



2016 ANNUAL REPORT

Radiation Medicine Program

ANNUAL REPORT CONTRIBUTORS

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Read the annual report online at www.radiationatpm.com

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**Precision Radiation Medicine.
Personalized Care.
Global Impact.**

Advance exemplary radiation medicine through patient care, research & education in partnership with our patients & community

Accelerate discovery to deliver
precision medicine

Integrate research & education with
clinical practice

Strengthen internal & external
community linkages

Extend high reliability with
systems thinking

Innovation

Excellence

Collaboration

Accountability

Integrity

CHIEF'S MESSAGE

The Radiation Medicine Program (RMP) at the Princess Margaret Cancer Centre is committed to delivering the highest standard of care to its patients. Over the past year, we continued to push the boundaries of innovation, as we worked towards achieving our mission to **“advance exemplary radiation medicine through patient care, research and education in partnership with our patients and community.”**

In 2016, I watched the implementation of our Strategic Plan, the ***Strategic Roadmap to 2020***, take effect. We made remarkable progress and impact in each of the four strategic pillars. Highlights included the clinical deployment of RayStation, a next generation treatment planning system, and the delivery of our first real-time MR-guided interstitial brachytherapy under general anesthesia to two gynecological cancer patients. These were significant milestones for both the program and the Princess Margaret, exemplifying the patient-centred approach that we strive to achieve.

We continued to develop innovative care delivery approaches through research and system improvements, which were executed at high levels of performance for every patient, every time. As a result, we recorded the highest number of radiation courses delivered in the recent decade. With the launch of UHN's new Purpose, Values and Principles (PVP) in 2016, we also began integrating these core PVPs into our programmatic policies and processes, ensuring that the needs of patients always come first.

RMP also continued its trajectory of advancing excellence in the training of future leaders in radiation medicine through the delivery of award-winning educational programs. Our multi-talented team was strengthened by the addition of new staff and leadership. We reinforced existing partnerships and established new ones that will have a lasting and positive impact for our program and patients.



2016 proved to be an eventful year for RMP. Our achievements and successes were made possible by the resilient support and collaborative efforts of our talented, multi-professional team that collectively strives to deliver world-class precision radiation medicine and personalized care for our cancer patients. Thank you to everyone in RMP for your continued hard work and unwavering dedication to our patients, and to our vision.

A handwritten signature in black ink that reads "F. Liu".

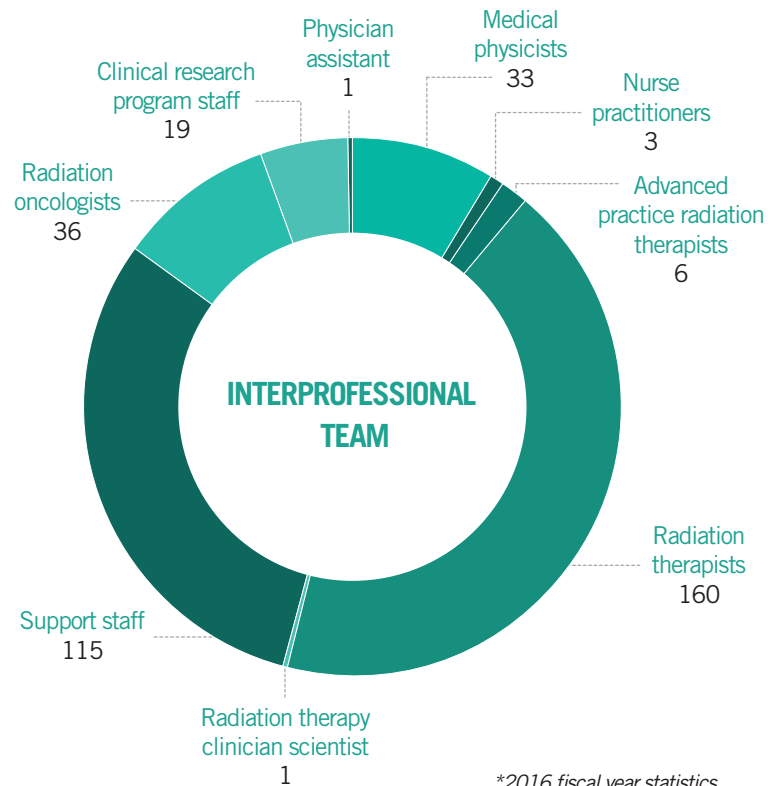
Fei-Fei Liu, MD, FRCPC
Chief, Radiation Medicine Program,
Princess Margaret Cancer Centre
Head, Department of Radiation
Oncology, University Health Network

PROGRAM OVERVIEW

The Radiation Medicine Program at the Princess Margaret Cancer Centre is the largest radiation treatment centre in Canada, and one of international acclaim. Inspired by our vision of “**Precision Radiation Medicine. Personalized Care. Global Impact.**” RMP endeavors to impact the quality of radiation therapy worldwide.

RMP is organized into the three core disciplines of radiation oncology, medical physics and radiation therapy; each supported by robust clinical, research, administrative and technical teams. Together, this multi-professional group of over 350 staff work collectively to deliver high quality and safe radiation treatment to over 8000 cancer patients every year. Our research program, which spans from biological studies, translational biology and physics, clinical trials, to health services and education research, aims to innovate and advance radiation medicine practice, producing over 200 peer-reviewed publications annually.

Our interdisciplinary environment facilitates an education program that covers the continuum of professional learning in radiation medicine, including training at the undergraduate, graduate and postgraduate levels in collaboration with the University of Toronto. RMP is also a provider of continuing medical education through our Observership Program and Accelerated Education Program (AEP). As such, many of our staff hold important education leadership roles at the University of Toronto, which supports and synergizes the development and delivery of innovative education and research programs.



