the University of Liberia (UL) has made a significant contribution to the social, economic, cultural and educational life of the Republic. The university is by far the **largest provider of life science education in Liberia**. At the outbreak of the Ebola epidemic, approximately 60% of all students studying the health and life sciences in Liberia were enrolled in UL's Faulkner College of Science and Technology (COST). Significant investment in the area of health and life science program thus promises to yield significant results towards meeting national goals for workforce development.

The Tubman National Institute of Medical Arts (TNIMA) was established in 1945 through the effort and cooperation of the Liberia National Public Health Service, now the Ministry of Health (MOH), and the United States Public Health Mission. In 1945, two existing programs for the training of nurses, namely professional and practical nursing, were merged and offered through the John F. Kennedy Medical Center (JFKMC). The union was named TNIMA, after the incumbent President of Liberia, William V.S. Tubman. TNIMA provides the only publicly-operated nursing and midwifery programs.

The Ministry of Health (MOH) in its document, *Investment Plan for Building a Resilient Health System 2015-2021*, has highlighted the need for improved communication between training institutions and MOH to better supply a Liberian healthcare workforce capable of providing "safe, quality Essential Packages of Health Services."[1] A high-priority investment area under this plan is to ensure that pre-service education is not only increased, but is needs-based, resulting in a robust system able to withstand public health emergencies, day-to-day demand, and preventative services. To meet these goals, great investment must be made to human capacity development within the MOH as well as within the training institutions.

Cognizant of the dire healthcare situation in Liberia even before the Ebola crisis and cognizant of higher education's unique position to make a powerful and long lasting contribution towards health systems strengthening, UL and TNIMA drafted a strategic plan to articulate steps towards achieving comprehensive training opportunities for Liberia's health care workforce originally funded under the Center for Excellence in Health and Life Sciences (CEHLS). CEHLS was funded by USAID and implemented by Higher Education for Development (HED) as a four-year (October 2011-June 30, 2015), $3 million activity to support academic partnership between the University of Liberia (UL), Indiana University (IU) and the University of Massachussets Medical School (UMMS) aimed at improving in health care workforce training in Liberia.

[1] Ministry of Health, Government of Liberia. (May, 2015). Investment Plan for Building a Resilient Health System 2015-2021, v12, unpublished.

The partnership focused on improving instructional quality in introductory courses, upgrading preclinical science curricula, and increasing access to teaching and learning resources. The major objectives of the partnership were to:

a) Improve delivery of health and life science programs at UL
b) Improve UL student access to education in and preparation for health and life science careers
c) Increase the status and permanence of UL as a leader in the areas of health and life science education

Accomplishments under the partnership include:

Faculty Support

- Supported (6) UL instructors to obtain advanced degrees at Kwame Nkrumah University of Science and Technology. All are currently teaching at University of Liberia after receiving advanced degrees in Public Health and Applied Sciences.

- Supported (2) TNIMA instructors to obtain advanced degrees at Indiana University School of Nursing. Both are currently teaching at TNIMA, as well as acting in lead administrative positions.

- Long-term faculty support for (2) visiting specialists for clinical supervision of medical students (Drs. Marshall and Kiiza).

- Support for specialists in Biology (Drs. Humphrey and Berestecky) and Public Health (Dr. Fallah) to update curriculum, mentor faculty, conduct trainings on pedagogy, incorporating instructional materials to the classroom, and enhance computer skills.

- (25) instructors trained on computer skills for classroom instruction on the Fendell campus.

- (30) instructors and staff trained on the use of WHO database (HINARI) for research and evidence-based practice at UL's A.M. Dogliotti College of Medicine (AMD).

- Logged (72) faculty teaching hours using new laboratory and instructional equipment.

New and revised curriculum

- Completed scope and sequence for baccalaureate curriculum and developed (5) new courses focused on clinical leadership, care of high-risk populations, and evidence-based clinical practice with stakeholder input for new BSc Midwifery and BSc Nursing degrees to be launched in 2015 through an agreement between UL and TNIMA.

- First cohort of (10) students completed the newly offered Certificate in Public Health (CPH) program for working professionals, launched in collaboration with Liberia's Ministry of Health to provide preventative-care training to mid-level health workers. First cohort of CPH students are currently trainers of trainers for community-based Ebola response teams.

- Digitized Public Health & You in Liberia curriculum to include case studies from CPH field experience.

- Restructured two-year core Biology curriculum developed and approved, first year implemented

- Comprehensive reorganization of Biology curriculum into (5) pathways: Medical Sciences; Plant Sciences; Microbiology; Environmental Sciences; and Science Education. New courses developed in cellular and molecular biology and biology of public health. New laboratory courses for general studies and first and second year biology majors. Instructors trained in delivery of new courses, new pedagogical guides developed with stakeholders.

- New remedial courses offered in biology and math at TNIMA.

Instructional resources

- Delivered and set-up equipment for microbiology labs to support new curriculum, trained and mentored faculty for use in the classroom, as well as its storage and maintenance.

- Established (23) computer workstations at UL's Fendall campus, AMD and JFK, including hot-spots at AMD to support a computerized learning management system, digital library, and evidence-based teaching.

- Provided library cataloguing and circulation software to AMD librarians (cross-referenced under training and mentoring).

Training and Mentoring

- (587) individuals participated in short term training covering anatomy, Helping Babies Breathe, laboratory pedagogy, public health instruction, using digital resource to support curriculum, evidence-based nursing practice, grant writing, and nurse-leadership training.

- Cohort of (10) MOH employees received training under the Certificate in Public Health program.

- Long-term mentoring for (54) instructors at UL, AMD, and TNIMA.

- Provided XX hours of training in library cataloguing and circulation to AMD librarians.

