

BRISBANE, QUEENSLAND, AUSTRALIA



- Population of 2.3 million
 - 3.4 million in south east Queensland, which is contiguous residential area
 - 3rd largest in Australia
- 7 radiation oncology centres
 - 13 in south east Queensland
 - We work at two different centres
- Weather is great!
 - Winter average high of 22°
 - Summer average high of 30°

ROYAL BRISBANE & WOMEN'S HOSPITAL

- Treats approximately 1800 patients per year
- Operated by the state government health department – ‘free’ for patients
- 14 radiation oncology medical physicists
 - Including 4 enrolled in clinical training program (3 year course, with exams)
 - Including 2 research staff
- Equipment
 - 3 Varian iX accelerators
 - 2 TomoTherapy systems
 - 2 HDR brachytherapy afterloaders
 - 2 CT simulators
 - 1 conventional simulator
 - 1 orthovoltage unit
 - Film, gel and OSLD dosimetry



LOCAL PHYSICS DUTIES

- Linac output calibration
- Fortnightly machine QA
- Patient specific QA measurements
- In-vivo dosimetry (OSLDs, film, etc.)
- External beam treatment plan checking
- Brachytherapy treatment planning
- Minor technical maintenance (MLC motors, ODI lightbulb, etc.)
- Commissioning new equipment
- Service development
- Radiation safety

RBWH HISTORY AND FUTURE

- Very early introduction of a linear accelerator
 - in 1956, one of the first 10 in the world
- Was initially called “Queensland Radium Institute” (from 1944-1991)
- Plans being made for new larger re-branded site, with proton therapy, university affiliations, etc.
 - We’re part of a proton therapy consortium, with another centre in Sydney



GENESIS CANCER CARE QUEENSLAND

- Private company, with branches in other states and Europe (UK & Spain)
- Government reimburse part of treatment cost; patient / insurance covers remainder
- 10 radiation oncology medical physicists
 - Including 0 enrolled in clinical training program
 - Including 0 research staff
- Equipment
 - 6 treatment centres (over 700 km between northern- and southern-most)
 - 12 conventional accelerators (Varian and Elekta)
 - 1 used for stereotactic radiosurgery (BrainLab)
 - 1 HDR brachytherapy afterloader
 - 2 LDR brachytherapy programs
 - 6 CT simulators
 - 1 orthovoltage unit



RADIATION ONCOLOGY IN AUSTRALIA

- 76 centres operating, another 9 in progress
 - Approaching 200 conventional accelerators
 - Approximately 74% in public centres
 - 5 TomoTherapy systems
 - 2 GammaKnife systems
 - 1 CyberKnife system
 - 0 particle therapy facilities
 - Fewer than half of all centres have Brachytherapy
 - Fewer than half of all centres have superficial kV
 - Despite very high skin cancer rates

RESEARCH IN AUSTRALIA

- National college has official journal “Australasian Physical & Engineering Sciences in Medicine” (published quarterly by Springer)
- Annual national conference “Engineers and Physical Scientists in Medicine” (generally 200+ attendees)
- Clinical training program requires peer-reviewed publication of research
- Very few clinical centres have full-time research personnel (<10 nationally)
- 6 universities with radiation oncology medical physics courses and associated research programs
- Few post-doctoral research positions in medical physics (<10 at any time)
- Majority of collaborative radiation oncology trials supported by Trans-Tasman Radiation Oncology Group

OUR RESEARCH & SUPERVISION

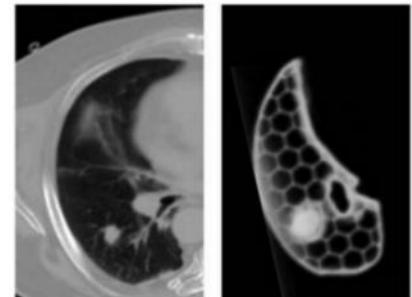
- I'm employed in a full-time research role
- Tanya has a full-time clinical role
- We collectively supervise
 - 1 professional research person
 - 7 ongoing PhD candidates
 - typically 3 Masters students each semester
 - research publication within our clinics
- Tanya is going to speak about some work in depth, I'll summarise other work

RECENT RESEARCH

- Multiple publications on small field dosimetry
 - Practical and theoretical definition of 'small' or 'very small' fields in Med Phys
 - Clinical guidelines for obtaining small field beam data for TPS using diodes and microchambers
 - Use of diamond detectors and film
- Developed software to perform independent assessment of both dosimetric quality and deliverability of treatment plans
 - Studies of dosimetric quality of 163 prostate treatments; 16 spinal treatments; and 1137 breast treatments.
 - Investigations into correlation between patient specific QA results and complexity metrics (including modulation index, % of MU with small leaf apertures, etc.)

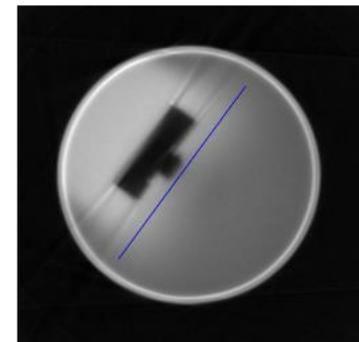
RECENT RESEARCH

- 3D printing of air gap diode caps
 - Overresponse of diodes in small fields (due to non-water equivalence) can be effectively removed by introduction of air gap above sensitive volume
- Working towards 3D printing of anthropomorphic phantoms
 - Printing tissue and lung equivalent phantoms from contour data
- Fricotan moulding material in Brachytherapy
 - Mass spectroscopy used to determine elemental composition
 - Monte Carlo simulation of Ir-192 source in varying thickness of Fricotan
 - Simulation results compared against film measurements



RECENT RESEARCH

- Comprehensive study of pacemaker dose resulting from kV and MV imaging; and 3D conformal, VMAT and TomoTherapy treatments, using pacemaker held in 3D printed cradle on a humanoid phantom; with transit film measurements
- System for generating calibration curves for EBT3 film when reference doses cannot be delivered, but approximate beam spectrum is known
- Development of new radiosensitive gel formulations
- Optical CT of gel dose distributions near opaque implant materials
- Use of glass beads (i.e. the type used for jewellery) as in-vivo dosimeters



RECENT RESEARCH

- We're both directors of our national college, and with membership and professional standards duties
- Published study of gender in our workforce
 - 28% of workforce are women, 19% of heads of departments are women
 - Similar discrepancies in proffered vs. invited or keynote conference speakers; and submitted vs. invited editorial paper authors
- Currently investigating the domestic job market
 - Currently about 175 MSc students and about 100 PhD students in medical physics courses in Australia and New Zealand
 - Conducting survey of number of applicants for training positions (which is about 40-60), candidate quality, graduate preparedness, etc.