Magnetic resonance-guided radiation therapy (MRgRT) facility at the Princess Margaret

STATE-OF-THE-ART FACILITY

- 4 CT simulators (1 with PET)
- 1 MR simulator
- 16 Linear accelerators
- 2 Perfexion (Gamma Knife) units
- 1 Orthovoltage/superficial x-ray unit
- 2 Brachytherapy high dose rate (HDR) remote afterloaders
- 1 Magnetic resonance-guided radiation therapy (MRgRT) facility

2016

THE YEAR IN NUMBERS

8596

patient consultations*



10,626

radiation treatment courses*

7,300

patients treated at Radiation Nursing Clinic*



35.8 million

peer-reviewed funding



233

peer-reviewed publications



183

prospective research protocols



27 radiation oncology residents

29 radiation oncology fellows

6 medical physics residents

46 medical radiation sciences students

**2016 fiscal year statistics*

PROGRAM STRUCTURE

Our multi-talented, interprofessional staff enables all aspects of our program to succeed. Led by the program Chief, the RMP Steering Committee defines the principles of operation and policies of governance for the management of clinical, quality assurance and safety, research, educational, operational and IT activities.

Steering

Chief: Fei-Fei Liu

Director, Operations: Sophie Foxcroft

Director, Quality & Safety: John Waldron

Director, Research: Michael Milosevic

Director, Radiation Therapy: Elen Moyo

Director, Clinical Programs: Andrea Bezjak / John Kim*

Director, Education: Rebecca Wong

Head, Medical Physics: David Jaffray

Associate Head, Medical Physics: Daniel Létourneau

Advisor, Resource Allocation: Richard Tsang

Manager: Catarina Lam

Quality

John Waldron, Stephen Breen, Lyndon Morley

Radiation Safety

Fei-Fei Liu, Frank Tourneur

Education

Rebecca Wong

Operations

Sophie Foxcroft

Research

Michael Milosevic

Interventional RT Process

Michael Milosevic, Brandee Pidgeon

External Beam

Daniel Létourneau, Jerry Roussos

Imaging

Stephen Breen, Jerry Roussos

Data & Technology

Terry Michaelson, Andrew Hope

**Effective October 2016*

STRATEGIC ROADMAP TO 2020: A YEAR IN REVIEW

Since the launch of the **Strategic Roadmap to 2020** in 2015, RMP has focused on implementing several key initiatives and activities in Year 1 to help achieve its four strategic priorities, which aim to: 1) accelerate discovery to deliver precision medicine for best patient and population outcomes; 2) integrate research and education with clinical practice; 3) strengthen internal and external community linkages; and 4) extend high reliability with systems thinking.



Brainstorm Session attendees

A Strategic Plan Brainstorming Session was held in December 2016 to reflect on the progress and lessons learned in Year 1, and also to aid in the development of key priority initiatives for Year 2. The well-attended event provided an opportunity for front-line staff and leadership to share and exchange ideas, and collaboratively strategize on how to ensure the program successfully achieves its 2020 goals.

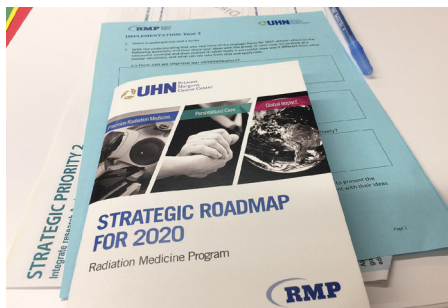


RMP-Southlake Symposium attendees

Highlights

STRENGTHENING COMMUNITY LINKAGES

RMP aims to strengthen its internal and external community linkages to improve continuity of care for our patients. As part of the initiative to reinforce existing partnerships, the first-ever joint symposium between RMP and the Stronach Regional Cancer Centre at Southlake was held in November 2016. The well-received event provided opportunities to reflect on successes since the formal partnership began in March 2007, as well as opportunities for continued improvements and ongoing treatment planning innovations.



PATIENT PARTNERS IN RMP

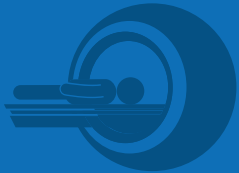
RMP strives to expand patient engagement in its treatment and in evidence generation. A key milestone for Year 1 was to invite a patient to participate on a programmatic committee. RMP is fortunate to have recruited Robert Rev to the Radiation Therapy Patient Education Committee, which aims to promote excellence in the delivery of RT patient education through the development and evaluation of patient education activities and resources, as well as collaborations with the Princess Margaret Patient Education Program. Robert brings to the committee a personal journey with cancer, as well as a customer service background.



Lorella Divanbeigi, Robert Rev, Angela Cashell

90%

Year-1 initiatives complete



Accelerate discovery to deliver precision medicine

- Established shared understanding of meaning & scope of precision medicine
- Implemented adaptive radiotherapy strategy
- Expanded patient engagement strategy to encompass clinical practice & research
- Prioritized MR-guided technologies as a central research theme to 'target cancer more precisely'

62%



Integrate clinical practice with research & education

- Initiated development of site group research plans
- Redesigned Target Insight Conference
- Delivered AEP Quality & Safety Workshop at CARO
- Launched new AEP Learning Management System

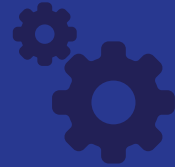
97%



Strengthen internal & external community linkages

- Facilitated staff access to UHN Wellness and Development Program
- Established RMP Interdisciplinary Peer-Support Wellness Rounds
- Hosted continuing education dinner with referring physicians from St. Joseph's Health Centre, St. Michael's Hospital and Humber River Hospital
- Held a symposium with Southlake to increase engagement and identify future steps

95%



Extend high reliability with systems thinking

- Initiated establishment of key performance indicators and operational metrics to promote shared ownership across RMP
- Reviewed RMP Committees to optimize accountabilities and alignment with priorities
- 10 RMP project leads completed formal project management training

CLINICAL CARE

Our clinical practice encompasses all aspects of cancer care, from diagnosis to survivorship (ongoing follow-up care after cancer treatment). In 2016-2017, RMP provided 8596 patient consultations and delivered 10,626 courses of radiation treatment, with 89% of new patient consultations being conducted within the 14-day target set by Cancer Care Ontario (CCO). The number of visits to the Radiation Nursing Clinic (RNC) for symptom and side-effect management was also higher, at 7300 visits.