Leveraged Funding/Future Funding

- UMMS awarded $7.5M to continue support to AMD in teaching, mentoring and residency focused on Ebola prevention and detection in clinical setting.

- MOU between IU's School of Public Health and UL for two fully-funded PhD fellowships (Epidemiology and Environmental Health) worth $287K. First candidate, James McClain started coursework in Spring 2015.

- Secured donation of approximately 25,000 text and reference materials in medicine, nursing, biology, chemistry, public health and general sciences for the AMD and COST libraries.

- MOU between USAID and UL for $7.5M renovation of the COST building on the Fendall campus.

Strategic Planning

- Strategic Planning document outlining development of **College of Health and Life Sciences (CoHLS)** at UL over the next 10 years, created in collaboration with MOH and Clinton Health Access Initiative partners, Ministry of Education, and TNIMA. See Appendix 1 for list of contributors.

Despite the transformative impact of CEHLS activity, important human capacity and institutional development (HCID) goals at UL in support of a sustainable health services delivery system in Liberia remain to be accomplished. Administrative and financial support for CoHLS is one mechanism for streamlining the process of continued HCID activity and will help leverage funding from USAID's planned investment in renovation of CoST facilities, CDC investment in public health training, and other various health systems strengthening activity under the MOH.

II. ADMINISTRATIVE OVERVIEW-CoHLS

Realignment of the health and life sciences within UL, under leadership of a Vice President for Health Sciences and supported by various deans, will position **CoHLS** to use its human, financial, and physical resources more efficiently and effectively to reach HCID goals. Despite the transformative impact of CEHLS activity, important HCID goals at UL in support of a sustainable health services delivery system in Liberia remain to be accomplished.

Implementation of the **CoHLS** Strategic Plan requires official assessment and approval by UL's University Senate and endorsement from the Board of Trustees. Approval is necessary not only to create a new academic entity within the university structure, but to obligate the Government of Liberia to assume proprietary ownership and responsibility for provision of financial and other appropriate logistic support for its existence, operation and sustainability.

To facilitate this process, **CoHLS** working groups have been established in order to solicit support in all aspects of articulation and actualization of the proposed project (See Appendix 2 for TORs). During the strategic planning phase, the working groups have been responsible for:

- gathering data and reports necessary for documenting current resources available for instruction in the selected field; gather data on project workforce development needs in the field over the next 5-10 years;
- making recommendations to the Executive Committee on program enhancements and/or new degree programs that should be instituted to meet future workforce needs based on UL areas for competitive advantage;
- soliciting external stakeholder recommendations on new program developments;
- meeting the timetable set by the Executive Committee for completion of data gathering and completion of initial drafts of the working group report ;
- insuring that the thrust of recommendations are clearly linked to and appropriate for the health care workforce development needs of Liberia; and
- making any changes subsequently recommended by the Executive Committee in the draft report.

During implementation, the Executive Committee will:

- adhere to outcome-oriented approaches to implementation and evaluation
- operationalize the **CoHLS** strategic plan within the current healthcare delivery system including the mechanism for health workforce supply/demand forecasting in concert with the MOH and other training institutions;
- identify and manage resources: sourcing, allocation and utilization;
- market the concept and reality of **CoHLS** as an important / vital entity and social product; and lastly

- mobilize internal and external input, support, good-will and linkages for external assistance, cooperation and support for long term sustainability.

III. ORGANIZATIONAL PRINCIPLES

VISION

CoHLS will be an educational institution of excellence, striving to operate by the highest standards of accredited scholarship and professionalism, mandated and dedicated to promoting evidence-based practice, community outreach and social welfare services, as well as research and scientific enquiry necessary to enhance successful pursuit of national reconstruction, development and nation-building.

MISSION

To establish, maintain and sustain a College that serves to develop appropriately qualified graduates capable of delivering requisite healthcare services that satisfy national need for sustainable, quality healthcare and self-reliance in education, training and skill transfer.

VALUES

CoHLS shall strive to fulfill its mandate in a variety of ways, including, but not limited to:

- pursuit of sustainable, self-reliant human capital development through education, training and skill transfer;
- engaging in scientific inquiry in all areas of the health sciences in order to generate new knowledge, information and data resulting in a better understanding of unknown quanta in the health professions and healthcare delivery system;
- cultivating and nurturing a sense of community awareness and service outreach to engender physical, mental and emotional fitness and social well-being;
- providing institutional leadership, support and cooperation in changing attitudes and mind- sets that are inimical to progressive modern nation-building;
- cultivating and practicing a sense of intra- and inter-sectorial collaboration and cooperation in Liberia;
- initiating and nurturing institutional support and cooperation within the university community and with other tertiary institutions, agencies and organizations in Liberia committed and dedicated to pursuing human resource development, training and acquisition and transfer of skills essential for national capacity-building;
- liaising with and collaborating with and supporting the Ministry of Health and Social Welfare in enhancing its efforts to provide nation-wide satisfactory healthcare delivery in Liberia;
- establishing collaborative relationships with other universities and research institutions both within the sub-region and abroad;

- serving the nation in any constructive and meaningful manner within the limitations of its basic core institutional philosophy and professional ethos.

IV. ENVIRONMENTAL SCAN

Liberia's health workforce training institutions face burdens that are common throughout the developing world. These include:

- Growing demand in every aspect of health care delivery
- Ineffective planning and policy initiatives
- Insufficient management and administrative support
- High-levels of brain-drain and attrition
- Problems of development and sustainability
- Inability to incorporate transitions of the 21st Century

(Golakai, V. (2015). *Presentation to UL Board of Trustees: Health Sciences Project*)

These factors reflect sector-wide barriers to capacity building and therefore guided an analysis of the strengths, weaknesses, opportunities and threats (SWOT) within the existing health and life science units: CoST, AMD, TNIMA, and Student Services. Because each unit is unique in its ability to respond to the environment, the analysis is conducted separately and summarized through a meta-analysis listing key determinants to be addressed in the strategic plan.

