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
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
- 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
AUSTRALIAN TREATMENT CENTRES

Red is public (state operated)
Blue is private (3 companies)
Purple is outsourced service (in public hospitals)

South East Queensland below
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
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
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
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
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.