Our clinical practice is integrated into four multi-disciplinary Superteams comprised of anatomically-related tumour site groups. Standardized treatment protocols that relate to evidence-based disease management guidelines are used by each site group to plan and treat patients.

In addition to site groups, a number of specialized programs exist to further support individualized care in a subset of patients. Together, our interprofessional team works collaboratively to assess, plan and deliver personalized care to our patients.

CLINICAL TEAMS

Superteams	Tumour Site Groups
Team 1	Head & neck, endocrine, skin, eye
Team 2	Lung, breast, upper gastrointestinal (GI)
Team 3	Genitourinary (GU), gynecological (GYN), lower GI
Team 4	Central nervous system (CNS), lymphoma, leukemia, sarcoma, pediatrics, palliative

SPECIALIZED PROGRAMS

Brachytherapy	Palliative Radiation Oncology
Gamma Knife Radiosurgery	Pediatric Radiation Therapy
Oligometastases	Stereotactic Radiation Therapy

Highlights

IMPROVING CLINICAL CARE FOR PATIENTS WITH METASTATIC NEURO-ENDOCRINE TUMOURS

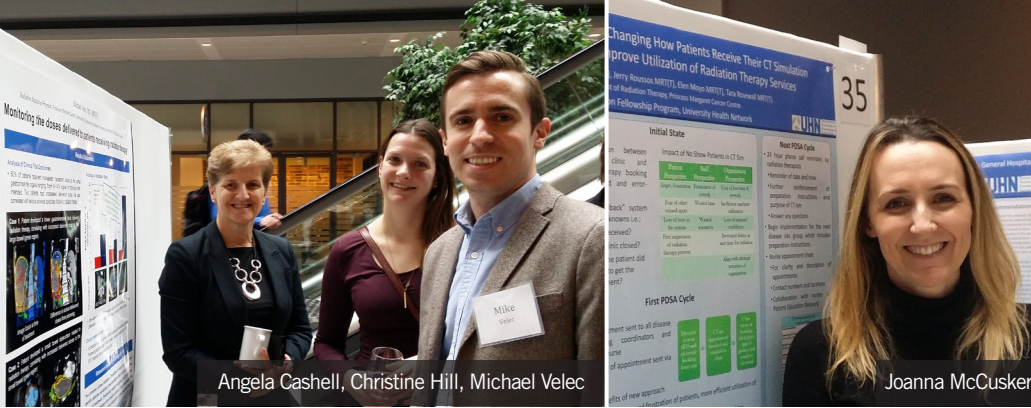
July 2016 marked a notable milestone for the Ontario neuroendocrine cancer patient community, with the first Gallium (Ga68) DOTATATE PET scan being performed as part of a Health Canada approved clinical trial launched by the Cancer Care Ontario NET (CNET) Consortium, of which UHN is a member and lead sponsor. Ga68 DOTATATE PET is considered to be one of the most effective tests for identifying patients who will benefit from radionuclide therapy; those patients who are identified as such will go on to receive treatment with the radioisotope Lutetium-177 (Lu177) DOTATATE.



Led by **Rebecca Wong** as Principal Investigator, this groundbreaking study (ClinicalTrials.gov ID: NCT02743741) has come to fruition thanks to the hard work and contributions of a multi-disciplinary team, including staff from RMP, Nuclear Medicine, Medical Imaging, Nursing, Radiation Safety and Clinical Trials. The trial is expected to generate data that will contribute to expanded access for patients in other Canadian provinces. At the Princess Margaret, eleven patients have been recruited and nine completed treatment with Lu177 in 2016.

“The commencement of the Ontario Consortium trial at [the Princess Margaret] for Lu177 treatment and Ga68 diagnostic is a significant positive move forward for the Ontario neuroendocrine cancer patient community.”

Jackie Herman, President of CNET



Angela Cashell, Christine Hill, Michael Velec

Joanna McCusker

RADIATION THERAPISTS SHOWCASE CLINICAL INNOVATION AND RESEARCH

The UHN Collaborative Academic Practice (CAP) Fellowship Program provides a unique opportunity to advance best practice in patient care within complex healthcare environments by allowing health professionals working at the point-of-care to lead quality improvement projects. **Joanna McCusker** was awarded the 2016 CAP Health Professions Innovation and Research Fellowship Award to continue her research on optimizing the patient experience for CT Simulation. Joanna is the second radiation therapist at the Princess Margaret to be awarded this prestigious Fellowship.

This year's CAP Research and Innovation Day was held in January 2017, bringing together health professionals from across UHN to share and discuss their experiences when "learning in practice, from practice and about practice." Radiation therapists were featured prominently within the program, with a podium presentation delivered by **Christine Hill** on her 2015 CAP Fellowship project entitled, "Radiotherapy Patient Education: A Refocus on Value to Patients." Six poster presentations that highlighted the quality and diversity of the research and clinical innovation work championed by radiation therapists were also showcased.

Grace Lee: Patient Experience Survey of Early-Stage Breast Cancer Patients Undergoing Whole Breast Radiotherapy

Joanna McCusker: Communication is Key: Changing How Patients Receive their CT Simulation Appointments to Improve Utilization of Radiation Therapy Services

Lyndon Morley: Tracking the Progress of Incident Learning in a Radiotherapy Department

Elizabeth Ng: Implementation of a Data-Driven Peer Review Program in a Radiotherapy Department

Nettie Sperduti: Workplace Violence in the Radiation Therapy Department

Michael Velec: Monitoring the Accuracy of the Doses Delivered to Patients Receiving Radiation Therapy

RAYSTATION TREATMENT PLANNING SYSTEM MIGRATION

One of the most challenging capital projects for 2016 was the clinical deployment of RayStation, a next generation treatment planning system. Thanks to the tremendous effort and teamwork of a dedicated group of staff from radiation oncology, radiation therapy and physics, the first four radiation treatments planned in RayStation were delivered on March 6, 2017. This marked a major milestone for RMP and the Princess Margaret, as we started to establish an innovative platform for centralizing clinical treatment, research and educational activities. To date, more than 160 RMP staff have been trained on RayStation with over 3200 hours of training combined. More than 310 treatment plans have been published, with treatment techniques for seven clinical sites being currently supported on RayStation; more sites to be added. Migration to the RayStation system will be completed over the remainder of this year.