CoST:

Strengths	Weaknesses
General: • Dedicated faculty • New core curricula • students who are motivated to learn • Modern computer learning lab *Organization:* • Willingness of department chairs to make a difference • Presence of faculty room with computers • Faculty is motivated to complete strategic planning for department, in-progress *Regulations/Policies:* • Policies are outlined and written down *Management:* • Adequate and effective *Human Resources:* • Promising leadership in faculty and department chairs • Fellowship programs to support the following: Biology (3 PhD, 9 MSc, 10 BSc); Chemistry (no PhD, 12 MSc, 6 BSc, Math 1 PhD part-time, 2 MSc, Physics, 3 PhD, 6 MSc) *Finance:* • Receive government funding	*General:* • Too many students • Students not adequately prepared for curriculum • Materials not available for teaching • Part-time/full-time ratio too high • Inadequate lab space and equipment • Lack of clinical laboratory science capacity *Organization:* • No advisory group • Limited processes and procedures in-place for organization structure, student services, etc. *Regulations:* • Lack of implementation/adherence to policy • Lack of clear consequences for violations *Management:* • Lack of resources • Lack of guidelines for departments *Human Resources:* • Student to faculty ratio too high • Lack of faculty with terminal degrees • Salaries are too small to attract and keep qualified faculty/pay is irregular and unreliable *Finance:* • Government provides less than 30% of funds

Administration: • Dean and department chairs are effective and willing to work *Infrastructure:* • Natural Sciences building is large and has lots of potential, very nice pre-war facilities • Adequate space • Room for expansion • Good environment for learning • Books are available and updated • Each subject has a reading room with updated textbooks • Modern/new library	requested by UL (last year UL presented a $30+ M budget and received $10M) • Student tuition is less than $2 per credit *Administration:* • Lack of IT and equipment for administrative capacity (grades, records, etc) *Infrastructure:* • Limited bathrooms • No cafeteria • No recreational facilities/student lounges • Lack of running water and electricity • Laboratories are not usable • Dearth of equipment and instruments, biological and chemistry supplies • Leakage in roof, window breaking or absent
Opportunities	**Threats**
General: • Remedial and/or supplemental classes/more tutorial sessions led by advanced students • Faculty training opportunities • Incentives to attract full-time faculty • Articulation programs with TNIMA, especially for a BSc Physician's Assistant program and BSc in lab science/biotechnology *Organization:* • Strategic planning process will illuminate areas where new policies and procedures need to be implemented • Strategic planning Executive Committee can mandate advisory groups • Cycle for review of policies can be articulated in strategic planning goals *Regulations:* • Strategic planning process will illuminate areas where new policies and procedures need to be implemented • Cycle for review of policies can be articulated in strategic planning goals *Management:* • Trainings for staff • Articulate goals for management improvements in development of strategic plan *Human Resources:* • Faculty training • Employ more full-time faculty with credentials *Finance:* • Business and Finance office needs to be updated • Improve processing of payments • Slight increase student tuition • Seed funding to support faculty research *Infrastructure:* • Renovation of facilities by USAID? • New donors to ensure power and water are reliable • Proper storage for chemicals/lab equipment	*General:* • Lack of reliable electricity/water supply • Politics of class size • overcrowding • Lack of financing or financing with donor restrictions that do not adequately meet needs and/or support long-term strategy for increased capacity *Organization*: • Political will to implement changes *Regulations:* • Political will to implement changes *Management:* • Lack of financing or financing with donor restrictions that do not adequately meet needs and/or support long-term strategy for increased capacity • Political will to implement programs *Human Resources* • Lack of financing or financing with donor restrictions that do not adequately meet needs and/or support long-term strategy for increased capacity *Finance:* • Financing is needed to train and equip Business Office with modern accounting system • Political will to implement changes *Administration:* • Lack of financing or financing with donor restrictions that do not adequately meet needs and/or support long-term strategy for increased capacity *Infrastructure:* • Insufficient financing to make major improvements or financing with donor restrictions that do not adequately meet needs and/or support long-term strategy for increased capacity

• Work with US and local partners to find more funding for materials and equipment • Increased capacity for clinical laboratory studies and research programs	

AMDCM:

Strengths	Weaknesses
General: • Quality students who are motivated to learn • Modern computer learning lab installed by CEHLS project • Anatomy lab upgrade, reintroduction of cadaver dissection program (2013) *Organization:* • proper administrative structures are in-place • effective governance • 41 faculty part-time, 5 PhDs, 36 MDs with various specialties • 1:6 student to faculty ratio *Regulations/Policies:* • Policies are outlined and written down • Policies are utilized and respected at AMD *Management:* • Adequate and effective *Human Resources:* • Faculty is mostly Liberian and is therefore able to deal with Liberian issues • International academic collaborative partnerships to help with mentorship for Anatomy, Biochemistry, Internal Medicine, OB-Gyn, Surgery, and Pediatrics faculty • Dedicated faculty *Administration:* • Adequate and effective *Infrastructure:* • Library contains 8,000+ new books • New computer learning lab (internet access could open markedly expanded access to conference and learning materials) • Guest house on campus for visiting faculty	*General:* • No space for expansion • Infrastructure needs maintenance and updates • Staff and faculty development in pedagogy, evidence-based teaching, utilizing instructional resources in the classroom *Organization:* • Student services are inadequate • Students are inadequately prepared for curriculum, leading to high attrition rate • # of part-time faculty too high, salary not enough to attract full-time faculty *Regulations/Policies:* • Policies do not currently have a regular cycle for review and updates *Human Resources:* • Constrained by # of qualified faculty in-country, competing resources and need • Two faculty in the following areas are needed: Anatomy, Physiology, BioChemistry, Pediatrics, Ob/Gyn, Surgery, Internal Medicine, Pathology • More staff development and trainings needed • Too many part-time employees • Not enough research activity for faculty *Finance:* • Inadequate funding • No independent budget • Not enough support from government • Not enough research dollars or grants management infrastructure to obtain grants directly • No overhead rate set by accrediting agency • No philanthropy/endowment for development *Infrastructure:* • Insufficient office space for Instructors • No functional labs (except Anatomy); Anatomy lab needs floor and fume fan repairs • Dilapidated buildings • Difficulty with utilities • insufficient space for more classrooms • Electricity, water supply, and internet are not reliable • Student dorms
Opportunities	**Threats**

