Questions for ODA Representatives

1. Emmanuel AMANKWAA-FREMPONG

1. From your current perspective, what are the three most important problems/challenges that you and others in radiation therapy in your country are facing? A) Machine breakdown B) Inadequate staff C) Lack of maintenance

2. Looking ahead:
   a. How do you see the physical infrastructure in your country changing over the next 5-10 years? Infrastructural changes are currently ongoing
   b. Do you sense that there is increased interest among healthcare providers in the care of patients with cancer in your country? Not that much

3. What radiation therapy system(s) do you have at this time?
   a. Linear accelerator(s): x-ray energies?, do you have electrons? electron energies?
   b. Cobalt-60 units
   c. Brachytherapy system(s)
   d. Treatment planning system(s)
   e. Simulation equipment: conventional simulator?, computed tomography (CT)-based simulator?, do you access to magnetic resonance imaging (MR) for simulation?, positron emission tomography (PET/CT) scanner?
   f. Treatment capability. Do you have: 3DCRT, intensity modulated radiation therapy (IMRT), image-guided radiation therapy (IGRT), stereotactic body radiation therapy (SBRT)?

4. What additional radiation therapy technologies would you like to have at your facility?
   a. What linear accelerator capabilities would you like to have?
      1) x-ray beam energy: 6 MV, 8 MV, 10 MV, other?
      2) Electrons? Energies?
   b. Brachytherapy system?
   c. Simulation equipment: CT?, MR?, PET/CT scanner?
   d. Treatment planning system?
   e. What additional treatment capabilities would you like to have? 3DCRT, IMRT, IGRT, SBRT?

5. Infrastructure and environment
   a. Do you have a reliable power supply for the linear accelerator? NO
   b. Do you have a reliable water supply for the linear accelerator? YES
   c. Do you have an air-conditioned facility for the equipment? YES
   d. Do you face harsh environmental conditions? If so what kind(s) and for what fraction of the year? NO

6. Adequacy of your workforce (staffing)
a. Radiation oncologists  4
b. Physicists  6
c. Dosimetrist none
d. Oncology nurses  4
e. Engineers none
f. Data manager(s) none

7. Education and training
   a. Do you have in-house education and training programs? If so, what kinds? YES Fellowship program
   b. How do you arrange for education and training of your staff elsewhere, if needed? Rely on foreign sponsorship
   c. Does your equipment supplier provide training? If so, how long? NOT YET
   d. Do you have a degree-awarding program for physicists? Other staff? YES

8. Procurement
   b. Is procurement a simple process or complicated? “Red tape?” COMPLICATED
   c. Does the Ministry of Health have a multi-year procurement plan? YES

9. Funding
   a. Is funding done yearly at a national level such as the Ministry of Health? YES
   b. Is all or some of your funding local? Some are local
   c. Do you compete with other departments for funds? YES
   d. Is funding adequate for your needs? NO
   e. Is your funding reliable year-on-year? NO

2. Simeon Chinedu ARUAH

7. From your current perspective, what are the three most important problems/challenges that you and others in radiation therapy in your country are facing?
   1. Lack of experts in Radiation Oncologists with modern training despite increasing diagnosis of cancer
   2. Lack of Radiation equipment including Linear accelerator and its accessories
   3. Poor budgetary allocation to health and lack of National Cancer Institute to collate Cancer incidence and mortality.

8. Looking ahead:
   c. How do you see the physical infrastructure in your country changing over the next 5-10 years?
      : The physical infrastructure in my country Nigeria is not likely to change over the next 5-10 years due to poor budgetary allocation to health unless there is intervention from external assistance.
   d. Do you sense that there is increased interest among healthcare providers in the care of patients with cancer in your country?
      : Yes, there is increased interest among healthcare providers in the care of cancer patients without concomitant increase in healthcare providers training, increase
budgetary allocation to health and few Radiation Oncology centers to cater for increasing number of cancer cases.