>160
staff trained
in RMP



>3200
hours of training
combined



7
clinical sites have
treatment tech-
niques supported on
RayStation



>310
treatment
plans published
to date

LEADERSHIP APPOINTMENTS

Laura Dawson (Upper Gastrointestinal), **Anne Koch** (Breast) and **John Waldron** (Head and Neck) were appointed as Princess Margaret Site Group Leaders, effective November 2016.

John Kim assumed the role of Director of Clinical Programs within RMP starting October 2016.



Tracey Williams, Iryna Tymoshyk, Jamie Austin, Chatale Blattler, Saadia Ramkissoon, Terri Seymour, Jane Hanes

SPACE TRANSFORMATION TO IMPROVE PATIENT CARE

Over the past 20 years, there has been significant growth in the size and scope of the clinical, research and education programs at the Princess Margaret Cancer Centre. In order to support the evolving needs our patients and staff, more than 500 staff were relocated from 610 University Avenue to newly renovated space on the 6th and 7th floors of 700 University Avenue in the fall of 2016. This move, which was led by **Tracey Williams** as “Move Captain”, was exceptionally collaborative with representatives from: Ambulatory Referral & Registration, Infrastructure Project Management, Medical Oncology & Hematology, Nursing, RMP, Surgical Oncology, Telecommunication, RMP eServices and SIMS IT. In total, approximately 1700 bins and 68 pieces of equipment were transferred to the new location. The available space at 610 University is currently being renovated to build new clinics in order to deliver better care and improved experiences for our patients as part of the Princess Margaret Space Transformation initiative.

MR-GUIDED BRACHYTHERAPY FOR GYNECOLOGICAL PATIENTS: IMPROVING THE CHANCE FOR CURE

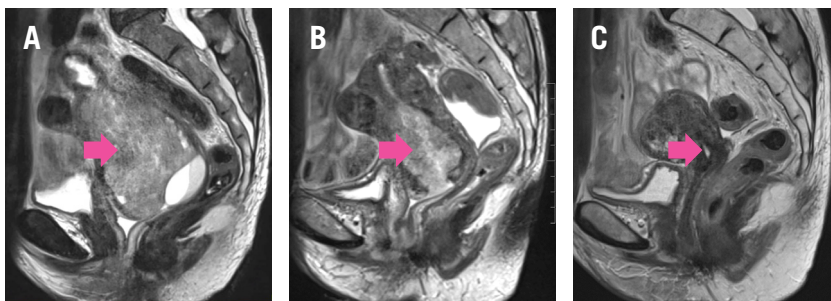
Since its launch in late 2015, the state-of-the-art Magnetic Resonance-guided Radiation Therapy facility at the Princess Margaret Cancer Centre has enabled us to offer unprecedented precision during treatment, and individualized care for our patients. It has presented a unique opportunity to perform real-time MR-guided brachytherapy (MRgBT), where the patient remains in one location, while the high dose rate remote afterloader and MR system mounted on ceiling rails move in and out of the interventional suite as needed.

Prior to the development of the MRgRT facility, MR-guided brachytherapy for gynecological patients involved multiple patient transfers: from the operating room, to the MR simulation room, then to the brachytherapy treatment room. With the MRgRT facility, this entire procedure now takes place in just one room; ultimately improving the accuracy of target coverage, patient comfort and treatment efficiency (reducing the average total procedure time from 8 hours to 3.5 hours).

In February 2017, a major milestone was reached when the MRgBT Program delivered its first real-time MR-guided interstitial brachytherapy under general anesthesia to two gynecological cancer patients. Using real-time MR-guidance, one of the cases was converted from likely incurable to hopefully curable with reduced side effects.

The design and successful execution of the real-time MRgBT Program has been made possible by the on-going contributions and collaborations of a dedicated team of radiation oncologists, radiation therapists, medical physicists, MR technologists, anesthetists, nurses and others. This magnificent multi-disciplinary effort exemplifies the patient-centred approach that RMP strives to achieve.

Sagittal scan of patient with locally advanced cervical cancer: (a) tumour at diagnosis; (b) tumour regression during external beam RT; (c) 12 months after receiving MR-guided interstitial brachytherapy

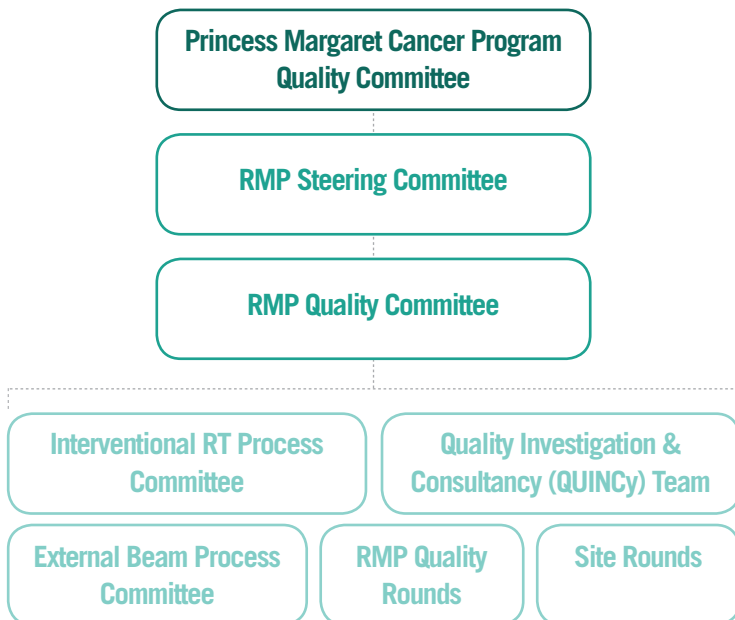


QUALITY & SAFETY

The RMP Quality Committee (RMP QC) functions to monitor, analyze, report and make recommendations on all aspects of radiation treatment quality and safety within RMP. The RMP QC aims to exceed national and international safety standards, and oversees a quality monitoring program for the department covering the following four domains:

1. **Performance Indicators**, aimed at evaluating compliance with relevant standards
2. **Quality Assurance**, aimed at monitoring radiation treatment quality control processes
3. **Quality Education**, aimed at contributing to quality and safety competence through education
4. **Incident Learning**, aimed at managing an incident learning system

QC REPORTING STRUCTURE



*All committees operate in accordance with the Quality of Care Information Protection Act

PERFORMANCE INDICATORS

The RMP QC uses the standards set by Cancer Care Ontario, Canadian Partnership for Quality Radiotherapy (CPQR) and Accreditation Canada to provide guidance in developing and maintaining quality in the program.