General: • New funding for strengthening health systems can be utilized to upgrade facilities and offer professional development to faculty/staff • Internet access could open markedly expanded access to conference and learning materials • Potential for campus-wide use of Moodle, already installed at AMD *Organization:* • Faculty trainings • Offer better services to students *Human Resources:* • With new funds, opportunities for local research • Academic collaborations offer opportunities for research training and collaborative research • Funding for graduate degrees in pre-clinical areas • Staff development for librarians, support staff *Finance:* • Establishing independent budget for AMD • Payment of fees by students *Collaboration:* • Within the next 5 yrs, offer BSc in Nursing, Midwifery, Public Health (or MSc?), Dentistry & Oral Health	*General:* • Lack of financing or financing that is restricted by donors and does not meet immediate needs and/or compatible with long-term strategy • Aging faculty • Collapsing infrastructure *Organization:* • Finances • # of available faculty in-country *Human Resources:* • Research capacity and full-time faculty appointments won't be possible with the majority of the faculty as part-time. • Full-time professional positions are needed and must be funded to be competitive with other opportunities. *Infrastructure:* • Without immediate improvements, some building will need extensive repairs. • Danger to students.

TNIMA:

Strengths	Weaknesses
General: • Nursing, Midwifery, Physician Assistant, Environmental Specialist, Nurse Anesthetists, Respiratory Assistant programs currently offered *Organization:* • Currently under JFK Medical Center *Infrastructure:* • TNIMA facilities are an existing strength in light of the severe overcrowding of facilities at UL. *Workforce Development:* • UL and the JFKMC are the main health professionals' workforce development stakeholders. *Collaborators:* • MOE is expected to support RN and RM articulation • MOH support is expected • Potential concern about competition from other institutions, political implications • WAHO standards are used by education and licensure bodies • LBNM is charged with quality assessment and licensing nursing and midwifery providers • International partners are expected to increase	*General:* • Associate degree level programs need to be advanced to bachelors' programs, faculty development needed to advance to higher education programs, increased number of faculty with masters' degrees needed *Organization:* • The programs compete with clinical patient care resources *Infrastructure:* • Learning and clinical facilities need to have major upgrade. • Learning labs at TNIMA need to be fully furnished with patient care furniture, equipment and supplies. • Classrooms need access to learning resources such as projectors for lecture support and small group work. *Collaborators:* • No country level plan exists to integrate all health professional education agency into meeting the workforce needs • WAHO standards are not met due to existing lack of facility preparation and clinical agency resources

funding for health systems strengthening efforts	• Training mission of TNIMA competes with patient care mission of JFK • LBNM needs to further develop professional resources, conduct effective licensure exams, and have the authority to accredit education facilities.
Opportunities	**Threats**
General: • Develop articulation programs to bridge associate degree (AD) graduates to bachelors' program at University of Liberia. Within 3-5 years discontinue AD program • BSc for Physician's Assistants and Laboratory Technicians *Organization:* • Benefit from use of JFK facilities *Infrastructure:* • UL should consider designating TNIMA as a health professionals' learning center and make effective use of the education space as well as the dormitories when remodeled. *Workforce Development:* • Develop an enrollment and progression strategy that addresses 50% of the projected workforce needs for the country. *Collaborators:* • National Legislature: external funding provided that meets workforce scale up needs • MOE and TNIMA could launch advocacy program with CoHE • Develop health professional planning group to develop unified enrollment and graduate plan • Establishing bachelors programs at UL would relieve JFK of this double education mission • LBNM could establish effective training and accreditation visits, improve the national exams, and monitor practice issues	*General:* • The country needs bachelors' program to prepare the workforce for the complexity of modern healthcare. *Organization:* • Without a strong partnership between UL and JFKMC, the gains from articulation may be lost due to loosing clinical sites. *Infrastructure:* • Without the continued use of TNIMA, UL will add a burden to its existing stock of classroom and clinical learning facilities *Workforce development:* • Private, for-profit providers have been increasing in supply • Unified planning does not occur • Financial support is not available to meet need for strengthened professional credentials, accreditation standards

Student Services:

Strengths	Weaknesses
Organization: • Academic Advising – frontline in helping students make sound and right academic choices • Career Counseling - ensures that academic program is in-line with career objectives/goals. • Personal Counseling - focuses on student mental health • Consultation - With faculty member input, makes recommendations for students who are in stressful crisis or distress situations • Referral - Networks with on-campus sources to get the best services for students.	*Organization/Staffing/IT* • The units described need additional staffing, specialized training, and additional infrastructure (internet connectivity, computers, networking between the campuses) to carry out functions for a new College of Health Sciences • Lack of an integrated information technology-based administrative system makes maintenance of student records, scheduling of classes and prompt and accurate bursar's data very difficult for advisors, planners , and finance staff to access • There are no Student Academic Support Centers