9. What radiation therapy system(s) do you have at this time?
   a. Linear accelerator(s): x-ray energies? do you have electrons? electron energies?
      : At my center National Hospital Abuja, Nigeria we have Linear accelerator.
   b. Cobalt-60 units
      : There are three Cobalt-60 units in two Government owned Radiotherapy centers and one private center but not in National Hospital Abuja.
   c. Brachytherapy system(s)
      : We have low dose rate (LDR) Cesium Brachytherapy machine in our center.
   d. Treatment planning system(s)
      : No center in Nigeria has Treatment planning system, however we are trying to acquire one in my center National Hospital Abuja.
   e. Simulation equipment: conventional simulator? computed tomography (CT)-based simulator? do you access to magnetic resonance imaging (MR) for simulation? positron emission tomography (PET/CT) scanner?
      : We have only one conventional simulator in my center and no other accessories
   f. Treatment capability. Do you have: 3DCRT, intensity modulated radiation therapy (IMRT), image-guided radiation therapy (IGRT), stereotactic body radiation therapy (SBRT)?
      : We are not capable of such treatment modalities because of lack expert training and equipment.

10. What additional radiation therapy technologies would you like to have at your facility?
    f. What linear accelerator capabilities would you like to have?
       3) x-ray beam energy: 6 MV, 8 MV, 10 MV, other?
          : 6MV, 8 MV, 10MV, 15MV
       4) Electrons? Energies?
          : 4 MeV, 10 MeV, 15 MeV.
    g. Brachytherapy system?
       : HDR, LDR
    h. Simulation equipment: CT? MR? PET/CT scanner?
       : We need CT simulator, 1.5 and 3.0 Tesla MRI, PET/CT scanner.
    i. Treatment planning system?
       : We need treatment planning system in all Radiation Oncology centers in Nigeria.
    j. What additional treatment capabilities would you like to have? 3DCRT, IMRT, IGRT, SBRT?
       : We will like to have treatment capabilities like 3DCRT, IMRT, IGRT, SBRT with training of end users.

11. Infrastructure and environment
    e. Do you have a reliable power supply for the linear accelerator?
       : Yes, we have dedicated power supply and standby generator set to power our linear accelerator.
    f. Do you have a reliable water supply for the linear accelerator?
Yes, we have

g. Do you have an air-conditioned facility for the equipment?
   : Yes, we have

h. Do you face harsh environmental conditions? If so what kind(s) and for what fraction of the year?
   : Not at all. We have good weather.

12. Adequacy of your workforce (staffing)
   g. Radiation oncologists
      :: Not adequate compare to Doctor: patient ratio
   h. Physicists
      :: Not adequate compare to Physicist: patient ratio
   i. Dosimetrists
      :: No available trained Dosimetrist
   j. Oncology nurses
      :: No adequate Oncology Nurses compare to patient volume
   k. Engineers
      :: No trained Radiotherapy machine Engineers
   l. Data manager(s)
      :: No trained Data manager(s)

13. Education and training
   a. Do you have in-house education and training programs? If so, what kinds?
      :: Yes, but the training is poorly supervised with inadequate training materials.
   e. How do you arrange for education and training of your staff elsewhere, if needed?
      :: Most training is on self-development as Government hardly sponsor any training program.
   f. Does your equipment supplier provide training? If so, how long?
      :: To the best of knowledge I have not witnessed any training by the equipment supplier.
   g. Do you have a degree-awarding program for physicists? Other staff?
      :: Not at all, excepts degree program in University for physicists but not medical physicists.

14. Procurement
   d. Is procurement of radiation therapy equipment done locally? Regionally? Country level?
      :: Country level
   e. Is procurement a simple process or complicated? “Red tape?”
      :: In Nigeria it is very complicated with a lot of bottleneck.
   f. Does the Ministry of Health have a multi-year procurement plan?
      :: None to the best of my knowledge as our Radiotherapy centers are not of World standard

15. Funding
   f. Is funding done yearly at a national level such as the Ministry of Health?
      :: Yes, but hardly used to procure Radiotherapy equipment.
   g. Is all or some of your funding local?
      :: Yes, through Hospital internal generated revenue.
   h. Do you compete with other departments for funds?
      :: Yes
   i. Is funding adequate for your needs?
      :: No
   j. Is your funding reliable year–on-year?
      :: Not reliable and sometimes it does not come
3. Hubert FOY

1. From your current perspective, what are the three most important problems/challenges that you and others in radiation therapy in your country are facing?
   a. Lack of equipment
   b. Lack of personnel
   c. Lack of awareness

2. Looking ahead:
   a. How do you see the physical infrastructure in your country changing over the next 5-10 years?
      a. More private and public facilities will be established due to increasing awareness, increasing service demand, and possible favorable government policies
   b. Do you sense that there is increased interest among healthcare providers in the care of patients with cancer in your country?
      a. Yes. At the very least, everyone seems to have lost a loved due to cancer or know someone who is suffering or passed away due to cancer.
      b. Greater media coverage and public discourse related to broken down RT equipment, poor services if it exist or none at all requiring medical tourism to other countries sometimes outside Africa suggest healthcare providers will have increased interest in the care of cancer.

