



# Liberia Hospital-based Residency Training Program Accreditation Assessment Visit



Conducted collaboratively November 14-21, 2016 by:

Liberian College of Physicians and Surgeons

U.S. Department of Health & Human Services, Health Resources and Services Administration

American International Health Alliance

## FINAL REPORT DELIVERABLE PACKAGE ON:

- Task 1: Hospital-based Residency Training Program
- Task 2: Biomedical Engineering Assessment for Residency Program



Submitted by the American International Health Alliance

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# **Liberia Hospital-based Residency Training Program Accreditation Assessment Final Report**

## **EXECUTIVE SUMMARY**

From November 14-21, 2016, a team of technical consultants assessed John F. Kennedy Hospital, Jackson F. Doe Memorial Hospital, Redemption Hospital, Phebe Hospital, C.B. Dunbar Maternity Hospital, and the Japanese-Liberian Maternity Hospital, all of which are teaching hospitals in the West African nation of Liberia. The assessment team was comprised of two groups, each with a representative of the Liberia College of Physicians and Surgeons (LCPS), the American International Health Alliance (AIHA), and the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services.

The technical consultants were deployed to conduct a needs assessment to support these training institutions as they prepare for formal accreditation by the West African College of Physicians, the West African College of Surgeons, and/or the Liberia College of Physicians and Surgeons. The disciplines assessed were internal medicine, general surgery, obstetrics and gynecology, and pediatrics. In addition, the team conducted an assessment of the biomedical engineering and technology capacity of the target institutions, focusing on ascertaining capacity at the facility, medical equipment maintenance, and personnel and training levels.

Major observations made during the assessment include:

- an acute shortage of faculty in the various clinical disciplines needed to teach and supervise residents;
- a severe lack of laboratory services to support clinical diagnosis and care, including the complete absence of a pathologist and radiologist at the main training site;
- a need for more robust restructuring and upgrading of both basic and more advanced equipment to enhance quality of care, as well as training of care providers; and
- a severe shortage of functioning medical equipment across all sites, which greatly hampers clinical training for medical specialists and results in sub-optimal care for patients.

While a significant amount of effort is already under way to address these and other issues, more support and targeted technical assistance is crucial to bringing training programs at these Liberian institutions up to a standard that will ensure accreditation and, importantly, the quality of physicians being produced in country.

## I. INTRODUCTION & BACKGROUND

Regular post-graduate medical education assessment is a requirement to review the technical and human resource capacities of any postgraduate clinical training program. This is essential to ensure that the highest standard of healthcare services is delivered to the people.

The Republic of Liberia was established in 1848. As pertains in the West African sub-region, development of infrastructure and human capacity is slow. The situation in Liberia has been worsened by the civil unrest in the 1980s and 1990s, as well as the recent Ebola epidemic in 2014-2015. These challenges resulted in the destruction of existing infrastructure and either the death or migration of healthcare professionals to other countries. As Liberia continues to strengthen its health system in the wake of these crises, a key component of rebuilding includes improving the human resources for health situation.

Liberia's only medical school currently graduates an average of 25 doctors a year. There is an urgent need to train the country's doctors as specialists/consultants to deliver high quality service, offer training, and conduct research.

The Liberian College of Physicians and Surgeons (LCPS) was established in May 2013 to oversee postgraduate medical training in the country. In the aftermath of the Ebola outbreak, LCPS approached the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services for assistance for its training program. A post-graduate residency assessment for Liberia was initiated by HRSA to assist LCPS in preparing residency programs across the country. HRSA enlisted the American International Health Alliance (AIHA) for assistance in implementing the assessment.

AIHA is an international development nonprofit working to strengthen health systems and workforce capacity worldwide through locally-driven, peer-to-peer institutional partnerships. AIHA has been a trusted implementing partner of HRSA since 2004 and currently manages HRSA's HIV/AIDS Twinning Center Program, which supports the U.S. President's Emergency Plan for AIDS Relief (PEPFAR). Through a series of three cooperative agreements with HRSA, AIHA has established and managed more than 55 capacity-building partnerships and initiatives in 14 countries through the Twinning Center Program.

## II. ASSESSMENT GOAL & PURPOSE

The goal of the assessment was to ensure that Liberia's postgraduate residency programs, including relevant training sites, are well prepared for accreditation.

### **Assessment objectives were to:**

1. Assess the a) human resource capacity; b) Technical /equipment needs; and c) Infrastructural needs of the postgraduate program; and
2. Identify what is required for accreditation.

## **EXPECTED OUTCOME**

It is expected that recommendations described in this report will be utilized to prepare the various training sites for a formal accreditation.

## **DESCRIPTION OF ASSESSMENT PROCESS**

The assessment team held an introductory meeting with the LCPS President, Dr. Roseda Marshall, and her team to orient the group and review the week's schedule. The Assessment Team was split into two groups tasked with assessing all four target hospitals. Teams are as follows:

### **Group 1**

- Dr. Bernard Nkum (team leader)
- Dr. Mike Ohene-Yeboah
- Philip Anyango (AIHA biomed program coordinator)
- Ray Goldstein (HRSA)
- Dr. Sunny Chineye (JFK Faculty)

Group 1 visited JFK Medical Centre (JFK) in Monrovia and Jackson F. Doe Hospital (JFD) in Tapeta.

### **Group 2**

- Dr. Jennifer Welbeck
- Dr. Samuel Obed
- Inna Jurkevich (AIHA)
- Jose Rafi Morales (HRSA)
- Dr. Angela Benson (LCPS)

Group 2 visited JFK Medical Centre and Redemption Hospital in Monrovia and Phebe Hospital and C.B. Dunbar Hospital (CDB) in Bong County.

At each facility visited, the assessment team first interacted with the facility management for formal introductions, as well as an overview of the site and all relevant departments. Each group then split into two disciplines and interacted with the department head and his staff, toured the units, and toured the rest of the hospital. Interviews were held with various staff and residents, and available equipment was inspected.

The teams collected information and structured the assessment visits using a compilation of various assessment tools shared by LCPS prior to the visit. At the end of the visits and report writing, a debriefing meeting was held at the College highlighting the observations and recommendations of the assessment team.

