RADAID Report for visit to Kenyatta Hospital in Nairobi, Kenya
Submitted by Kim Rans, Regina Ley, and Shilpen Patel for a visit from August 6th-August 14th

Background:
The Kenyatta National Hospital (KNH) in Nairobi is the largest publicly funded hospital in Kenya with over 2000 in-patient beds. It is the only public hospital dedicated to cancer management in the country. There are 4 private cancer centers which treat with Radiation Therapy as well in Nairobi. Daily radiation treatment cost at KNH is 1,000 Kenyan shillings ($10USD) per session, while the private hospitals charge 5,000-10,000 Kenyan shillings ($50-$100 USD) per session. The Kenya radiation clinic has two Cobalt-60 machines which were commissioned ~6 and 21 years ago and a new Elekta linear accelerator installed in March 2016. The Co-60 machines are Theratronic units which treat 30-40 patients on the older unit and 70-80 patients per day on the newer unit, for an average of 110-130 patients per day. The Elekta Linac is currently treating 5-15 patients per day, but these numbers have the potential to ramp up very quickly. Currently, technological glitches and unfamiliarity are major road blocks to escalating patient numbers. The conventional simulator sees around 10-20 patients per day who then get treated on the Co-60 units. Patients on the Elekta receive a diagnostic CT with 2mm cuts in the treatment position. They also treat 8 gynecological patients per week using Oncentra TP software and a Nucletron HDR remote afterloader. These patients are currently being treated with a 2D technique with a total dose of 16 Gy over two fractions. At any given time, there are 5 consultant radiation oncologists, 3 medical physicists, and 17 radiation therapists including two students and two cross-trained in nuclear medicine. Physicians work “part time” at KNH and also work elsewhere to supplement their income.

Observations about the visit:
- Currently, no restroom in linac building. Have to walk ¼ mile to “bathroom”.
- Therapists work well together for the most part. Physics, physicians, and therapists share workspace so it can be distracting. Chief therapist seems to keep everyone in line.
- Patients take their diagnostic films home with them – there is no place to store them.
- It is difficult to get MDs to give more info on Rx – therapists get frustrated. MDs are in another area of the hospital grounds and difficult to contact although the trainees seem to do some contouring in the small workspace.
- Power outages are common and internet is spotty at best and not reliable.
- They haven’t had any MLC issues yet but are informed that some physics staff know how to change the MLC motors. Elekta service rep has to come from South Africa which is 4 hours away by plane. Elekta seems to be responsive for any machine issues. The same can’t be said for any issues surrounding MOSAIQ.
- Questioned about whether patients discontinue treatment and stop showing up when the side effects kick in. Surprisingly this is extremely rare. It was explained that the patients know how “lucky” they are to be able to receive treatment and just deal with it.
- Tea break from 10am-10:30am, lunch from 1pm-2pm, and a second tea break in the afternoon... Patients are given either “A.M.” or “P.M.” appt. times. They wait outside until called. There seems to be no schedule. Therapists determine who will go next. No “first come first served”. New starts typically come at the end of the day.
- Of the 12 patients on treatment during our visit, 10 were 4 field pelvis GYN cases. 2 were pediatric C/S cases. Children were not anesthetized and were moving quite a lot screaming and crying on the table.
- Therapists are EXTREMELY accurate with making sure tattoos are on.
- 2 therapists set the table / board parameters to double check each other.
- No running water for sink. Use hand sanitizer. Also use the same 2 sheets for all patients and the same gowns over and over again.
- Charts come with generic diagrams but are mostly blank with nothing filled out or drawn out to indicate where patient is to be treated. A few MDs have drawn on the Rx where the patient is to be treated but it seems to be the rarity rather than the norm.
- For new starts physics exports the plan parameters and therapist then imports and enters the number of fractions/dose and the patient info into Mosaic. One RTT reads the plan from the printout whilst another RTT checks off the computer monitor.
- Most RTT students will get hired by one of the hospitals. RTT training consists of 3 years of Diagnostic X-ray School followed by 18 months of radiotherapy training. The RTT staff is almost entirely male. The public and private hospitals do collaborate to train RTTs and share resources/knowledge according to the chief therapist. Starting salary for public hospital therapists is 4K USD/month. For private hospitals it is 6k-8K USD/month according to the chief therapist. The school was established at KNH under the guidance of the chief therapists. He has hopes to start other schools including nursing and residency but his time is exceptionally limited.
- Therapists were asked why they entered the profession and most said they were told they were to become therapists due to the shortage of RTTs. They stated they were not given a choice. Most were given loans from the government that have to be paid back.
- The therapists are all very eager to learn new techniques and skills. They do feel they are making a difference and are looking forward to advancing their technology.
SUGGESTIONS FOR THE THERAPY STAFF
Regina worked with the R.T.T.s on the Elekta Synergy. Several suggestions were made to the team at the time based on direct observation. These included:

- Chart should be flagged.
- Better communication on what patient is being brought in the room. Several times it was observed the wrong patient was going to be loaded. Some kind of “time-out” should be in place.
- Watch patient on monitor more. At one point the team was taking a “selfie” while a patient was on the table. This was pointed out as to maybe not be the safest thing.
- Inform patient when there is a delay of treatment due to clearing faults.
- Keep a downtime log/fault log
- Use “float” on the couch more – they use the deadman with the switches for minute shifts and overshoot – using float is faster and more accurate.
- Shifts from the physics plan should be done manually daily – not with auto-enter parameters that were captured on the first day. It seemed there were finding hard to understand that the patient may not be in the EXACT same spot on the table from when the parameters where captured.
- The head/neck board should not be used for pelvis setups – it brings the patient too inferior on the table and they ran into couch long interlocks. When questioned they said they use it because it came with the linac. Patients should be as superior as possible on the couch for pelvis setups to avoid these issues.
- Therapists check SSD reading on LAT fields – they are in the habit of doing this from working on the Cobalt machines. This is not necessary on the linac and suggested checking ANT SSD instead.
- Therapists should load the patient and field info before setting up the patient. They wait till setup is done and then go outside and mode up the field.
- Gauges on machine i.e. Gas, H2O temp and level should be labeled and indicate what the normal ranges are for easy reporting of discrepancies to physics and/or service rep.
- Treatment should start with the most posterior field to insure clearance of gantry.
- They palpate the sternum to make sure the patient is straight superiorly but it is not tattooed – suggested tattooing at time of sim for better reproducibility. Right now they are just “guesstimating”.
- Hands for pelvis patients should be placed high on chest – not above head. They have no support under the arms and noticed several patients’ arms shaking.
- Therapists need to start taking weekly images on patients to confirm iso – especially due to the planned shifts from physics.
- Photos need to be taken of setup and tattoo location. It was very difficult to see the tattoos on many patients and most times they just assumed it was the correct mark. Did not film to verify. Gave them some Beekley stickers to use to cover the marked tattoos and they loved them. After 2 days, the patients were still compliant in keeping the
stickers on. Will try and obtain more for them. 1 box of 100 stickers cost $105. Also in need of short rulers.

- Backup MU monitor was pointed out in case of power outage or machine going down mid-treatment. They did not know this existed.

- Suggested asking Elekta service rep a list of faults that can be cleared by moding up electrons – they didn’t realize they didn’t have to put the cone in the actually use this technique. Also what faults can be cleared by “crashing” the machine. They did not realize you could do this.

- Ask Elekta service rep if there is a two minute time delay (similar to Varian machines) that will reset many of the secondary faults.

- Physics staff currently do the morning QA – suggested R.T.T.s start getting involved as well where-in therapists do the initial check and physics can follow up.

- Taught therapists the “sheet tug” trick in triangulation patient. They found it very useful and started using it. Explained the move halfway/halfway table side to patient side movement.

Additional Clinical Staff Suggestions
Clinical discussions were exceptionally fruitful and productive. There is a real desire to learn and understand. Contouring and planning from a clinical side was reviewed in depth both for external beam and brachytherapy. Clinical management was also reviewed for the more common cancers.

- Currently no formal training program exists for radiation oncology at KNH.

- Contouring and planning are not taught yet and there is quite of bit of trial and error in terms of treatment planning.

- There is a disconnect between attending physicians and residents and medical students. There are no direct supervision requirements for patient care.

- Very few contouring atlases and articles are available to use as a reference. Dr. Patel provided a number of resources moving forward.

- Clinician oversight is not found at all steps of the brachytherapy process.

- BED and EQD calculations are not done nor understood completely.
Additional treatment planning suggestions:
Training with the staff was very rewarding and useful.