3. What radiation therapy system(s) do you have at this time?
   a. Linear accelerator(s): x-ray energies?, do you have electrons? electron energies? Two are under installation.
   b. Cobalt-60 units
   c. Brachytherapy system(s)
   d. Treatment planning system(s)
   e. Simulation equipment: conventional simulator?, computed tomography (CT)-based simulator?, do you access to magnetic resonance imaging (MR) for simulation?, positron emission tomography (PET/CT) scanner?
   k. Treatment capability. Do you have: 3DCRT, intensity modulated radiation therapy (IMRT), image-guided radiation therapy (IGRT), stereotactic body radiation therapy (SBRT)?

4. What additional radiation therapy technologies would you like to have at your facility?
   a. What linear accelerator capabilities would you like to have?
      1) x-ray beam energy: 6 MV, 8 MV, 10 MV, other?
      2) Electrons? Energies?
   b. Brachytherapy system?
   c. Simulation equipment: CT? MR? PET/CT scanner?
   d. Treatment planning system?
   e. What additional treatment capabilities would you like to have? 3DCRT, IMRT, IGRT, SBRT?

5. Infrastructure and environment
   a. Do you have a reliable power supply for the linear accelerator? The national grid is unstable but we hope to us UPS to stabilize the national power
   b. Do you have a reliable water supply for the linear accelerator? Yes
   c. Do you have an air-conditioned facility for the equipment? Yes
   d. Do you face harsh environmental conditions? If so what kind(s) and for what fraction of the year? Historically, no major disaster has occurred at any of the
current facilities. Although environmental site assessments are carried and approval accorded to construct facilities, one cannot rule out the possibility of future natural disaster

6. Adequacy of your workforce (staffing)
   a. Radiation oncologists
   b. Physicists
   c. Dosimetrists
   d. Oncology nurses
   e. Engineers
   f. Data manager(s)

7. Education and training
   a. Do you have in-house education and training programs? If so, what kinds? No. But Varian has provided training to staff who will operate and maintain the LINAC under installation. We do also have bilateral training opportunities with universities and IAEA.
   b. How do you arrange for education and training of your staff elsewhere, if needed? In the past, we have been approached to benefit from external training opportunities. If we are aware of some, we can request for support if it does not place a financial burden on our organization.
   c. Does your equipment supplier provide training? If so, how long? Yes. Varian provide planned training, on and off, over 1-2 years leading to the start of the machine and, based on warranty, training will continue into the early years of the machine operation.
   d. Do you have a degree-awarding program for physicists? Other staff? Ghana Graduate School of Nuclear and Allied Science provide postgraduate training for radiation physicist and nuclear technicians.

8. Procurement
   a. Is procurement of radiation therapy equipment done locally? Regionally? Country level? Country level. Since the equipment are purchased through loans via partnershi, the lender is also involved in the procurement process.
   b. Is procurement a simple process or complicated? “Red tape?” Complicated because they are many stakeholders and long policies to ensure transparency and minimize mismanagement.
   c. Does the Ministry of Health have a multi-year procurement plan? Yes

9. Funding
   a. Is funding done yearly at a national level such as the Ministry of Health? Funding is done locally but RT finding cannot be achieved locally entirely. It will require a loan and negotiations and conditions to fulfill.
   b. Is all or some of your funding local? Only a tiny fraction is local. Majority is via loan/credit.
   c. Do you compete with other departments for funds? Yes. Especially departments for communicable diseases.
   d. Is funding adequate for your needs? No
   e. Is your funding reliable year–on-year? No

4. Surbhi GROVER
1. From your current perspective, what are the three most important problems/challenges that you and others in radiation therapy in your country are facing?