• Crisis Intervention – Addresses crisis situations and strengthens abilities to achieve goals. • Outreach – serves as a bridge between the University and community • Therapeutic – liaison between students and all aspects of university life as well as between students and their parents • Assessment/Reporting – tracking, critical engagement and submission or findings that will enhance the quality of the university. *Scholarships:* • Internship office has support from EHELD, they are currently designing template for internship and Service Learning opportunities *Infrastructure:* • Housing for students at Fendall	with tutoring and individual assistance for students in basic math, science, and writing skills. • Lack of institutional support for student special interest clubs and organizations. • Lack of open and transparent process for scholarship/fellowship opportunities • Lack of student health center
Opportunities	**Threats**
• Development of a Career Lab as a centralized office for student professionalization, scholarship, and internship activity (see Student Services Objectives and Priorities) • Career counseling/skills analysis • Professional Guest Speakers series/forums/panel discussions to promote exchange of ideas • Testing center for GRE • Writing center/Tutorial center • Continued collaboration with Accountability Lab to help implement effective policy for student/faculty grievances, promoting transparency and openness • Medical and health insurance for students • Identification cards • Student Organizations/Societies • Extracurricular activities • Mobilization of students through existing extra-curricular groups, support for Student Activities through external funding, service fee, other • Expansion of Service Learning/Internship opportunities •	*Service Learning/Internships:* • Complicated program to implement because it requires faculty members to integrate non-traditional kinds of learning outside the classroom into the classroom component of the course. • UL will need to fund Internship Office when EHELD grant closes • UL faculty senate will need to approve credit hours earned for internships, supervision of the internship duties • Fair and transparent practices for selecting interns • Fair and transparent practices for monitoring internship activity • Fair and transparent practices for evaluating internship activity *Student Life:* • Student protests and threats for violence disrupt classes and shut-down campus. • Lack of adherence to academic calendar • Lack of effective policy for handling student/faculty grievances

Cross-cutting Analysis: CoHLS

Strengths	Weaknesses
• Computer resource rooms • Space at Fendall campus • Stronger undergraduate life science programs with applied laboratory offerings to prepare UL students for medical entrance exam and provide strong Biology background for programs articulated with TNIMA.	• Students not prepared for rigorous curriculum • Business practices, accounting at UL • No grants administration capacity for international accounting standards • No computerized university system for Bursar, Admissions, Records, Finance, Libraries, etc. • Infrastructure needs – buildings

• Articulation framework with TNIMA to use with future programs	• Infrastructure needs – Lab equipment • Little or no connectivity for students and faculty to high bandwidth,, globally-connected internet • Dearth of instructional resources
Opportunities	**Threats**
• Combined resources allow for full-time faculty hires at a more competitive rate, reduction in part-time faculty • More full-time faculty will allow for specialization and curriculum expertise, more student mentoring • Faculty mentoring • Articulation programs with other training institutions (Medical Lab Technician program at Mother Patern, for example) • Pursue commitment from Peace Corps Response for retired professors to teach for UL faculty on leave for fellowships • Campus-wide use of Moodle (already installed at AMD) would regulate course content, grading system, etc.	• Management of resources • Infrastructure • Lack of IT • Accountability and transparency in policy • Administrative capacity for supporting a new College (internet connectivity, computers, networking between the campuses) • **An emphasis on science and math throughout the elementary and secondary educational system is necessary to improve the quality of candidate seeking health and life science careers.**

V. CAPACITY ANALYSIS

Delayed plans for infrastructure improvements at the Natural Sciences building stunted the vision for increased laboratory capacity for the undergraduate life sciences under the CEHLS grant. Initial plans were scaled-back because of the lack of electricity, water, and plumbing at the building. The resulting mobile demonstration labs mark a significant improvement, but fall woefully short of providing individual students with hands-on laboratory experience. Continuing support for the originally envisioned goals of the CEHLS project and outlined in the ***Objectives & Priorities*** section of this document would help to leverage USAID's planned investment in renovation of CoST facilities and support new health care training initiatives in the country.

Currently, UL and TNIMA still face overwhelming obstacles in providing students the foundational knowledge and skills essential for entry into professional health services. These include:

(1) Students who are unprepared for a rigorous science curriculum;
(2) A shortage of instructors with advanced degrees;
(3) Inability to compensate instructors appropriately;
(4) Lack of updated and applied health and life science courses;
(5) Inadequate support for facilities management and professional development;
(6) A shortage of text, reference, and instructional material/technology to support classroom teaching;

(7) A gender imbalance in life science enrollments; and
(8) Little coordination between the life sciences curriculum and the country's other tertiary institutions;

In addition, there is a lack of administrative resources to serve as a foundation for strong academic programs. Immediate priorities for improvement include: (1) developing a reliable and independently auditable financial management system in order to improve efficiency, accountability, and grants administration; (2) connectivity to the internet across all campuses; (3) introduction of a digital management system for student records, bursar accounts, data management and regulation of learning environment (5) adequate IT access and support for administrative and academic endeavors; (4) and professional development for staff.

Because life science education relies heavily upon the concepts and skills learned through laboratory instruction, achieving many of the key health care workforce goals depends upon access to appropriate facilities and technology. **The facilities in UL's Natural Sciences building are woefully inadequate even though the undergraduate programs will form the foundation for all branches of the healthcare workforce.** The basic mechanical and electrical systems in the building no longer function. There is no building-wide power supply (electrical wiring and lighting are in need of replacement) and no hot and cold running water, gas or supply systems for Bunsen burners, cold rooms for storage of chemicals, or lockable storage cabinets for chemicals and supplies.