### III. REPORTS ON INDIVIDUAL CLINICAL DISCIPLINES

#### A. INTERNAL MEDICINE

Areas Assessed	Findings		Comments & recommendations	
	JFK Teaching Hospital	JFD Teaching Hospital	JFK Teaching Hospital	JFD Teaching Hospital
<b>A) DEPARTMENTAL REQUIREMENTS</b>				
1) Consultant or Specialist Staff	3/3 Neuro, Endocrine and Emergency	0/2	High Priority. URGENT ATTENTION REQUIRED	High Priority. URGENT ATTENTION REQUIRED
2) Trainees or Residents	11 for 3 cohorts	2		
3) Academic Activities	Weekly Grand Rounds, case presentations, and postgraduate seminars are held; journal club meetings, morning reviews, and mortality reviews are held; no pathological and radiological interactions	Morning rounds, reviews, case presentations, and seminars are held; Clinico-pathological and radiological interactions held	High Priority.. URGENT ATTENTION TO RECRUIT PATHOLOGIS/ RADIOLOGIST	Intermediate Priority. To increase academic activities
4) Space	44-bed ward; consultants share offices, lounge; shared residents lounge and sleeping rooms	32-bed ward; specialists have well-furnished offices; residents have a lounge and live close to ward; seminar room available	Intermediate Priority. Expected to improve on completion of renovation	Adequate
5) Facilities	Ultrasound, EKG, echocardiograph, and endoscopic machines available and functional; no EEG, biopsy (liver, kidney, skin, pleural) needles available; no lumbar puncture or thoracentesis sets	Ultrasound, EKG, echocardiograph, and endoscopic machines available and functional; no EEG	High Priority. URGENT ATTENTION NEEDED TO ACQUIRE THE FACILITIES	Adequate
6) Medical Ward	X-ray viewing box, diagnostic sets, suction machines, pen torches,	X-ray viewing box, diagnostic sets, suction machines, pen	Adequate	Adequate

	glucometers, sphygmomanometer, thermometers, oxygen concentrators and cylinders, wheel chairs and screens available and functional	torches, glucometers, sphygmomanometers, Thermometers, oxygen cylinders, wheel chairs, and screens available and functional		
7) Medical Outpatients Department	2 consulting rooms with ample waiting area for patients and necessary functioning equipment as in the ward	6 consulting rooms with ample waiting area for patients and necessary functioning equipment as in the ward	High Priority. intermediate. Expected to improve completion of renovation	Adequate
<b>B) SUPPORT SERVICES</b>				
1) Emergency Unit	Headed by a medically qualified consultant with the necessary functional equipment, including defibrillators and resuscitation kits	No medically qualified consultant; has necessary functional equipment	Adequate	High Priority. Intermediate. Attention to recruit an emergency physician
2) Intensive Care Unit	Not in use due to lack of equipment	No medically qualified consultant; not in use	High Priority. URGENT ATTENTION NEEDED TO EQUIP	Intermediate Priority. Attention to recruit an emergency physician
3) Medical Records	Ample space; no trained officer; has filing and retrieval system; not computerized	Ample space; no trained officer; has filing and retrieval system; not computerized	Intermediate Priority.	Intermediate Priority.
4) Medical Library and Medical Illustration	Ample space but without current medical books or journals; has overhead and slide projector and multimedia facility	Ample space but without current medical books or journals; has overhead and slide projector and multimedia facility	Intermediate Priority. Action to resource	Intermediate Priority. Action to resource
5) Radiology and Radiotherapy	No radiologist or radiotherapist available; ultrasound and X-ray available; no contrast studies, CT scan, or MRI available	Radiologist, but no radiotherapist; ultrasound and X-ray available; no contrast studies; has radiation protection, but no monitoring; expecting	High Priority. URGENT ACTION NEEDED TO RECRUIT AND EQUIP	Adequate

		a new CT scan; installing an MRI		
6) Psychiatry	2 psychiatrists with a functioning psychiatric unit	No psychiatrist; no psychiatric unit	Adequate	High Priority. URGENT ATTENTION TO RECRUIT AND SET UP A UNIT
7) Medical Microbiology, Chemical Pathology, Hematology, and Histopathology	No medically qualified consultant; has 1 technician; has virology research unit (PEPFAR); no facility for M/C/S, parasitology, or mycology; HIV, HBV, and HCV serology done	1 pathologist and 1 histopathology technician; no autopsy facility; microbiology unit being set up	High Priority. URGENT ATTENTION NEEDED TO RECRUIT AND SET UP	Intermediate Priority. attention to recruit
8) Nursing Services	1 nurse per 4 patients per shift on the ward	1 nurse per 16 patients per shift on the ward	Adequate	Intermediate Priority.
9) Pharmacy	2 qualified pharmacists, with standard store and quality control system	2 qualified pharmacists, with standard store and quality control system	Adequate	Adequate
10) Physiotherapy, Dietetics, and Medical Social Work	No physiotherapist or unit; no dietician or unit; 2 trained social workers with a functional unit	1 physiotherapist with a functional unit; no dietician or unit; 1 trained social worker; 2 motorcycles available	Intermediate Priority. Physiotherapy and dietetics units expected to be set up on completion of renovation	Intermediate Priority. attention needed to set up a dietetics unit
11) General and Utilities	Under construction; some water supply, electricity, sterilization, laundry, and refuse disposal services offered	Clean and tidy environment; water supply and distribution, electricity supply, sterilization, laundry and refuse disposal systems available	Intermediate Priority. Expected to be restored fully on completion of renovation	Adequate
12) Isolation	Isolation cubicles on the ward and the Ebola Treatment Center now	Isolation cubicles on the ward; has an Ebola Treatment Center	Adequate	Adequate

	converted to Urgent Care Unit			
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*Abbreviations:*

*JFK- John F. Kennedy*

*JFD- Jackson F. Doe*

*CT scan- Computer Tomography Scan*

*EKG-Electrocardiogram*

*MRI- Resonance Magnetic Imaging Neuro- Neurology*

*M/C/S- Microscopy, Culture and Sensitivity*

**Findings in Internal Medicine Specialty**

Two training centers, namely JFK Memorial Hospital and JFD Memorial Hospital, were assessed. At JFK Hospital, the team was supported by Dr. Njoh (a Neurologist) and his staff. It is worth noting that the Department Head and two other consultants died from Ebola disease. JFK was shut down during the Ebola epidemic, which has adversely affected the department. It is currently undergoing a major renovation that is expected to be complete in a year.

At JFD Hospital the team was supported by the Head of Department. JFD Hospital was not significantly affected and was not shut down.

**Recommendations for Internal Medicine:**

1. Training Centers

- Two postgraduate training centers should be established, one at John F. Kennedy Memorial Hospital to cover the Southern part of the country and one at Johnson F. Doe Memorial Hospital for the Northern part of the country. This will minimize faculty and resident travel to remote areas and make for more efficient use of resources.

2. Consultant Staff

- JFK will require a cardiologist, pulmonologist, nephrologist, gastroenterologist, dermatologist, radiologist, and a pathologist.
- JFD will require a cardiologist, pulmonologist, neurologist, gastroenterologist, nephrologist, and a microbiologist.