CCO Performance Measures

CCO monitors 3 key performance areas: referral-to-consult wait times, ready to treat-to-treatment start wait times and peer review rates. The provincial target for both wait times was 85% within 14 days. The peer review provincial target was for 75% of all radical cases to be reviewed. RMP exceeded all 3 CCO Performance Measures in 2016.

Indicator	RMP Compliance Rate
Referral to consult within 14 days	86.6%
Ready to treat to treatment start within 14 days	92.4%
% radical cases peer reviewed	90%

CPQR Program Compliance

CPQR has published a series of 16 guidelines in 3 categories: technical quality control, quality assurance and patient engagement. To date, compliance has been assessed against 86% of the guidelines; 3 were deemed not applicable to RMP practice, full compliance was determined in 9, and partial in 2. Assessment against the remaining 2 is targeted for the coming year.

Accreditation Canada Standards

Accreditation Canada introduced new radiation oncology specific standards to the QMENTUM Program in 2017. The RMP QC is currently reviewing the new standards and assessing compliance against them; with a goal of achieving full compliance by UHN's next survey in June 2019.

QUALITY EDUCATION

The RMP QC aims to offer educational activities that enhance staff competence in quality and safety. In 2016, the RMP QC sought staff feedback on ways to improve programmatic quality education. Minor changes were made to the format of the monthly Quality Conference, a monthly Radiation Therapy Quality Forum was also piloted and a quarterly eBlast communication – “Quality Matters” – is being launched. In the coming year, RMP QC plans to develop performance indicators for Quality Education.

Highlights

CARING SAFELY AT RMP

With the launch of UHN's Caring Safely initiative in the past year, RMP began engaging its staff to build awareness of preventable harm and to strengthen the program's commitment towards safety for patients and staff. Led by **Brandee Pidgeon**, RMP piloted daily safety huddles amongst the front-line staff in 2016, providing employees with additional opportunities to speak up about safety, allowing leaders to be sensitive to operations, and ensure that safety concerns are being addressed appropriately. A 3-hour interactive Caring Safely Core Curriculum Education Module has also been developed, focusing on the UHN Error Prevention Toolkit, which outlines the key safety behaviours to be used by all staff in support of a culture of safety. The mandatory training session, facilitated by the Caring Safely Faculty has been rolled-out to all RMP staff starting July 2017.



Brandee Pidgeon speaking about the UHN Caring Safely initiative at RMP Quality Conference



Svetlana Taneva-Metzger, Nicole Harnett, Stephen Breen, Michael Milosevic

QUALITY RADIOTHERAPY AT CARO

The delivery of high precision and increasingly personalized radiation treatments in Canada have rendered imaging and treatment procedures highly complex, elevating the quality assurance bar significantly. Innovative approaches to manage this complexity, while achieving optimal performance are required to guarantee the highest level of patient safety and quality care. To address this complexity, RMP's Accelerated Education Program and the Canadian Partnership in Quality Radiotherapy joined forces with the Canadian Association of Radiation Oncology (CARO) to host an interactive preconference workshop at the 2016 CARO Annual Scientific Meeting.

The goal of the workshop was to encourage discussions amongst the radiation oncology community on adopting a systems thinking approach to initiate quality improvement in patient care and radiation treatment work flow, as well as the challenges and opportunities of ensuring quality and safety when embedding adaptive radiotherapy in a culture of systems thinking. Led by **Michael Milosevic**, **Stephen Breen** and **Nicole Harnett**, this well-received workshop had 46 registrants and saw participants engaged in lively discussions with the speakers and fellow attendees.

QUALITY ASSURANCE

Machine quality control (QC) tests are an essential component of ensuring the accuracy of machine functionality and parameters. AQUA is a data repository that describes tests and who they are assigned to, and allows for tracking of their completion and pass/failure rates. Machine physics leads review AQUA data and a monthly Physicist Quality Forum is used to review and discuss this infrastructure QC data. In 2016, the average compliance for QC test completion was 98%.

INCIDENT LEARNING

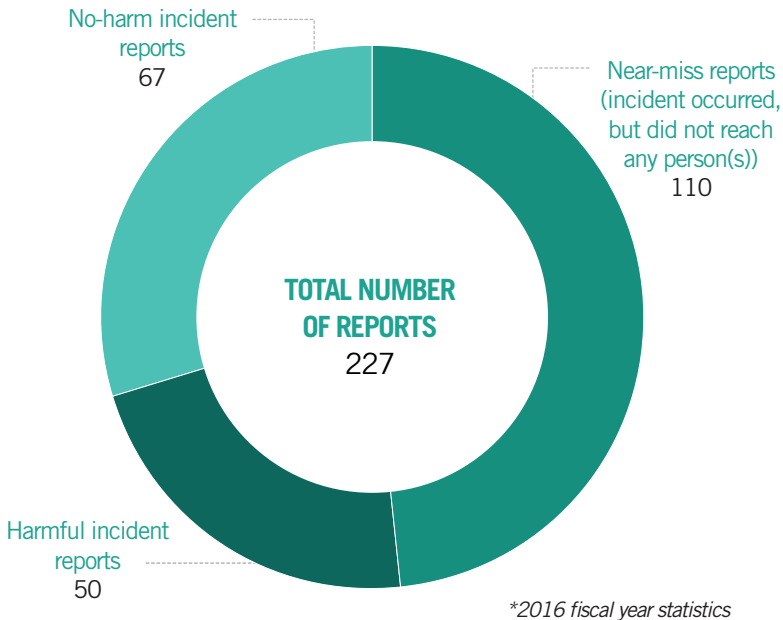
Incident Reporting

The RMP QC has adopted the use of control charts to review monthly incident rates by type and severity. Out of control events are investigated for causation. The total number of reported events was in control for the 2016 fiscal year. The RMP QC reported five comprehensive incident investigation and analysis reports in 2016.