In addition, teaching laboratories lack the most basic equipment and supplies needed for instruction. The requisite chemicals, specimens, and standard equipment such as autoclaves, chemical hoods, scales, freezers, thermal cyclers and safety equipment are lacking, and there are few technology resources available to help augment instruction such as a local area network, laptops and projectors. Improving the physical infrastructure of labs and teaching venues is essential to improving the UL's capacity to contribute to the country's health care workforce.

VI. Objectives and Priorities

AMDCM:

From the period 2001-2008, AMDCM graduated 38 medical doctors. From 2009-2013, the number rose to 84. The clinical and pre-clinical science curricula have been revised to match the requirements of the West African Health Organization. Course descriptions, syllabi and recommended texts for Anatomy and Physiology courses in the pre-clinical science program have been completed and are in use. Mentoring and faculty development workshops in Anatomy and Physiology have been completed and assistance has been provided for the improvement of instruction in Biochemistry, Genetics and Molecular Biology through collaboration with UMMS. Faculty and student evaluations have been developed and are being implemented to augment institutional data and guide decision-making, all marked improvements in the administrative and academic capacity of the College.

To effectively and efficiently meet demand from the MOH, the CoHLS working group has identified key supply-side determinants to providing high-quality training while reaching MOH targets for health care providers (HCP) per capita. An estimated cost of **($895 thousand)** over the next (3) years is needed to support:

- Faculty hires in critical areas/visiting faculty support: anatomy, physiology, and biochemistry
  - ✓ UMMS/Allen Foundation
- Adequate laboratory space, supplies, and instructional material for physiology, biochemistry, and anatomy
  - ✓ Restoration of damaged physical facilities
- Curriculum development and implementation for programs in:
  - ✓ MSc Medical Microbiology
  - ✓ Biomedical Engineering
- Incorporation of JFKMC as Teaching Hospital for COHLS
- Effective administrative and accounting systems to ensure grants and donations can be directed towards COHLS programs
- Progressive increased student enrollment (50-75/year)
  - ✓ Dependent on supply of qualified applicants, therefore undergraduate training in science needs to be improved
- Research and research-oriented capacity-building
- Continuing professional development (CPD)
- Reliable and sustainable communication skills for teaching and learning

Since attrition rates, retention, job placement and remuneration are dependent on demand-side decisions, continual planning and cooperation between AMDCM and the MOH is necessary. Under the legislative development of CoHLS, formalization of communication between the two entities will be established.

CoST

At an estimated cost of **($5 million)** over (3) years, support for UL's health and life science program will include MSc fellowships for UL faculty at US and African universities in Biology, Math, Chemistry and Public Health, visiting science instructors from the US for one-semester and one-year teaching assignments at UL, curriculum development and pedagogy workshops for faculty, lab equipment and training in lab instructional approaches and equipment maintenance, computer labs for students, summer start programming, seed funding for research and honors programming, and support for administrative positions in finance, grants management, and IT support. This estimate does not include (a) instructional support or other assistance for AMDCM; (b) a wireless, high-speed connection between the international cable landing in Monrovia and the Fendall campus; (c) PhD fellowships to fill all senior faculty

positions by 2025; or (d) infrastructure investment of low water plumbing/sewer technology, reliable electricity and water sources, all of which are desirable.

In the **short-term** (within the next 1-2 years), administrative priorities include: (1) operationalize CoST's short term-to-long term strategic/action plan; (2) establish a *University of Liberia Development & Advisory Council on Technology & Science* (UL-ACTS), an international group of eminent people that will serve as benefactors, that will identify potential benefactors and, that will offer advice to the UL CoST Dean; (3) liaise with the Ministry of Foreign Affairs to establish a creative strategy for recruiting science and engineering faculty (nationals, expatriate nationals and expatriates) regionally, and beyond; (4) re-establish the long term Fulbright program at UL. This will help in at least two ways: (a) provide relief for vacant faculty slots, (b) provide interim faculty when UL faculty are abroad pursuing advance studies; (5) establish independent 1-2 semester Visiting Professor programs directly with current and future MOU institutions; (6) strengthen offerings in BSc Biology tracks esp. Microbiology and Medical Science; and (7) establish *Environmental Science* graduate & undergraduate programs.

Medium-term priorities for lab development are dependent on renovations made to the Natural Science building. Two additional laboratories can be equipped for upper division biology courses including the laboratory components of Bio 204 Microscopy with Applications to Microbiology; B301 Medical Microbiology; B305 Advanced Techniques in Molecular Biology; B312 Microbiology of Food and Water; Bio 309-310 Biochemistry; Bio 405 Clinical Laboratory Techniques; B408 Genetics and Genomics. These labs should be equipped with more advanced instructional equipment including autoclaves, floor model centrifuges, chemical hoods; thermal cycler systems, medical microscopes for individual student use, camera equipped teaching microscopes; and commercial grade freezers. All teaching laboratories should also be supplied with non-consumable probes, micro centrifuges beakers, sensors, slides and PH meters, TLC plates/tanks; tube racks as necessary, incubators, student eye protection and safety equipment to provide clinical laboratory science experience for all students.

Focus will also be given to additional BSc articulation agreements with TNIMA. For example, Physician's Assistants have proved to be an essential part of the health care team, therefore an MOU with TNIMA will be a priority, as well as BSc in Lab Science/Lab Technicians program. Within UL, strengthening the concentrations within the BSc Biology program starting with Medical Science with a secondary effort in relation to Plant Sciences will proceed with new and/or substantially revised courses will be developed for fourteen courses: B207 Sophomore Seminar on Methods of Logic and Scientific Inquiry; B301 Medical Microbiology; B302 Plant Physiology and Development; B305 Advanced Techniques in Molecular Biology; B306 Systemics of West African Flora; B312 Microbiology of Food and Water; Bio 309-310 Biochemistry; Bio 405 Clinical Laboratory Techniques; B408 Genetics and Genomics; B412 Topics in Infectious Diseases; B415 Topics in Nutrition. In addition,

undergraduate courses will be developed for Human Anatomy and Human Physiology in support of Physician Assistant training and for preparation in the medical sciences.