3. Specialist / Technical staff

- Both institutions will require more specialists to support consultant staff. Technologists and/or technicians will be required in the hematology, chemical pathology, microbiology, and radiology laboratories.

4. More nursing staff needs to be employed at JFD to attain the appropriate nurse to patient ratio of 1:8 and ensure effective services

5. Facilities - the ongoing renovation at JFK Hospital should proceed as scheduled, while installation of CT scan and MRI should proceed at JFD Hospital.

6. Support Services need to be revamped at JFK and JFD

- At JFD, an emergency physician should be employed and an emergency unit set up
- At JFK, an intensive care unit to be set up as well as a radiology and radiotherapy unit
- Laboratory consultants should be employed at both institutions to set up medical microbiology, chemical pathology, hematology, and microbiology laboratories



**B. SURGERY**

Sections or Areas assessed	Findings		Comments & Recommendations	
	JFK	JFD	JFK	JFD
1) Bed Capacity	44  Main training institution	32  For rotations in general surgery	High Priority. Minimum of 20 for general surgery (10 beds for each team); 20 for trauma and orthopedics; 5 for urology; 5 for pediatric surgery; and 10 for plastic, neuro, cardiothoracic ENT, ophthalmology	Adequate. Rotation for general surgery
2) Number of Surgeons	3 full-time general surgeons, who also serve as faculty; 2 orthopedic surgeons, 1 is full-time	2 general surgeons, one doubles as CEO	High Priority. Consultant CVs have to be provided; need a full-time minimum of 1 urologist, 1 trauma surgeon, and 1 pediatric surgeon	Consultant CVs have to be provided; number is adequate for rotation
3) Organization of Surgery Department	Surgical staff not organized into teams or firms; no office for department head; no secretarial support; all surgical staff share a common room; no seminar or meeting rooms for morning meetings, seminars, and teaching	Surgical staff not organized into teams or firms; 1 surgeon doubles as CEO	High Priority. At least 2 teams for general surgeons with each team headed by a consultant; a duty roaster is needed; an office for the department head is urgent; a departmental library and rooms for academic work is a basic requirement for training	Adequate for rotation
4) Residents	11 residents	3 residents	Number is adequate for 3 consultants	Adequate for 2 consultants

5) Outpatient Services	Adequate consulting rooms for consultants and residents; clinic records for both old and new patients are lumped together in one book	Inadequate. The office of one of the surgeons is shared by the two as a consulting room. There is dedicated room for the resident. There is no nurse in the consulting office	Intermediate Priority. Separate books for old and new patients and for each surgical specialty is an improvement; a procedure room and an emergency drug trolley will make an excellent surgical outpatient service	Intermediate Priority. Separate consulting room for each surgeon with a nurse; a procedure room and an emergency drug trolley will make an excellent surgical outpatient service
6) Surgical Wards	Part of this area is under renovation; 44 beds are in use and shared by all specialties; all wards need extensive renovation as the floors are worn; no functioning suction machine	32 beds on the surgical ward are shared between males and females; more beds are made available for males; no beds are available for children; only 1 suction machine in the entire ward; ward has an excellent emergency drug trolley	Intermediate Priority. Lifesaving items such as suction machines, sphygmomanometers, and diagnostic sets readily available and functioning will greatly improve over-all patient care and can reduce avoidable morbidity and mortality on the wards; separate records for each specialty is recommended	Intermediate Priority. It is possible and desirable to separate male and female patients; more ward equipment such as airway care devices and suction machines for the post-op ward is needed
7) Operating Theatres	4 operating rooms, but only 1 is in use (the other 3 are not functional); minor operations are done in the adjoining recovery rooms	2 operating rooms are used for all operations; no record of operations kept by surgeons or nurses; it was not possible to assess the surgical case spread; theatres were clean	Until renovations are complete, the theaters cannot be assessed; the operating capacity of surgeons could not be adequately assessed as they have no rooms in which to operate	2 theatres seem adequate for the case load as estimated by anesthetist records; it is urgent that surgeons start recording the operations he performs as required by law
8) Surgical Case Spread	Only minor operations are performed, providing a very limited case spread	Using records kept by anesthesia, case spread is adequate for membership training	A repeat assessment is required after the completion of the renovations	High Priority. Improvement in record keeping is urgent; a second look is recommended when records of operations are available

9) Accidents & Emergency Unit	Admissions to the A&E is not direct as all patients must be screened for febrile illness; existing A&E ward has 14-18 beds; no duty roaster for residents; no clear cut consultant cover; no underwater seal drainage system; suction machines are kept in the medical ward; no oxygen source; no chest tubes for drainage	A&E is well designed, but small; no procedure room; no records of minor procedures performed by staff	High Priority. Area requires attention to detail (e.g., provision of airway care, patient monitors (3), defibrillators (1), suction machines (3), oxygen sources, functioning and readily available BP apparatus in adequate numbers, and an up to date emergency drug trolley); appointment of a trauma surgeon will greatly improve A&E services	Intermediate Priority. Some expansion is needed to provide triage, airway care, and other equipment for resuscitation
10) Anesthesia Service	There is no anesthetist	Anesthetist is on holiday; there is some uncertainty if she will come back	High Priority. At least one consultant anesthetist is required for service and training of residents	High Priority. Recruitment for anesthetist is desirable
11) Radiology Services	1 radiologist; 5 radiographers; available services are plain radiography and an ultrasound machine; unit is closed for renovation	1 radiologist; 3 radiographers; services are plain radiography and ultrasound; a CT scan has been purchased and is awaiting installment	Ongoing renovations at the department excluded any detailed assessment; there are rooms earmarked for a CT scanner and an MRI machine on completion of the work	Radiology is adequate
12) Intensive Care Unit (ICU)	There is no dedicated ICU for surgery	There is a side ward with two beds labeled as the ICU; no equipment	High Priority. An anesthetist is needed	High Priority.

13) Library with internet	There is no library for the department of surgery	There is no library	High Priority. A library with comfortable sitting space (with cooling) and access to current journals, text books, and the internet is required to facilitate learning	High Priority.
14) Histology and other Laboratory Services including Blood Bank	There is no pathologist; 1 laboratory technologist and 5 technicians	Adequate	High Priority. Laboratory services at JFK are grossly inadequate; this a challenge to the provision of services and training; Urgent efforts are needed to change this situation	Adequate

**Recommendations for Surgery**

1. There is an urgent need to recruit at least one urologist, trauma surgeon, and pediatric surgeon at both JFK and JDK.
2. A pathologist and a radiologist need to be recruited urgently for JFK Hospital to improve service delivery and training of residents.
3. Laboratory services should be improved by expanding the range of tests done to include other hematological tests, as well as blood chemistry, cultures, and histopathology services.
4. The use of resident log-books should be enforced.
5. External attachment for 2-3 months for rotations in urology, accidents and emergencies (A&E) and pediatric surgery in fully accredited institutions in the sub-region should be seriously considered, especially as a short-term measure for the current batch of senior residents.
6. Accelerated efforts to complete the renovations at JFK have the potential to impact positively on service delivery and residency training.
7. Items for urgent attention:
  - a. Surgical record-keeping at all levels in both hospitals needs immediate attention and improvement.
  - b. Adequate numbers of suction machines, chest drainage tubes, and sphygmomanometers on all the wards and theatres must be provided.