Risk Management

UHN is adopting the Healthcare Performance Improvement (HPI) classification of safety events as part of its Caring Safely initiative. A Serious Safety Event (SSE) is defined as one that reaches the patient or employee and results in either moderate harm, severe harm or death. The overall SSE rate in RMP was both low and in control. A review of the events reported as 'severe' (since 2010) using RMP's established

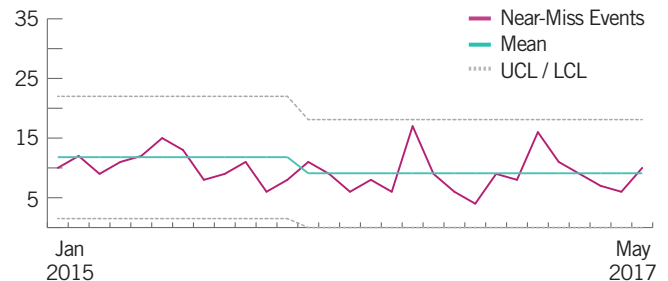
classification system revealed that only 1 out of the 5 reported qualified as a SSE under UHN's definition. Moreover, in line with UHN's reporting of Never Events (events that have inherent contextual severity and potential clinical severity), RMP is pleased to report that no such events occurred in 2016.



CONTROL CHART: TOTAL REPORTED EVENTS



CONTROL CHART: NEAR-MISS EVENTS



RESEARCH

The Radiation Medicine Program at the Princess Margaret Cancer Centre is a world-leader in radiation research aimed at developing more precise, personalized solutions that will cure more patients with fewer side effects. Its research program spans the breadth of the four professional disciplines of radiation oncology, medical physics, radiation therapy and radiation nursing, and is led by nationally and internationally recognized experts. The program encompasses the full spectrum of radiation research from basic biologic studies through translation biology and physics to clinical trials, health services and education research.

The **Strategic Roadmap to 2020** identifies four interconnected themes that guides research priorities towards achieving our vision of “**Precision Radiation Medicine. Personalized Care. Global Impact.**”

1. **Targeting cancer more precisely** through innovation in MR-guided technologies and proton therapy
2. **Adapting radiation therapy** informed by tumour morphological, micro-environmental and genomics features
3. **Enhancing patient and survivor health** by better understanding the needs of our patients during and after treatment, measuring outcomes in a more relevant manner, managing long-term treatment side effects more effectively, and mitigating toxicity through tissue regeneration
4. **Learning from all of our patients** by assembling comprehensive clinical, biological, dosimetric and outcomes ‘big data’ repositories to support research and innovation

These research themes are highly integrated and closely aligned with the research objectives of the Princess Margaret, UHN and University of Toronto’s Department of Radiation Oncology (UTDRO). Strong collaborations exist with other academic and industry-based research groups within UHN, as well as external groups locally, nationally and internationally.

Highlights



Mary Gospodarowicz was awarded the 2016 Canadian Cancer Society O. Harold Warwick Prize for outstanding achievements in cancer control research



Grace Lee and **Tara Rosewall** both published articles that were selected as the Editor’s Choice for the Top 5 *Journal of Medical Imaging and Radiation Sciences* Articles in 2016ⁱ



\$35.8M

peer-reviewed funding



\$0.7M

industry funding



145

peer-reviewed grants



233

peer-reviewed publications



373

active clinical studies



183

prospective clinical research protocols



11.4%

new patients accrued to prospective clinical research studies

**2016 calendar year statistics*

NOTABLE PUBLICATIONS



Genetic Drivers of Prostate Cancer

Robert Bristow and colleagues published a landmark study in *Nature Communications* describing the genetic basis as to why men with germline mutations in the *BRCA2* gene develop such aggressive localized prostate cancer (5-year survival rate of approximately 50-60%), justifying the delivery of aggressive initial treatment for this patient populationⁱⁱ.



Unlocking the Future of IGRT through Knowledge Translation

A team of RMP staff, led by **Caitlin Gillan**, published a Commentary articulating the importance of team work in the successful implementation of image guided radiation therapy (IGRT), as well as the value of inter-disciplinarity, and the integration of education with research as we move into the next phase of technology innovation and implementation for improved outcomes for cancer patients^v. This report is a great testament to the success of the RMP Education Program, particularly the award-winning Accelerated Education Program.



Early Breast Cancer Screening for Young Survivors of Hodgkin's Lymphoma

David Hodgson and colleagues published the first report indicating that early MRI-based screening can reduce breast cancer mortality for female survivors treated with thoracic radiation therapy for childhood Hodgkin's lymphomaⁱⁱⁱ. Published in the *Journal of the National Cancer Institute*, this study provides evidence supporting earlier breast cancer screening in this patient population, for which uptake is currently low.



Driving Safety and Quality Assurance Practice in Canada

Jean-Pierre Bissonnette published a report describing an important initiative led by the CPQR and the Canadian Organization of Medical Physicists (COMP) to develop a suite of Technical Quality Control guidelines for radiation treatment equipment, with the aim to promote integrated quality assurance programs nationwide^{vi}. The resulting series of guidelines outline specific performance objectives and criteria that equipment should meet in order to ensure an acceptable level of radiation treatment quality.



Fully Automated Treatment Planning for Head and Neck Radiotherapy

A team of RMP physicists, led by **Thomas Purdie**, reported the development of an automated treatment planning platform based on a novel dose prediction method with dose mimicking, which can generate complete treatment plans in 12-13 minutes without user interaction^{iv}. This study demonstrates a promising approach for fully automated treatment planning, and can be readily applied to different treatment sites and modalities.