In the next two to three years, further strategic development goals include (1) strengthening BSc Biology tracks, esp. Environmental Science and Public Health; (2) establishment in UL CoST a Division for *Information & Communications Technology*, (2) establishment of a separate College of Engineering; (3) establishment of a *Regional Research Center for Water, Waste & Pollution Management* to promote research and internship opportunities for students*;* and (4) summer start programs as a the foundation for a Biology Honors program.

Long-term goals for departmental capacity is to (1) attain a 1:50 faculty-student ratio; (3) reverse the ratio of full time to part time faculty from 1:4 to 4:1; (4) only TAs and Lab Assistants with 1st degrees, all faculty with MSc. and above; (5) honors program partnerships with LIBR, JFK, NGOs, etc.; (6) established summer start program for 50% of first-time admissions; and (7) internal research capacity, including effective administrative support for grants administration, faculty publications, and proposal submission.

Biological Sciences:
RECOMMENDATIONS: FACULTY NEEDED

Level	Degree	Rank	Specialization	# Needed
Senior or Junior Faculty	PhD or MSc	Open Rank	Ethnobotany/Botany/ Plant Physiology	1
Senior or Junior Faculty	PhD or MSc	Open Rank	Comparative Anatomy & Physiology	1
Senior or Junior Faculty	PhD or MSc	Open Rank	Genetics, Molecular Biology, Bioinformatics	2
Senior or Junior Faculty	PhD or MSc	Open Rank	Entomology	1
Senior or Junior Faculty	PhD or MSc	Open Rank	Parasitology, Microbiology	2
Senior or Junior Faculty	PhD or MSc	Open Rank	Ecology Environmental Science	3

Chemistry Department:
RECOMMENDATIONS: FACULTY NEEDED

Level	Degree	Rank	Specialization	# Needed
Senior or Junior Faculty	PhD or MSc	Open Rank	Material Chemistry	3
Senior or Junior Faculty	PhD or MSc	Open Rank	Petroleum Chemistry	3

Senior or Junior Faculty	PhD or MSc	Open Rank	Environmental/ Forensic Chemistry	3

TNIMA

Owing to a shortage of physicians, routine health care in Liberia will necessarily be supplied largely by skilled nurses and public health officials—especially outside of urban areas. Liberia's major publicly-operated nursing program, TNIMA, is a diploma-level institution and is struggling to produce increased numbers of students in practical nursing and midwifery. The trend in nursing education in Africa is for professional nursing to be housed in universities with entry into practice at the Baccalaureate level. This trend toward university-based programs is fueled by the recognition that achievement of core competencies in the sciences contribute significantly to a nurse's ability to provide quality care based on evidence.

In fall 2015, the first cohort of BSc Midwifery students will take undergraduate science courses in newly revised biology and life sciences curriculum under an articulation agreement and curriculum established by the USAID/HED CEHLS project. A priority for establishing the program will be to hire a Phd-trained Nurse Educator/Midwife to serve as a full time Academic Director for the new program. This individual (either a recent post-doc or a retired nurse educator) would serve as a mentor/instructor in the new program to model new teaching approaches, assist with course development efforts and help to plan and conduct faculty/development workshops along with visiting faculty. See Appendix 3: BScM BScN Articulation Plan.

Estimated cost for three years of support for BSc MW/Nursing (1 academic director, 2 visiting faculty members for one year each from other African university programs), 2 MA degree Fellowships in Nurse/Midwifery at an African university, simulation equipment and training in the use of the equipment for midwifery program would be **($595,000).**

Further priorities include; (1) strengthening the Physician Assistant (PA) program based on revised scope and sequence of the curriculum; (2) conduct capacity analysis for an articulation between the Physician Assistant program at TNIMA and pre-clinical science offerings at the Fendall campus that would contribute to an immediate improvement in the science preparation of Physician Assistants, including Chem 105-106; Bio 204 Microscopy with Applications to Microbiology; Bio 205 Molecular and Cellular Biology with Laboratory Applications; Bio 309-310 Biochemistry; Bio 405 Clinical Laboratory Techniques; B412 Topics in Infectious Diseases; and sB415 Topics in Nutrition, as well as general education requirements in language and mathematics. New undergraduate courses in Human Anatomy and Human Physiology with special reference to Physician Assistants will be included in this articulation.

Public Health

To support the infusion of public health competencies throughout the health and life science curriculum as well as to developed on-going public health training programs at the certificate and master's levels, the estimated cost for (3) years of support for public health activity would be **($700,000).** The goal of the Public Health component of the CoHLS is to infuse public health concepts into workforce training at all levels of nursing education, medical education, and life science instruction. This will be done in the following complementary ways:

- Support for Certificate in Public Health training, candidates from the pilot program would be selected each year from 2-3 rural catchment areas that meet certain agreed upon criteria. The program for practicing professionals delivered under the CEHLS initiative required 3-months of instructional programs followed by 3 months in the field. Case studies from the pilot focus on maternal and child health with cross-cutting topics in HIV/AIDS, Water/Sanitation, Pre-Natal Care, Nutrition, and Malaria Prevention. See Appendix 4: Certificate in Public Health proposal.

- Conduct needs assessment and capacity analysis for expanding public health curriculum to Masters-level.