**C. PEDIATRICS**

Sections or Areas Assessed	Findings				Comments & Recommendations
	JFK	REDEMPTION	PHEBE	C.B.DUNBAR	
1) Teaching facility	1 full-time pediatric cardiologist; 1 visiting emeritus professor; 2 part-time consultants; CV sighted for first two	1 adjunct faculty; CV sighted	Nil	Nil	High Priority. Inadequate faculty numbers to train at all sites; urgent need for faculty recruitment to all sites
2) Residents	5 year-1 (saw 2); 3 year-3 (saw 1); 1 <sup>st</sup> and 3 <sup>rd</sup> year residents train here	4 year-2 (saw 1); 2 <sup>nd</sup> year residents rotate here for 3 months	Nil; 2 <sup>nd</sup> year residents expected to rotate here for 3 months, with attachment to NICU at CBD	Nil; residents in Phebe will be attached to NICU here	
3) Academic Program	Daily hand-over rounds each morning with Grand Rounds held every Monday morning for all doctors; seminars held twice a week where topics are presented by residents; a case presentation takes place once a week; ward rounds are held daily with consultants; joint teaching sessions organized with	Daily morning hand-over meetings from 9-10:00 a.m.; case presentation sessions twice a week on Mondays and Fridays, interspersed with journal club meetings; some teaching meetings jointly held with other residents at JFK Hospital	None; would run joint program with CBD	None	Described academic program appeared structured following the stipulated curriculum provided there will be enough faculty to offer teaching and supervision; printed schedules were not sighted; there is a well-established nutrition unit at Redemption hospital, which all residents get exposed to during their rotation; log-book use by residents should be enforced

	the residents rotating at Redemption Hospital; current editions of Nelson's textbook seen				
4) Space & Facilities for Academic Activities	Departmental meetings are held in the consultants' office, which doubles as a seminar room; a resource area, to be located on the 3rd floor, is in the making and will be equipped with e-resource facilities (Wi-Fi, computers, etc.) for the residents; most current editions of Reference textbooks were available; residents have an on-call room minimally equipped with 2 beds, washroom facilities, and a desk and chair	Departmental meetings are held in the doctor's lounge; internet access is available to the residents and faculty of the Hospital; an on-call room is available for interns and residents	Facilities for training include a seminar room that doubles as the on-call room; there is a very well-resourced library with e-journals and internet connectivity all year round -	The hospital has a well-furnished on-call room for residents; Wi-Fi service available all day with access to e-resource subscriptions provided by an NGO	A great effort is being made to provide adequate facilities to enhance teaching and learning
5) Clinical Facilities	All services are free for children under five years in Liberia; additionally all services are free in Redemption Hospital and CB Dunbar Hospital				
5a) Ward	General ward has 56 beds/cots; ~50% bed occupancy, with more surgical than medical patients;	The main pediatric area is demarcated into units for emergency care, triaging, and patient stabilization (3	Department has a 50-bed general ward, arranged in smaller units	N/A	

	6-bed “high dependency” unit; 2- bed ward for malnourished children; a side ward for isolation cases; another ward where some unfortunate abandoned children were kept (4)	beds); a5-bed step-down ward from the emergency unit; a 2-bedICU for critical cases; a general ward for stable children and babies with 20 beds and cots; residents have the unique opportunity to be trained in malnutrition management with resources provided by UNICEF.			
5b) Emergency Unit	12-beds/cot unit offers 24-hour service with doctor on call; side laboratory for quick preparation of Sickling preps, Hb and RDT tests; a pharmacy outlet is also located here	3-bed emergency care area for triaging and stabilization of patients	General emergency room that receives both adults and children, with a 4-bed children’s area	N/A	
5c) Outpatient Unit or Clinic	Run by Physician Assistants who are supervised by doctors; there a follow-up clinic run by the doctors for chronic care patients focused on hematology,	Run by Physician Assistants the new cases; special follow-up clinics are held by the doctors for the chronic conditions like epilepsy, cerebral palsy, sickle cell	A general outpatient clinic is located a little distance from the ward area and caters to patients of all ages; patients are all initially seen by general duty doctors and physician assistants; there	The hospital offers immunization services for children.	

	cardiology, neurology, nephrology, respiratory, and infectious disease; there is also a neonatal follow-up clinic	disease, prematurity, malnutrition, TB/HIV among others	is a malnutrition outpatient outfit at the child welfare clinic manned by nurses		
5d) Neonatal Intensive Care Unit (NICU)	Located at Japanese-Liberian Maternity Hospital; has 6 cots; admits both in-born and out-born babies; has a step-down ward with mothers where kangaroo mother care (KMC) is practiced	Located in a room adjacent to pediatric wards, far from labor suite; has 4-5 spots equipped with a couple of incubators and cots; accepts both in-born and out-born newborns	Located in Obstetric Unit; has 4 cots, 2 incubators, and an overhead warmer	Unit has 6 cots and 4 beds for mothers; Kangaroo Mother Care (KMC) is practiced	Intermediate Priority. Relocation of NICU at Phebe Hospital to nearer the labor and delivery suite should be considered; in-born and out-born neonates will need to be in separate wards or areas
6) Equipment	Basic equipment is available, such as oxygen supply from oxygen concentrator, nebulizers, glucometers, resuscitation; there are no phototherapy facilities for exchange transfusion	Some basic complement of equipment for pediatric care was sighted, including resuscitation equipment (ambu bags and face masks with oxygen tubings, oxygen supply from an in-house oxygen plant as well as in cylinders, suction machines, nebulizer, and glucometer); there were a couple of phototherapy	Basic equipment such as resuscitation kits, suction machines, nebulizers, and an oxygen supply from cylinders are available; pediatric-size cuffs were not available		Intermediate Priority. More equipment will be required to replace the old ones available and also to provide back-up in all the units visited