Staging System for HPV-Related Oropharyngeal Cancers

Brian O'Sullivan and **Sophie Huang** reported the results of a landmark multi-centre cohort study by the International Collaboration on Oropharyngeal Cancer Network for Staging (ICON-S), which developed a TNM classification specific for HPV+ oropharyngeal cancer, a rapidly emerging disease in the Western world^{vii}. The proposed ICON-S staging system, published in *Lancet Oncology*, permits a more appropriate depiction of the character and prognosis of this increasingly important disease entity.

LEADERSHIP APPOINTMENTS

Anthony Fyles was appointed as the Director of the RMP Clinical Research Program (CRP) effective April 2016, succeeding **Rebecca Wong**, who has held this position since 2009.

Tara Rosewall was appointed as the Research and Development Leader to the Joint Department of Medical Imaging (JDMI) and RMP in October 2016.

Michael Velec was appointed as the inaugural Allied Health Clinician Scientist (Radiation Therapist) in RMP, effective September 2016.

NOTABLE PEER-REVIEWED FUNDING

Alejandro Berlin received funding for the project entitled, “Focal MRI-Guided and Genomics-Driven High-Dose-Rate Brachytherapy as a Monotherapy for Localized Prostate Cancer: A Pilot Study.” Funding source: CARO/ABBVIE Oncology ACURA Uro-Oncology Radiation Award

Scott Bratman received funding for the project entitled, “Early Detection of Tumour Response for Adaptive Therapy in Oropharynx Cancer.” Funding source: Canadian Cancer Society Research Institute

Timothy Craig received funding for the project entitled, “Adaptive Radiation Therapy in Postoperative Management of High-Risk Prostate Cancer.” Funding source: CARO/ABBVIE Oncology ACURA Uro-Oncology Radiation Award

Meredith Giuliani received funding for the project entitled, “The Role of Prostate Cancer Survivors in Managing Survivorship Care: A Cross-Sectional Descriptive Study.” Funding source: Sanofi-CARO Award for Research in Prostate Cancer Therapies

Rachel Glicksman and **Alejandro Berlin** received funding for the project entitled, “[¹⁸F]DCFPyL PET/MRI for Personalizing Prostate Cancer Subclinical Metastatic Ablative MR-Guided Radiotherapy: A Pilot Study (PSMA MRgRT).” Funding source: CARO/ABBVIE Oncology ACURA Uro-Oncology Radiation Award

Winnie Li received funding for the project entitled, “Frame-Based versus Frame-Less Immobilization for Gamma Knife Stereotactic Radiosurgery: Patient Perspective.” Funding source: Canadian Association of Medical Radiation Technologists

RMP Radiogenomics/Radiomics Grants

Alejandro Berlin: Genomic Characterization of MRI-Normal Prostate to Support Actionable Treatment Adaptation of Focal MRI-Guided HDR Brachytherapy for Prostate Cancer

Scott Bratman: Detection of Genomic Clonal Heterogeneity in Oral Cavity Squamous Cell Carcinoma

Kathy Han and Michael Milosevic: Radiogenomic and Radiomic Characterization of Cervical Cancer for Patient Selection and Treatment Adaptation

Highlights



DID YOU KNOW?

The Canadian Cancer Trials Group (CCTG) led CE.6 Phase III trial involving **Normand Laperriere** and members of the multi-disciplinary **CNS Site Group** was selected as one of the Top Canadian Cancer Society-funded research stories of 2016. Published in the *New England Journal of Medicine*, this landmark study demonstrated that adding temozolomide to short-course radiation therapy improved overall survival for elderly glioblastoma patients^{viii}.

EDUCATION

RMP is committed to training the next generation of radiation medicine professionals through the provision of high quality educational programs. As the largest single-site radiation medicine program in North America, RMP provides one of the most comprehensive clinical settings for the formal training of radiation oncologists, physicists and therapists.

As a fully-affiliated teaching hospital of the University of Toronto, RMP's education portfolio is closely aligned with education programs of the University of Toronto's Department of Radiation Oncology. This strategic alignment enables the optimal utilization of educational expertise and infrastructure, and facilitates the achievement of the central education mandate of RMP and UTDRO.

The formal professional training programs include: undergraduate training for radiation therapy (BSc Medical Radiation Sciences) and medical education; post-graduate training programs for radiation oncology residency, fellowship and physics residency; as well as the Master of Health Science in Medical Radiation Sciences (MHScMRS) graduate program and the Strategic Training in Transdisciplinary Radiation Science for the 21st Century (STARS21) training program (formerly known as EIRR21). RMP staff also provide teaching for residents and fellows from other training programs, as well as MSc and PhD students from graduate programs, such as IHPME, Dalla Lana School, Nursing and Medical Biophysics.

RMP offers a wide range of interdisciplinary opportunities and programs that cater to practicing radiation medicine professionals, who seek to gain informal or structured learning experiences within our clinical environment at the Princess Margaret, including the RMP Observership Program; the Accelerated Education Program, which delivers in-depth structured 2-3 day courses; and the Personalized Learning Program™ (PLP™) in Radiation Medicine, which offers 3-6 months of on-site and online learning opportunities.

“ This was an extremely valuable course. It is well developed, represents all disciplines and provides comprehensive coverage of the topic. ”

AEP Liver SBRT IGRT Course participant

DIVERSE LEARNERS

UNDERGRADUATE

- 46 BSc Medical Radiation Sciences students
- 23 Undergraduate Medical Education students
- 2 CARO-CROF students
- 15 Summer students

GRADUATE

- 3 MHSc Medical Radiation Sciences students
- 27 Strategic Training in Transdisciplinary Radiation Science for the 21st Century scholars

POST-GRADUATE

- 27 Radiation oncology residents
- 29 Radiation oncology clinical fellows
- 6 Medical physics residents

CONTINUING EDUCATION

- 72 Observers from 23 countries
- 7 Residents in Ghana/ PM Clinical Research Mentorship Program
- 72 AEP participants (3 on-site AEP courses)
- 1 Personalized Learning Program participant from Hunan Cancer Hospital, China