-Human resources
-Technical expertise
-Political challenges

2. Looking ahead:
   a. How do you see the physical infrastructure in your country changing over the next 5-10 years?
      -We will likely have the new public RT dept open with one linac and one brachytherapy unit.

   b. Do you sense that there is increased interest among healthcare providers in the care of patients with cancer in your country?
      -In some departments, yes, but in others, still a lot of challenges getting cancer on the differential diagnosis and to speed up work-up. There is still a sense that cancer patients will all die, so why waste time. We don't have any people in other departments such as surgery that are trained in oncology.

3. What radiation therapy system(s) do you have at this time?
   a. Linear accelerator(s): x-ray energies?, do you have electrons? electron energies?
      Private sector department has an elekta linac with Elekta VERSA HD – 6 + 10 MV; 4, 6, 8, 10, 12 MeV.

   b. Cobalt-60 units
      None

   c. Brachytherapy system(s)
      Neuclotron HDR

   d. Treatment planning system(s)
      Monaco

   e. Simulation equipment: conventional simulator?, computed tomography (CT)-based simulator?, do you access to magnetic resonance imaging (MR) for simulation?, positron emission tomography (PET/CT) scanner?
      -CT simulator

   f. Treatment capability. Do you have: 3DCRT, intensity modulated radiation therapy (IMRT), image-guided radiation therapy (IGRT), stereotactic body radiation therapy (SBRT)?
      3DCRT

4. What additional radiation therapy technologies would you like to have at your facility?
   Would like to have all the ones mentioned below in the public sector-Linac, brachytherapy, CT simulator and TPS.

   a. What linear accelerator capabilities would you like to have?
      1) x-ray beam energy: 6 MV, 8 MV, 10 MV, other?
      2) Electrons? Energies?

   b. Brachytherapy system?

   c. Simulation equipment: CT?, MR?, PET/CT scanner?

   d. Treatment planning system?

   e. What additional treatment capabilities would you like to have? 3DCRT, IMRT, IGRT, SBRT?
5. Infrastructure and environment
   a. Do you have a reliable power supply for the linear accelerator?
      Yes
   b. Do you have a reliable water supply for the linear accelerator?
      Yes
   c. Do you have an air-conditioned facility for the equipment?
      Yes
   d. Do you face harsh environmental conditions? If so what kind(s) and for what fraction of the year?
      Heat waves for 30-40% of the year

6. Adequacy of your workforce (staffing)-In public sector as we plan for the new center
   a. Radiation oncologists-2 (2 in private)
   b. Physicists- 0 (1 in private)
   c. Dosimetrists-0 (2 in private)
   d. Oncology nurses-2 (2 in private)
   e. Engineers-0
   f. Data manager(s)-0

7. Education and training
   a. Do you have in-house education and training programs? If so, what kinds?
      No
   b. How do you arrange for education and training of your staff elsewhere, if needed?
      IAEA
   c. Does your equipment supplier provide training? If so, how long?
      We are working with IAEA on a tender for public sector. In private, eleckta does provide training, but it is limited (unclear if due to lack of supply or demand)
   d. Do you have a degree-awarding program for physicists? Other staff?
      No

8. Procurement
   a. Is procurement of radiation therapy equipment done locally? Regionally? Country level?
      Regionally (through SA)
   b. Is procurement a simple process or complicated? “Red tape?”
      Very complicated. We will likely go through IAEA for the public center
   c. Does the Ministry of Health have a multi-year procurement plan?
      There is no plan

9. Funding
   a. Is funding done yearly at a national level such as the Ministry of Health?
      Yes
   b. Is all or some of your funding local?
      Yes
   c. Do you compete with other departments for funds?
      Yes
   d. Is funding adequate for your needs?
      No, but could be enough with appropriate management
   e. Is your funding reliable year–on-year?
      Yes
5. Taofeq IG

1. From your current perspective, what are the three most important problems/challenges that you and others in radiation therapy in your country are facing? A – Inadequate Budgetary Provision to run the service B - Manpower shortages and C – Lack of proper and decent Maintenance of the equipment.

2. Looking ahead:
   a. How do you see the physical infrastructure in your country changing over the next 5-10 years? It appears promising as government is now investing in some critical infrastructure earlier left to decay and wither away.
   b. Do you sense that there is increased interest among healthcare providers in the care of patients with cancer in your country? Sure – this is an understatement inspite of the apparent frustration on the part of the few available human resource.