		units, a CPAP-machine, some incubators, and scales for different age groups; the department has a few portable ultrasound machines, which all the residents are trained in using and can be used in a limited fashion (2D mode) for cardiac patients, too			
7) Skills Acquisition by Residents	Residents are able to do basic phlebotomy, lumbar punctures, abdominal paracentesis, chest tube insertion, and some ultrasonography, but there is only minimal laboratory support; residents are expected to use log-books to track their training, but this appears not to be enforced	Residents undertake limited IV access and phlebotomy (nurses do it more), and lumbar punctures; chest tube insertion with underwater seal drainage is also undertaken			High Priority. Timely use of log-books by residents should be enforced
8) Spread of cases	Common neonatal cases seen are asphyxia,	Acute infectious/febrile ailments like malaria,	Acute conditions like anemia, febrile conditions, and common	Common neonatal cases are seen (e.g.,	There appears to be a good spread of acute cases giving the residents

	prematurity, and neonatal jaundice and sepsis	pneumonia, diarrheal illnesses, and sepsis are commonly seen; others cases include severe anemia, asthma, severe malnutrition, renal and cardiac conditions, sickle cell disease with complications, and also suspected cancers; neonatal cases seen include asphyxia, neonatal sepsis, prematurity, and neonatal jaundice; chronic conditions requiring long-term follow-up are also seen	neonatal conditions are seen	prematurity, asphyxia, sepsis)	fairly good exposure in acute pediatric care; there is also adequate exposure to common neonatal conditions that plague this sub-region in the neonatal units visited; a number of patients with chronic conditions do not keep their follow-up appointments so chronic care clinics may not offer a good range for residents
9) Laboratory & Other Support Services	Hospital has a lab that only offers basic tests in hematology; no morbid anatomy, chemical pathology, or microbiology services are offered; there is a blood bank for transfusion services; a radiology	Hospital has facilities for plain X-Rays and electrocardiogram services; only very basic investigations are done here (e.g., Hb, blood smear for malaria parasites, and urinalysis); no cultures or biochemistry	Hospital laboratory offers support with urine dip stick examination, blood sugar determination, and hemoglobin estimation; no chemistry or microbiology tests are done except a little parasitology; blood bank services are	Hospital laboratory is headed by a technician; the lab offers hemoglobin (HB) and packed cell volume (PCV) determination, urinalysis, stool routine examination, and blood sugar	High Priority. The absence of a well-established and functional laboratory and a pathologist/radiologist in all the hospitals curtails the diagnostic process required in a residency training institution

	<p>department offers routine x-ray services, but has no radiologist; the department has portable ultrasound for use on the ward</p>	<p>labs are available, nor is there opportunity to do any other pathologic investigations like fine needle aspirations, blood film comment for cell morphology, or biopsies; the laboratory and the radiology units were not inspected</p>	<p>provided; the radiology department, headed by a technician, has a digital machine that offers plain radiographs and ultrasound services; the pharmacy also has a manufacturing unit for IV fluids; support services also include 2 social workers</p>	<p>measurements; the lab also provides a mini-blood bank service</p>	
<p>10) Resident Welfare Issues</p>		<p>Accommodation is available outside the hospital, but close enough for quick access into the hospital.</p>	<p>Canteen facilities are also available</p>		

## Recommendations for Pediatrics

1. There is the need for immediate recruitment of pediatric faculty to resource all the hospitals being used for training of residents.
2. A pathologist and a radiologist will need to be recruited urgently for JFK Hospital as a start to support all disciplines in training.
3. Laboratory services should be improved by expanding the range of tests done to include other hematological tests, as well as blood chemistry, cultures, and histopathology services.
4. More equipment should be purchased as back-up in all the pediatric units, with old equipment replaced; additional equipment should be acquired to enhance pediatric care (e.g., phototherapy units, blood pressure units with pediatric cuffs).
5. The separation of pediatric emergency patients from adult patients in Phebe and CB Dunbar hospitals should be encouraged in future reorganization; at Redemption Hospital, in-born and out-born neonates should be kept in separate areas.
6. Long-term follow-up clinics for chronic cases need to be more structured to improve resident exposure and experience.
7. The use of resident log-books should be enforced.
8. External attachments at other programs in the sub-region for a duration of 2-3 months should be seriously considered, especially as a short-term measure for current senior residents who appear uncertain about the future of their program which has had to be extended. This might boost their morale as they strive to complete their course.
9. JFK Hospital has great potential for residency training provided the above challenges are addressed.
10. Affiliate Hospitals will continue to be a great asset to the residency program to offer additional exposure in acute pediatric care, exposure to neonates, and nutritional rehabilitation.



*A resident and faculty member at Redemption Hospital's Pediatric Ward.*

## D. OBSTETRICS AND GYNECOLOGY

Sections or Areas Assessed	Findings				Comments & Recommendations
<b>A. ACADEMIC REQUIREMENTS</b>					
	<b>JFK</b>	<b>REDEMPTION</b>	<b>PHEBE</b>	<b>CBD</b>	
Consultants or Specialists	3/1	0/1	2/0	0/1	High Priority in all centers.

	1 (Dr. Kpoto) has M.Med; CV not available (need to vet to find out equivalence); the other 3 not available	Only 1 specialist, trained in China; CV not available	1 very experienced consultant with CV available; 1 fellow, graduated June 2016	Dr. Dolo, MGCS (Ghana); FWACS Pt. 1	There is need to employ more faculty for effective teaching
Residents	5	5	5	5	
Curriculum	Available	Available	Available	Available	
<b>LECTURES</b>					
Hours per week	2	6	6	0	High Priority (except for Redemption)
<b>LECTURES</b>					
Bedside Teaching	Daily	Daily	Daily	Daily	adequate
Tutorials per week	2	0	4	2	adequate
Library	Nil	Nil	Electronic	Nil	High Priority (except for Phebe)
Textbooks	Only few electronic copies				inadequate
Logbook	Available but not used properly				
Coordination of residency training	Nil	Nil	Nil	Nil	Coordinaters are needed
<b>B. OBSTETRIC SERVICES</b>					
<b>ANTENATAL</b>					
Consulting Rooms	4	2	4	2	adequate
Ultrasound Machine	1	1	1	1	adequate
<b>NURSING SECTION</b>					
Space	Adequate	Adequate	Adequate	Adequate	
Staffing	Good	Good	Good	Good	
<b>TRIAGE/EMERGENCY</b>					
Space	Adequate	Adequate	Adequate	Adequate	
Basic Tools	Available	Available	Available	Available	
Electronic Monitors	Nil	Nil	Nil	Nil	Urgently need
<b>PHARMACY</b>					