- Integrate public health concepts and instruction into the TNIMA nursing curriculum and the undergraduate curriculum in Biology at Fendall (see above). Graduates of these programs would thus also be exposed to concepts and skills in public health education, such as how to:

    - **Monitor** health status to identify community health problems.
    - **Diagnose and investigate** health problems and health hazards in the community.
    - **Mobilize** community partnerships to identify and solve health problems.
    - **Enforce** laws and regulations that protect health and ensure safety.
    - **Evaluat**e effectiveness, accessibility, and quality of personal and population-based health services.
    - **Research** for new insights and innovative solutions to health problems.

Student Services and Outreach Programs:

Access to learning resources, small classes, and real-world learning opportunities serve to attract and retain students. Similarly, students must see a path from their studies into the world of work and be given the technical and personal skills to be successful. UL is committed to developing programs that link the study experience in a positive way with employment opportunities and advanced study opportunities in Liberia.

Under the direction of the Office of Institutional Development, development of a Career Lab (CL) as a centralized resource for professionalization of students and alumni relations will address current threats to student relations and professionalism. Interested in individual empowerment under the direction of strong expert advocates as well as for external stakeholders looking to engage the next generation of Liberian leaders, the CL will be based upon principals of: (1) advocacy, (2) transparency, and (3) accountability. Specifically, CL services will include:

1. Setting guidelines for scholarship selection criteria;
2. Publically posting scholarships opportunities and disseminate information to students;
3. Consulting and/or manage the application process in a fair, peer-reviewed forum with pre-determined selection criteria;
4. Hosting career days and arrange for guest speakers throughout the semester;
5. Managing trainings and job placements by liaising between external stakeholders and universities;
6. Conducting GRE and other standardized test trainings, eventually become accredited to administer the GRE at least once a year;
7. Advocating on behalf of ALU to regional and/or overseas universities for fellowships or reduced-rate scholarships;
8. Reaching out to the schools throughout Liberia to host career days;
9. Offering summer program for talented students, summer-start for students needing additional English/Math skills;
10. Providing resources (computer and print) for writing resumes, interviews, industry trends;
11. Assisting with resume writing, performing mock interviews, and making career decisions; and
12. Maintaining database of professional alumni

See Appendix 4: Career Lab proposal attached. Estimated cost for three years is **($360,000).**

VII. Next steps: Governance & Timeline

The UL Strategic Planning Executive Committee will be responsible for carrying the plans within this document through the following procedures:

1. Operationalize Strategic Plan for the COHLS at its various Schools / Programs
2. Joint stakeholder conference for project formulation
3. University Faculty Senate / Presentation to Legislature
4. Legislative Act establishing the COHLS and its various schools.

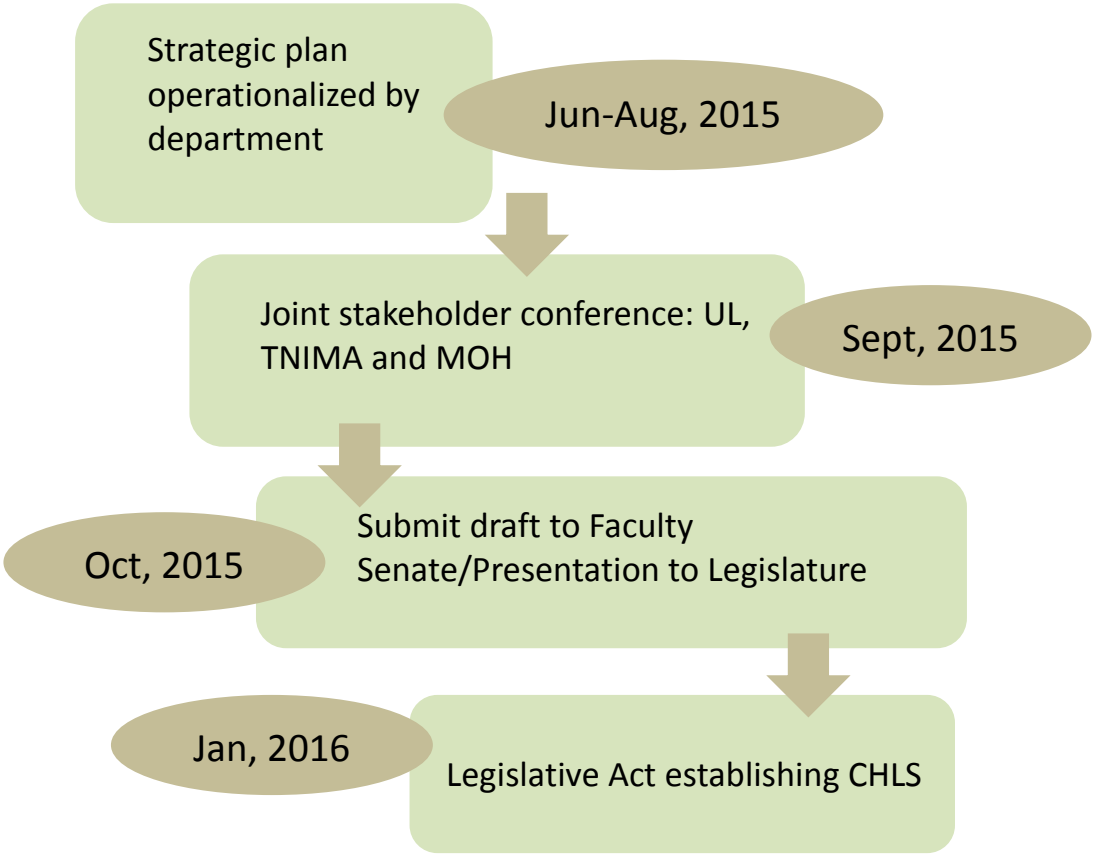

Figure 1: Timeline for establishing College of Health and Life Sciences

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