3. What radiation therapy system(s) do you have at this time?
   a. Linear accelerator(s): x-ray energies?, do you have electrons? electron energies? Linacs – mostly 6 & 15 mV’s (5 no.) but now there is one with 6, 10 & 15mV’s (1); mixed of electron energies – 4, 6, 8, 9, 10, 12, 15 and 18 mev’s.
   b. Cobalt-60 units – 3 EBRT systems
   c. Brachytherapy system(s) – 3 Cs-137(LDR) based systems, 1 Co-60 (HDR) and 1 Ir-192 (HDR)
   d. Treatment planning system(s) – 5 TPS (4 – Preciseplan and 1-Monaco)
   e. Simulation equipment: conventional simulator? 1) computed tomography (CT)-based simulator? 5 CT-SIMS, do you have access to magnetic resonance imaging (MR) for simulation? NO, positron emission tomography (PET/CT) scanner? NO.
   d. Treatment capability. Do you have: 3DCRT, This is our aspiration as at now - YES, intensity modulated radiation therapy (IMRT) NO, image-guided radiation therapy (IGRT) NO, stereotactic body radiation therapy (SBRT)? NO

4. What additional radiation therapy technologies would you like to have at your facility? IMRT, VMAT.
   a. What linear accelerator capabilities would you like to have?
      1) x-ray beam energy: 6 MV, 8 MV, 10 MV, other? See above in 3a.
   b. Brachytherapy system? More Co-60 and Ir-192 HDR systems
   c. Simulation equipment: CT?, MR?, PET/CT scanner? PET/CT scanner?
   d. Treatment planning system? Monaco and Pinnacle
   e. What additional treatment capabilities would you like to have? 3DCRT, IMRT, IGRT, SBRT? IMRT, VMAT.

5. Infrastructure and environment
   a. Do you have a reliable power supply for the linear accelerator? Yes
   b. Do you have a reliable water supply for the linear accelerator? Yes
   c. Do you have an air-conditioned facility for the equipment? Yes
   d. Do you face harsh environmental conditions? If so what kind(s) and for what fraction of the year?

6. Adequacy of your workforce (staffing)
   a. Radiation oncologists - 50
   b. Physicists - 30 (Two third of this number are trainees)
   c. Dosimetrists - RTT’s: 40
   d. Oncology nurses - 50
7. Education and training
   a. Do you have in-house education and training programs? If so, what kinds? – Yes:
      Residency Programme for the Doctors (established), Physicists (still on test-run),
      RTT’s (with IAEA support, not frequent). Oncology Nurses (School of Oncology
      Nursing fully established)
   b. How do you arrange for education and training of your staff elsewhere, if needed?
      Mostly via IAEA support
   c. Does your equipment supplier provide training? If so, how long? Yes – between 1 –
      3 weeks (at most)
   d. Do you have a degree-awarding program for physicists? Other staff? Yes – MSc and
      PhD for Medical Physicists academic with minimal or no clinical component

8. Procurement
      level? Both Locally and at Country level
   b. Is procurement a simple process or complicated? “Red tape?” Not Simple!
   c. Does the Ministry of Health have a multi-year procurement plan? Not sure

9. Funding
   a. Is funding done yearly at a national level such as the Ministry of Health? Yes
   b. Is all or some of your funding local? Yes.
   c. Do you compete with other departments for funds? Yes.
   d. Is funding adequate for your needs? No.
   e. Is your funding reliable year-on-year? No.

6. Hellen MAKWANI
1. From your current perspective, what are the three most important problems/challenges
   that you and others in radiation therapy in your country are facing?

   The challenges we face in our country with radiotherapy is we have only two centers
   at moment ie Ocean Road Cancer institute and Bugando Medical Center comparing
   with the number of patients.

   Most of the patients are seen with very advanced disease most of them stage three
   and four which limits the potential of curing the disease in an earlier disease.

   Most of the patients are poor although with ORCI the service is free, this limits them
   to reach Hospitals earlier than required hence results into poor prognosis of their
   illness.