Pharmacist	3	3	1	1	Adequate
Dispensers	?	4	1	1	Adequate
Basic Drugs	Available	Available	Available	Available	
Mfg Infusions	No	No	Yes	No	Needed in the other three centers without
<b>LABORATORY</b>					
Technologist	Nil	Nil	Nil	Nil	Seriously needed to offer effective service
Technicians	6	4	18	4	
Scope of Work	Only basic hematology, urinalysis, and stool routine				There is a need to expand the scope of laboratory services
<b>BLOOD BANK</b>					
Fridges	2	1	1	1	adequate
Only whole blood, no fresh frozen plasma no platelet concentrate. Donation mainly by replacement system					
<b>LABOR AND DELIVERY</b>					
<b>First Stage Room</b>					
Beds	12	6	12	10	adequate
Basic Monitors	Adequate	Adequate	Adequate	Adequate	
Electronic Monitors	Nil	Nil	Nil	Nil	Seriously needed
Ultrasound Machine	1	1	1	1	adequate
<b>Second Stage Room</b>					
Delivery Beds	6	4	4	4	adequate
Ventuose Set	1	1	1	1	adequate
Forceps	Not seen in all sites				Not essential
Operating Room	2	2	2	2	adequate
<b>Scope of Cases</b>					
Caesarean Section	Yes	Yes	Yes	Yes	
Hysterectomy	Yes	Yes	Yes	Yes	

Manual removal of placenta	Yes	Yes	Yes	Yes	
<b>Recovery Ward</b>					
Beds	6	6	12	6	adequate
Monitors	Only basic monitoring done. Not electronic				High Priority. There is a need to introduce electronic monitors
Lying in Wards					
Beds	96	35	12	30	adequate
<b>NICU</b>					
Pediatrician	1	1	0	0	High Priority.
Facilities	Very Good	Good	Good	Poor	CBD needs to get good pediatric facility
Family Planning	Available	Available	Available	Available	
<b>2015 STATISTICS</b>					
Total OPD Cases	15,043	?	39651	35271	
Total Deliveries	2709	307 (October)	1112	1926	
Caesarean Section	709	63	278	-	
C/S rate	26.2%	26.5%	25%	27%	
Family Planning Cases	?	?	?	3479	
Maternal Deaths	39	3	?	?	
Maternal Mortality Rate Per 10000					
	1439	1260	?	?	
<b>C. GYNECOLOGICAL SERVICES</b>					
All use obstetric facilities					
Oncology	Nil	Nil	Very basic	Nil	High Priority.
Endocrinology	Nil	Nil	Nil	Nil	Gynaecological

Laparoscopy	Nil	Nil	Nil	Nil	services in whole country needs to be revamped
<b>Visiting Obstetric</b>					
Fistula repair expert	Yes	No	Yes	No	Intermediate Priority. One national center is good but has to be equipped
<b>2015 STATISTICS</b>					
Abnormal Hysterectomy	8	2 (September)	9	16	
Vaginal Hysterectomy	0	0	2	1	
Myomectomy	19	2	14	?	
Minor Surgery	46	11	60	?	
VVF repair			42		
<b>D. SUPPORT SERVICES</b>					
Pathology	Nil	Nil	Nil	Nil	There is urgent need to get these services as soon as possible
Anesthesiologist	Nil	Nil	Nil	Nil	
Radiology	No Radiologist				
Scope of work	Only Plain X-rays				
Urology	Not available in all centers				
Laboratory	No laboratory physician or technologist; very limited range of tests				

### Recommendations for OB/GYN

1. An adequate library facility exists only in Phebe Hospital, with a general lack of textbooks for the residents. The others need to have good library facilities.
2. There are no structured lectures at the centers and a need for a well-standardized series of lectures for all institutions.
3. Residents should fill out log-books at the end of each session, with periodic individual reviews to take place once every two months to assess progress and address learning and training gaps.
4. Only Phebe Hospital has experienced faculty to solely handle residency training programs. Dr. Dolo in C.B. Dunbar should be supported to complete the fellowship program. The faculty at Redemption Hospital's qualification should be vetted so as to find out if it is equivalent to a fellowship. If the M. Med qualification is not considered equivalent to a fellowship and if the other consultants in JFK Hospital have a fellowship, then Dr. Kpoto can be used as back-up faculty.



5. The concept of use of multiple sites for training is a good idea, however not all sites have equal strengths; JFK Hospital and Phebe Hospitals can be used as main training centers and Redemption and C.B. Dunbar as district rotation sites for 2<sup>nd</sup> year residents.
6. There is an adequate load of obstetrics cases in all the hospitals for residency programs, but there is a need to improve the NICU facilities at Redemption and C.B. Dunbar to make obstetric care complete.
7. Gynecology services are very limited for residency training, so one of the sites (either JFK or Phebe Hospital) should be equipped with the necessary tools to offer services, including basic oncology, endocrinology, and at a minimum, diagnostic laparoscopy.
8. The lack of pathology services in all the centers is of serious concern; arrangements should be put in place to get a pathologist as a matter of urgency.
9. There is lack of rotations in general surgery, urology, anesthesia, neonatology, radiology, and pathology; these can be arranged in a structured manner with other countries in the sub-region on a short-term basis not to exceed six months for all these rotations per resident until capacity is built up.
10. Electronic monitoring in all centers and provision of electronic monitors in the ICU and recovery wards will enhance patient care and also reduce the burden on the nurses.

## **OVERALL RECOMMENDATIONS FOR MEDICAL RESIDENCY PROGRAM**

There is a real need for Liberia to train specialist medical doctors. The current cohort of residents are very eager to learn, but there is an obvious apprehension among them of the outcome of the training program and their future. Therefore, our recommendations are as follows:

### **Urgent Issues for Short-Term Attention**

1. There is the need for immediate recruitment of consultants for all the training centers for all the disciplines.
2. A pathologist, an anesthetist, and a radiologist will need to be recruited at JFK Hospital as a start to support all disciplines in training.
3. Laboratory tests should be improved by expanding the range of tests, including, but not limited to: full blood count/film comment trephine, bone marrow biopsy, renal function test, lipid profile, cytopathology/histopathology cultures and sensitivity tests.
4. More basic equipment should be purchased and old equipment replaced.
5. Higher-level equipment should be purchased to carry out the recommended tests above.
6. Gynecology services should be expanded. Currently only basic infertility services are available; additions to services should include: contraceptive and reproductive endocrinology, urogynecology and pelvic medicine, and gynecologist oncology and preventive oncology services.
7. Good record keeping in the surgical theatres of all the training centers should be implemented.
8. A procedure room and an emergency drug trolley will make an excellent addition to surgical outpatient services.
9. The use of resident log-books should be enforced as soon as possible.
10. Biomedical engineering support is required to make equipment functional.

### **Intermediate-level Issues**

1. Separation of male and female patients in JFD Hospital should be encouraged.

2. Separation of pediatric emergency care from adult patients in Phebe and C.B. Dunbar hospitals should be encouraged in future reorganization, and in-born and out-born neonates in Redemption Hospital should be kept in separate areas.
3. Libraries in the training institutions should be stocked with current textbooks and journals.
4. External attachments for 2-3 months at other programs in the sub-region should be seriously considered, especially for the senior residents who appear uncertain about the future of their program.