- Kim reviewed with the medical physics and planning radiation therapists some techniques for 3-D conformal planning.
- Kim covered different sites such as pelvis, breast, and abdomen.
- Kim and Dr. Patel reviewed a 2-D gynecologic brachytherapy plan and Kim gave them some advice on dwell positions for the HDR treatment.
- Dr. Patel gave some guidance on BED calculations for combined external beam and HDR brachytherapy treatment as the Kenya staff had concerns about the bladder dose and tumor coverage.
- The staff are on a big learning curve as they transition from 2D to 3D treatment planning and from 2D to 3D treatment from a Co-60 machine to a linac.

**Treatment Planning**

- Kim Rans gave a one hour presentation on Wed Aug 10 which included some adult education theories, treatment planning for breast cancer, Quantec guideline review and Dose Volume Histogram overview.
- The breast treatment planning which Kim showed the RT planning staff covered the mono-isocentric breast technique including technique, distributions, isocenter placement, pseudo-isocenter placement, design of field borders, MLC placement, and the use of field of field to reduce hot spots and to increase PTV coverage.
- Kim reviewed two plans using the four field technique on a pelvis patient and an abdomen patient with the RT planning staff and showed them how to use wedges, weighting, and mixed energies to optimize the dose distribution. He walked them through the process of what a made an ICRU acceptable plan.

**Radiation Therapist Presentation**

Regina Ley gave a one hour presentation as an introduction to Radiation Therapy. This consisted of the technical side and the personal side of treatment. The technical side presented Radiation therapy techniques with examples of patient setups and documents. The personal side dealt with intercommunication with other staff and dealing with stress in the workplace.

**Oncologist Presentation**

Dr. Patel presented information on lung cancer as well as a presentation of safety and quality improvement. Both were well received and a number of questions were raised in terms of the current program which exists and how to build out the program. Physicians from surrounding hospitals attended the presentation.
Immediate Needs

- The RT department at the Kenyatta hospital needs more support from Elekta for clinical applications support (i.e. MOSAIQ) and linac hardware support. The Kenya staff tried to contact Elekta and they didn’t hear back. This needs to be investigated further with Elekta.
- If the Rad-Aid team had more time, there would have been many other tumor sites we could have reviewed with the Kenya staff for treatment planning and treatment delivery techniques.
- Dr. Patel scheduled a meeting with Elekta Global Health for early September to discuss potential solutions and make the group aware of the concerns.

Future Needs

- For future teams going, it would be a good balance to send one radiation therapist and one treatment planner as these were both areas where they had specific training needs.
- Sending a medical physicist in the future may be beneficial to aid the Kenya medical physicists with 3D quality assurance for the software and machine hardware and future IMRT planning and treatment.
- Moving forward, the best practice would be to have the radiation therapists stay for at least a week to maximize time and resources for the cost of sending volunteer staff to Kenya.
- A team going back within the next 6 months- 1 year would be valuable to follow-up on how they are doing in their transition from 2D to 3D planning and treatment. Alternatively distance learning should be established to ensure there is some support as issues come up.
- It may be beneficial to have consistent Rad-aid volunteers go back on the next site visit as building relationships is key for a sound foundation in the Kenyan culture. In addition, volunteers should ideally be willing to provide support to the team in Kenya so as questions come up they can be answered.
- When the clinic transitions to IMRT planning and treatment, they will require support from Rad-aid volunteer staff for training, implementation, and quality assurance.
- Setting up distance learning training modules for the staff on 3D conformal treatment planning techniques via the Internet would aid the Kenya radiation therapy staff on how to plan the various techniques for each tumor group. Kim Rans has some ideas on distance learning he will discuss with Longino (RT Manager), Dr. Patel, and Regina.
- May benefit if R.T.T.s can go to U.K. / U.S.A for observation/training at other facilities. (although in confidential conversations, no money exists for sending staff to the states)
- Develop a partnership with a US based hospital to partner directly with KNH for long term development.
- Partner with a company like Brainlab for consideration of remote dosimetry help.
Other tips:

- Consider coming a day early to avoid missing flights as Dr. Patel’s flight was canceled and he arrived at 6 am for the morning of the first day.
- Consider sending past participants.
- Expand the program or partner with other local doctors for symposium to talk build out the hospital as a center of excellence.
- Consider sending a specialist in palliative medicine.
- Given that the rad oncs are giving chemotherapy it may also be wise to bring someone from medical oncology.
- More information to be provided on multidisciplinary pathways.