2. Looking ahead:
   a. How do you see the physical infrastructure in your country changing over the next
      5-10 years?
      The physical infrastructure in Tanzania in the next five to ten years will have good
      radiotherapy services and we shall have more centers developing like Mbeya
      Refferal Hospitals and Kilimanjaro Christian Medical Center.
   b. Do you sense that there is increased interest among healthcare providers in the
      care of patients with cancer in your country?
      Yes there is increased interest in care of cancer patients.
3. What radiation therapy system(s) do you have at this time?
   a. Linear accelerator(s): x-ray energies?, do you have electrons? electron energies? We do not have linear accelerators but on process of getting two linear accelerators both with xray energies and electron energies.
   b. Cobalt-60 units
      We have two Cobalt-60 units at ORCI and one unit at BMC.
   c. Brachytherapy system(s)
      We have two brachytherapy units at ORCI one will be installed soon at BMC.
   d. Treatment planning system(s)
      One for brachytherapy unit.
   e. Simulation equipment: conventional simulator?, computed tomography (CT)-based simulator?, do you access to magnetic resonance imaging (MR) for simulation?, positron emission tomography (PET/CT) scanner?
      Have only one conventional simulator.
   f. Treatment capability. Do you have: 3DCRT, intensity modulated radiation therapy (IMRT), image-guided radiation therapy (IGRT), stereotactic body radiation therapy (SBRT)?
      We do not have any of the above.

4. What additional radiation therapy technologies would you like to have at your facility?
   a. What linear accelerator capabilities would you like to have?
      1) x-ray beam energy: 6 MV, 8 MV, 10 MV, other?
         X-ray beam energy 6MV and 15MV
      2) Electrons? Energies?
         6Mev,9Mev and 12Mev.
   b. Brachytherapy system?
      We have two units.
   c. Simulation equipment: CT?, MR?, PET/CT scanner?
      CT, MR and PET/CT scanner
   d. Treatment planning system?
      At least four treatment planning systems.
   e. What additional treatment capabilities would you like to have? 3DCRT, IMRT, IGRT, SBRT?
      3DCRT and IMRT.

5. Infrastructure and environment
   a. Do you have a reliable power supply for the linear accelerator? Yes
   b. Do you have a reliable water supply for the linear accelerator? Yes
   c. Do you have an air-conditioned facility for the equipment? Yes
   d. Do you face harsh environmental conditions? If so what kind(s) and for what fraction of the year?
      The harsh condition is throughout the year as we have a lot of cancer patients.

6. Adequacy of your workforce (staffing)
   a. Radiation oncologists
      We are 25 Radiation Oncologists in Tanzania
   b. Physicists
      We have four physicist in Tanzania.
   c. Dosimetrists
      None
   d. Oncology nurses
      Four Oncology nurses.
7. Education and training
   a. Do you have in-house education and training programs? If so, what kinds?
      Yes we do have Bachelor of science in Radiation Technology and Masters of Medicine in Clinical Oncology.
   b. How do you arrange for education and training of your staff elsewhere, if needed?
      Depending on the need of a person to be trained for a specific purpose or depending on the Country allocated fund for a specific training.
   c. Does your equipment supplier provide training? If so, how long?
   d. Do you have a degree-awarding program for physicists? Other staff? No for Physicist but for Radiotherapists and Clinical Oncologists.

8. Procurement
   a. Is procurement of radiation therapy equipment done locally? Regionally? Country level?
   b. It depends with the equipment needed at that particular time. Some locally some county level.
   c. Is procurement a simple process or complicated? “Red tape?” Not complicated it follows the international procedures.
   d. Does the Ministry of Health have a multi-year procurement plan? Yes the plan is present.

9. Funding
   a. Is funding done yearly at a national level such as the Ministry of Health? Yes.
   b. Is all or some of your funding local?
      Some are local funding.
   c. Do you compete with other departments for funds?
      No we do not compete for funds.
   d. Is funding adequate for your needs?
      The funds are not enough to cover the population.
   e. Is your funding reliable year–on-year?
      Yes but the amount varies from year to year.