## **Conclusion**

There appears to be a well-structured program for residency training as laid out in the various sectional curricula sighted, with JFK Hospital as the main training site supported by the other affiliate hospitals visited. JFD Hospital could be supported to be another full training site for internal medicine in the northern part of the country to minimize faculty and resident travel to remote areas. This will also make for more efficient use of resources.

The few faculty members at post appear dedicated and would need additional faculty support to strengthen their programs. There is an urgent need to recruit additional faculty for the postgraduate curriculum to run successfully. There is also an equally urgent need to expand laboratory and pathology services to support training in all the hospitals and the country at large so as to produce well-trained specialists who are capable of delivering a high standard of healthcare services to the people of Liberia. Without these in place, the result of training may be substandard and accreditation will likely be difficult to attain.

## **IV. REPORT ON BIOMEDICAL ENGINEERING CAPACITY TO SUPPORT RESIDENCY PROGRAM**

This section of the report provides an assessment of the current and prospective state of health facilities in terms of biomedical engineering services in Liberia. This was a walk through assessment to evaluate the state of facilities and equipment. It covered four areas: service departments, support departments, utilities, and biomedical equipment.

Departmental heads were interviewed using a structured questionnaire and observations were made. Results of the information gathered show that there is a serious need for a biomedical engineering cadre in the country.

A key finding of the assessment was that when most service department and medical equipment breaks down, new equipment is bought in lieu of repairing existing equipment. The Ministry of Health, by sending groups of biomedical engineers for training out of the country, is acting on this urgent need.

A limitation of this assessment was the short time-period and unforeseen delays that prevented the team from visiting one of the planned hospitals. Nevertheless, the technical consultants offer the following recommendations for action, among others:

- A rescue team of knowledgeable and experienced Biomedics to work with existing Biomedics in the lead two facilities, providing training and mentorship;
- Development and launch of a pre- and in-service biomedical training program; and
- Additional country-wide assessment to gain a clearer picture of gaps and needs at Liberia's healthcare institutions.

### **BIOMEDICAL ENGINEERING ASSESSMENT OVERVIEW**

This assessment covered all departments of each facility and was divided in three areas: infrastructure, medical and hospital equipment, and engineering staff. Under infrastructure, service departments, support department, and utilities departments were assessed. Four facilities were initially identified to be assessed, but, due to time constraints, only three were visited: John F. Kennedy and Redemption in Monrovia, and Jackson F. Doe in Tapeta.

## FACILITIES BACKGROUND

### John F. Kennedy Hospital



*The A&E entrance at JFK Hospital in Monrovia.*

The facility was built in 1971 with a grant from the U.S. Government. JFK is a 500-bed capacity facility and is the biggest teaching and referral hospital in the country. By standards when it was built, it was well planned, designed, and constructed.

With time and many years of war, however, the facility has deteriorated and now is under major renovations.

### Jackson F. Doe Hospital

JFD was built with a grant from the Chinese Government in 2009. It's a 120-bed facility situated in Tapeta, some 350 kilometers North of Monrovia. While JFD was well-equipped, much of its medical equipment was inoperable due to lack of maintenance. Donors have since procured new equipment and there is need to put a maintenance management in program in place for sustainability.



*JFD Hospital in Tapeta.*



*Japanese Maternity Hospital.*

### Japanese Maternity Hospital

Japanese Maternity Hospital is a 108-bed facility constructed with support of the Japanese Government.

### Redemption Hospital

Located in the center of Monrovia, RFD was originally a market and was turned to hospital in 1982 to address the country's need at that time. It is a very busy hospital with a 150-bed capacity. Redemption is a well-equipped facility but,

similar to most other hospitals in Liberia, there is no biomedical equipment maintenance program. Plans to relocate this facility are currently under way.

## FACILITY INFRASTRUCTURE ASSESSMENT

### Service Departments:

Department	John F. Kennedy	Jackson F. Doe	Redemption	Japanese Maternity Hospital
<b>Accident &amp; Emergency</b>	Drop off area is not well designed; triage area is small; basic equipment (defibrillator, patient vital signs monitors, suction, BP machine)	Well planned, designed, and constructed drop off area; adequate area; floor is finished with tiles; hand wash basin in every service room; walls are painted	No drop off area; limited triage area; basic equipment	Well planned, 2-floor facility; floor is tiled; walls are painted
<b>ICU</b>	No ICU; currently using examination rooms in A&E as critical care unit	Has a room set a side as an ICU, but not equipped for purpose	No ICU	
<b>Operation Theatres</b>	5 operation rooms with 1 common scrub room; well designed and constructed; walls and floor are tiled and still in good condition (should be maintained)	2 operation rooms that are well designed and constructed; floor and walls are finished with epoxy sheet	Two small operation rooms that are not properly designed, but are serving	
<b>Medical Laboratory</b>	Main laboratory is under construction	Well designed, but the rooms are not adequate; floor is tiles and has adequate lighting	One well designed room, but it is not adequate	
<b>Imaging</b>	Under renovation	In good condition, but not adequate; screening unit has room for CT scan and radiographic unit (both are installed in the	One room being used as screening and radiographic units; floor is tiled and wall is painted; site is not adequate	

		same room); floor is tiled and wall is painted		
<b>Surgical Wards</b>	Located on 4th floor and is well designed and constructed; floor is tiled and in sound condition; wall is painted; has hand wash basins, sluice rooms, and pantry rooms; patient call alarms are not working; has adequate natural lighting; renovations are under way	Well designed and constructed; floor is tiled and walls are painted; has hand wash basin for each cubical of four patients; sluice and pantry rooms; patient call alarms are installed, but not used	Not properly designed and constructed; floor is tiled and walls are painted; air circulation is limited; has hand wash basins, but no pantry room	

#### Support Departments:

DEPARTMENT	John F. Kennedy	Jackson F. Doe	Redemption
<b>Laundry</b>	Not visited	2 washer extractors, ironer, and tumble dryer are all broken down; 2 small domestic laundry machines are use, but will soon break down due to overloading	3 working domestic laundry machines and 9 broken down; anytime a set breaks down, it's set a side and a new one purchased
<b>Biomedical Engineering</b>	Small room being used by 5 BME staff; not well equipped and room is full of broken down equipment; some Biomed have undegone short trainings in USA, China, and Japan	Department is manned by 2 electrical artisans housed in a makeshift timber building, which is full of broken down equipment	Electrician oveesees maintenance; a visiting Biomed comes from the Ministry of Health 3 times a week
<b>Central Sterile Supply</b>	All autoclaves are beyond repair	2 main autoclaves and the water treatment plant are broken down; 1 small autoclave is in use, but inadequate for the facility	Main autoclave is broken down; they now rely on a small one that is inadequate for the facility