7. Ekidio NGIGI

1. From your current perspective, what are the three most important problems/challenges that you and others in radiation therapy in your country are facing?
   - The cost of radiotherapy equipment and maintenance
   - The majority of patients cannot afford the cost of radiotherapy service

2. Looking ahead:
   a. How do you see the physical infrastructure in your country changing over the next 5-10 years?
      - Three (3) new radiotherapy centers will be put up with at-least five (5) new radiotherapy equipment installations
b. Do you sense that there is increased interest among healthcare providers in the care of patients with cancer in your country? - Yes, actually immensely

3. What radiation therapy system(s) do you have at this time?
   a. Linear accelerator(s): x-ray energies?, do you have electrons? electron energies?
      - In the country eight (8) Linacs in private center and one (1) in public facility.
      - Most of the Linacs are dual energies (6 MV and 15 or 18MV) with electron energies 6, 9, 12, and 15 MeV
   b. Cobalt-60 units
      - Two (2) units at public facility
   c. Brachytherapy system(s)
      - Three (3) HDR units
   d. Treatment planning system(s)
      - Five (5) TPS in five centers with minimum of 3D capabilities
   e. Simulation equipment: conventional simulator? – Yes, two (2) in public facilities only, computed tomography (CT)-based simulator? - Yes, five (5) centers including public, do you access to magnetic resonance imaging (MR) for simulation? - No, positron emission tomography (PET/CT) scanner? - No
   f. Treatment capability. Do you have: 3DCRT? - Yes, intensity modulated radiation therapy (IMRT)? – Yes only one private center, image-guided radiation therapy (IGRT)? - No, stereotactic body radiation therapy (SBRT)? – No

4. What additional radiation therapy technologies would you like to have at your facility?
   - dedicated CT-Simulator, IMRT/IGRT and PET/CT with cyclotron facility for isotope production & research
   a. What linear accelerator capabilities would you like to have?
      1) x-ray beam energy: 6 MV, 8 MV, 10 MV, other? - 15 MV
      2) Electrons? Energies? – 6, 9, 12, 15 MeV
   b. Brachytherapy system? – HDR with Co-60 Source
   c. Simulation equipment: CT?, MR?, PET/CT scanner? – All
   d. Treatment planning system? -
   e. What additional treatment capabilities would you like to have? 3DCRT, IMRT, IGRT, SBRT? – All, but mainly 3DCRT and IMRT

5. Infrastructure and environment
   a. Do you have a reliable power supply for the linear accelerator? - Yes, but mainly with reliable back-up
   b. Do you have a reliable water supply for the linear accelerator? – Yes
   c. Do you have an air-conditioned facility for the equipment? – Yes
   d. Do you face harsh environmental conditions? If so what kind(s) and for what fraction of the year? – No

6. Adequacy of your workforce (staffing)
   a. Radiation oncologists, - Shortage of qualified/untrained approximately 50%
   b. Physicists, - Shortage of qualified/untrained approximately 40%
   c. Dosimetrists, – N/A, we have RTTs Shortage of qualified/untrained approximately 30%
   d. Oncology nurses
   e. Engineers, - Lack of properly trained biomedical engineers on maintenance of radiotherapy machines
   f. Data manager(s), – No trained personnel

7. Education and training
a. Do you have in-house education and training programs? If so, what kinds? – *Basically, on-the-job training*

b. How do you arrange for education and training of your staff elsewhere, if needed? – *Mostly rely on fellowship and scholarships due to cost.*

c. Does your equipment supplier provide training? If so, how long? – *Basically short, at-most a week.*

d. Do you have a degree-awarding program for physicists? Other staff? – *Only RTTs for now. Plan underway for MP, RO & NO.*

8. Procurement
   b. Is procurement a simple process or complicated? “Red tape?” – *Complex*
   c. Does the Ministry of Health have a multi-year procurement plan? – *Its purely annual.*

9. Funding
   a. Is funding done yearly at a national level such as the Ministry of Health? – *Yes*
   b. Is all or some of your funding local? – *Can be local or external*
   c. Do you compete with other departments for funds? – *Yes, infectious diseases take center stage in funding.*
   d. Is funding adequate for your needs? – *No*  
      Is your funding reliable year-on-year? – *No*

**8. Shaid YUSUFU**

1. From your current perspective, what are the three most important problems/challenges that you and others in radiation therapy in your country are facing?
   - The challenges we face in our country with radiotherapy is we have only two public cancer centers at moment Ocean Road Cancer institute and Bugando Medical Center and 1 new private clinic which are not enough comparing with the number of patients.
   - More than 60% of cancer patients are reporting to hospital with very advanced disease.
   - Most of the patients are poor and cannot afford therapy despite of free radiation services provided in the public hospital.

2. Looking ahead:
   a. How do you see the physical infrastructure in your country changing over the next 5-10 years?
      - The physical infrastructure in Tanzania in the next five to ten years is have more radiotherapy centers of 5 in total includes Mbeya Referal Hospitals and Kilimanjaro Christian Medical Center.
   b. Do you sense that there is increased interest among healthcare providers in the care of patients with cancer in your country?
      - Yes there is increased interest in care of cancer patients.

3. What radiation therapy system(s) do you have at this time?
   a. Linear accelerator(s): x-ray energies?, do you have electrons? electron energies?
There is one private clinic possessing 6 MV linac.

b. Cobalt-60 units
   - There are two Cobalt-60 units at ORCI and one unit at BMC.

c. Brachytherapy system(s)
   - There are two brachytherapy units at ORCI

d. Treatment planning system(s)
   - Yes, at Private clinic they have TPS

e. Simulation equipment: conventional simulator?, computed tomography (CT)-based simulator?, do you access to magnetic resonance imaging (MR) for simulation?, positron emission tomography (PET/CT) scanner?
   - There are two conventional simulators, and 1 CT-SIM.

f. Treatment capability. Do you have: 3DCRT, intensity modulated radiation therapy (IMRT), image-guided radiation therapy (IGRT), stereotactic body radiation therapy (SBRT)?
   - Private clinic has started 3DCRT

4. What additional radiation therapy technologies would you like to have at your facility?
   a. What linear accelerator capabilities would you like to have?
      1) X-ray beam energy: 6 MV, 8 MV, 10 MV, other?
         - X-ray beam energy 6MV and 15MV
      2) Electrons? Energies?
         - 6Mev, 9Mev and 12Mev.
   b. Brachytherapy system?
      - There are two units in the country.
   c. Simulation equipment: CT?, MR?, PET/CT scanner?
      - CT, MR and PET/CT scanner
   d. Treatment planning system?
      - 3 treatment planning systems. Will be available in near future
   e. What additional treatment capabilities would you like to have? 3DCRT, IMRT, IGRT, SBRT?
      - 3DCRT and IMRT.

5. Infrastructure and environment
   a. Do you have a reliable power supply for the linear accelerator? Yes
   b. Do you have a reliable water supply for the linear accelerator? Yes
   c. Do you have an air-conditioned facility for the equipment? Yes
   d. Do you face harsh environmental conditions? If so what kind(s) and for what fraction of the year?
      - The harsh condition is throughout the year as we have a lot of cancer patients.

6. Adequacy of your workforce (staffing)
   a. Radiation oncologists
      - There are 25 Radiation Oncologists in Tanzania
   b. Physicists
      - There are four physicist in Tanzania.
   c. Dosimetrists
      - None
   d. Oncology nurses
      - Four Oncology nurses.
e. Engineers
   • Five engineers.

f. Data manager(s)
   • Four data managers.
   •

7. Education and training
   a. Do you have in-house education and training programs? If so, what kinds?
      • Yes we do have Bachelor of science in Radiation Technology and Masters of Medicine in Clinical Oncology.
   b. How do you arrange for education and training of your staff elsewhere, if needed?
      • Depending on the need of a person to be trained for a specific purpose or depending on the Country allocated fund for a specific training.
   c. Does your equipment supplier provide training? If so, how long?
      • Only 5 days in house training
   d. Do you have a degree-awarding program for physicists? Other staff?
      • No for Physicists degree program in the countrys.

8. Procurement
   a. Is procurement of radiation therapy equipment done locally? Regionally? Country level?
      • It depends with the equipment needed at that particular time. Some locally some county level- some of huge equipments are supplied by International Atomic Energy Agency
   b. Is procurement a simple process or complicated? “Red tape?”
      • Not complicated it follows the international and national procedures.
   c. Does the Ministry of Health have a multi-year procurement plan?
      • Yes the plan is present.

9. Funding
   a. Is funding done yearly at a national level such as the Ministry of Health?
      • Yes.
   b. Is all or some of your funding local?
      • Some are local funding.
   c. Do you compete with other departments for funds?
      • No we do not compete for funds.
   d. Is funding adequate for your needs?
      • The funds are not enough to cover the population.
   e. Is your funding reliable year–on-year?
      • The allocated budget varies from year to year.