<b>Medical Gasses</b>	Oxygen plant donated, but not yet installed; facility uses oxygen concentrators and cylinders	No medical gasses plant onsite; uses oxygen concentrators and cylinders	Onsite oxygen plant that fills cylinders used throughout the facility; it is well maintained and backed up with oxygen concentrators
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*Scenes from the biomedical equipment lab at JFK.*



*Scenes from the biomedical equipment lab at JFD.*



**Utilities:**

Department	John F. Kennedy	Jackson F. Doe	Redemption
<b>Water</b>	Facility receives water from the city water supply and has a bore hole in case there is failure; water supply is adequate	Facility relies on water supply from a bore hole; supply is adequate	Facility receives water from the city water supply
<b>Electricity</b>	Facility receives power from mains as the primary source, with 4 generators as back up; all generators are serviced and working; they require manual switch on	3 generators are primary source of power; 1 runs during the day and another takes over during the night; power from main is not yet; transformer has been installed	Main is the primary power source, with a standby generator as back up; generator is well maintained, but must be switched on manually



*Power generators at JFD.*



**Equipment:**

Equipment & Department	John F. Kennedy	Jackson F. Doe	Redemption	Remarks
<b>Radiology:</b> <ul style="list-style-type: none"> <li>General purpose x-ray</li> <li>Diagnostic Ultra sound</li> <li>MRI</li> <li>CT Scan</li> <li>Flourosopic unit</li> </ul>	1(Good) 4(one faulty) 0 0 1	1(Good) 2(Good) 1(in Box) 1(Faulty) 1(Good)	1 0 0 0 1	Most of the equipment is good because they are replaced when one breaks down
<b>Medical Laboratory</b>	40% broken down, but can be repaired	60% not in use or not yet installed	40% not installed	
<b>Theatre</b> <ul style="list-style-type: none"> <li>Anaesthetic machine</li> <li>Surgical Lamp</li> <li>Electrosurgical Unit</li> <li>Suction unit</li> <li>Operation table</li> <li>C-Arm</li> <li>Endoscopy</li> </ul>	5(2New,3Old) 5 Good 6(3Good,3Faulty) 4 Good 6 (3 Good) 0 1(Not in use)	4(1-New) 2(New) 4(2, New) 4 Good 4 Good 1 Good 2(1 New)	2 2 4 4 4 0 0	
<b>Central Sterile Supply</b> <ul style="list-style-type: none"> <li>Autoclaves</li> <li>Water purify</li> </ul>	5(Faulty) None	4(Faulty) 1(Faulty)		
<b>General Wards</b> <ul style="list-style-type: none"> <li>Suctions units</li> <li>BP Machines</li> <li>Infusion pumps</li> <li>Weighing scales</li> </ul>	Good Good Good Good	Good Good Good Good	Good Good Good Good	
<b>Maternity (JMH)</b> <ul style="list-style-type: none"> <li>Suction machine</li> <li>BP Machine</li> <li>Delivery coach</li> <li>Infant incubators</li> <li>Baby warmers</li> <li>Resustaires</li> <li>Anaesthetic Machines</li> <li>TSSU</li> </ul>	Good Good Good Good Good Good Good Autoclave faulty			

## Biomedical Engineering Staff:

Level of Training	John F. Kennedy	Jackson F. Doe	Redemption	Ministry of Health
Degree	None	None	None	
Diploma	2	None	None	6
Technician	1	None	None	
Artisan Electrical	2	2		
Undergoing Training in Kenya	-	-	-	15

## SUMMARY OF FINDINGS

The assessment covered three health facilities being considered for residency training for doctors in Liberia: John F. Kennedy Hospital in Monrovia, which is the biggest teaching and referral hospital in the country; Jackson Doe Hospital in Tapeta; and Redemption Hospital in Monrovia.

### Key Findings:

1. At JFK, most equipment is obsolete and requires replacement.
2. The JFK maternity unit is well equipped, but there is no maintenance program in place and must be addressed.
3. JFD is well equipped, but due to lack of preventive maintenance, much of the equipment is inoperable across most departments (e.g., CSSD, laundry, laboratory, and imaging); additionally, patient monitors and oxygen concentrators are not working.
4. There are a number of medical equipment donors supporting the country's need for both new and old equipment, but very little attention is given to sustainability and maintenance.
5. JFK has an in-house Biomedical Engineering Department with three technologists with backgrounds in electronics and specialized training in biomedical engineering, but the department is not equipped with needed tools and test equipment.
6. There is a significant shortage of qualified biomedical engineering professionals at all skill levels (technicians, technologists, engineers).
7. There is a great need for an in-country training program for Biomed.
8. Power Supply:
  - a. JFK is connected to the grid and has standby generators for main facility and generators, but are not on automatic;
  - b. JFD is running on generators, one during day and one in the night; they are adequate. The national power grid has yet to switch them on.
  - c. Redemption is connected to the national grid and has a manual standby generator.
9. Water System:
  - a. All facilities have adequate water supply from both city and borehole.

10. Training Facilities:

- a. Professors are using the same room for teaching and office space.
- b. There is no resource center.

## **RECOMMENDATIONS FOR BIOMEDICAL ENGINEERING & LABORATORY SERVICES**

1. Staffing recommendations are for a minimum of one biomedical technologist, supported by additional technicians, for Jackson Doe; at least two biomedical engineers and five technologists, supported by additional technicians, for JFK; and one technologist for Redemption.
2. There is need for a rescue team of knowledgeable and experienced Biomedics to go work in the two facilities to address immediate needs and provide in-service training and mentoring for local staff.
3. Facilities should construct and equip Biomedical Engineering Departments.
4. Further assessments for all the facilities in the country is needed and should be performed by an external team of experienced biomedical engineers and technologists accompanied by local experts; selected repairs and training can be conducted in tandem with this activity.
5. There is need for in-service training for existing Biomedics.
6. There should be a serious advocacy program for the integration of biomedical engineering staff into healthcare service system.
7. JFK's A&E Department should be re-designed to have a proper drop off area with a drive through and a canopy to protect patients and staff from the elements, similar to that of JFD.

## **CONCLUSION**

For the assessed facilities to be used effectively for a residency program, medical equipment should be available all the time and in an optimally functioning state. From the findings above, the serious problem of equipment maintenance, which has led a number of key equipment being out of service, can be reduced by ensuring the country has adequate training programs for all Biomedics at both the in-service and pre-service levels and by building and equipping structures in a manner that supports biomedical engineering and technology in keeping with best practices. This will increase the lifespan of the equipment and reduce both the cost of maintenance and expenses for new equipment.