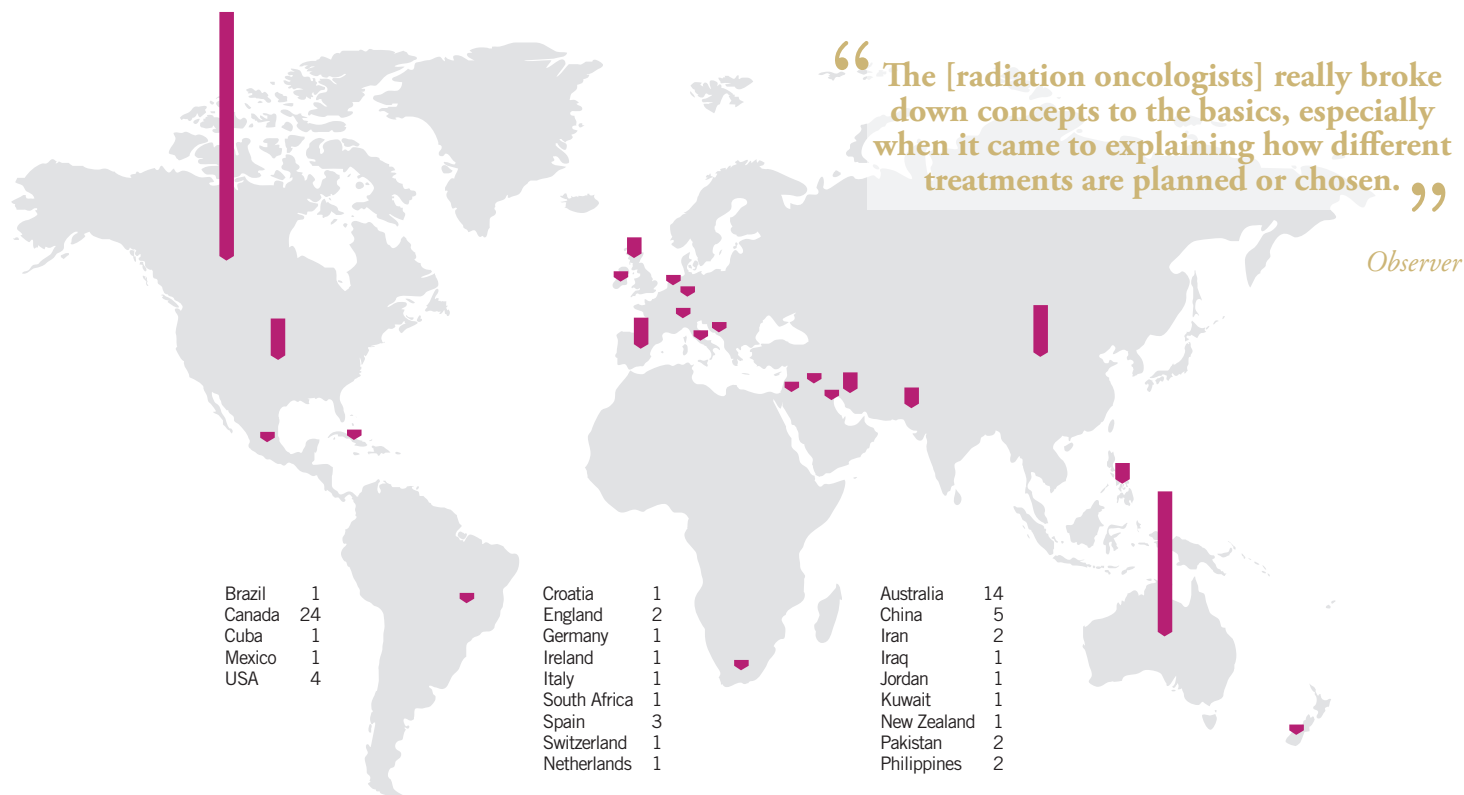
**2016 academic year statistics*

RMP MENTORSHIP PROGRAM

Jolie Ringash and **Jennifer Croke** developed a pilot Radiation Oncology Mentorship Program at the Princess Margaret to support the career development of new faculty members, as well as the career progression of current staff. Launched in April 2016, the overall objectives of the RMP Mentorship Program are to: (1) assist with faculty staff career development; (2) improve staff satisfaction and retention; (3) improve rates of academic promotion; and (4) improve academic productivity. To date, 4 RMP faculty members have identified and met with their mentors, while others are still at various stages of establishing their mentoring relationships.

GLOBAL CAPACITY BUILDING

As global leaders in clinical practice, research and education, RMP actively disseminates its knowledge and best practices so that quality care is made available to all patients within our global community. In 2016, RMP hosted 72 observers from 23 countries; a record number for the program with an increase of 22% compared to 2015. Observers spent a median of 5 days (range: 1-80) at RMP, and included health professionals from radiation oncology (35%), medical physics (19%), radiation therapy (14%), as well as trainees (32%). In 2016, RMP continued discussions with global partners in Kenya, Ghana, Ethiopia, Jordan and China on strategies to leverage radiation and educational expertise to enhance global capacity within radiation medicine.



AEP SNAPSHOT: PUTTING INNOVATION TO WORK IN 2016

The Accelerated Education Program (www.aepeducation.ca) continued to offer dynamic educational programs promoting the integration of emerging technologies, and the creation of innovative workplace models for radiation professionals. The program actively pursued opportunities to raise its profile and increase enrollment in 2016.



3

on-site courses
delivered (72 total
participants)



4

new e-modules
published (16 total
e-modules)



migrated to new learning
management system &
updated website



created new AEP
LinkedIn account

LEADERSHIP APPOINTMENTS

Andrea Bezjak was appointed as the Director of UTDRO's Postgraduate Medical Education Program, effective September 2016, succeeding **Barbara-Ann Millar**, who has held this position since 2007.

Jennifer Croke assumed the role of Director of the Personalized Learning Program™ (PLP™) in Radiation Medicine in February 2017, succeeding **Meredith Giuliani** who has held this position since 2014.

Meredith Giuliani was appointed as the Medical Director of Cancer Education at the Princess Margaret, effective May 2016.

Andrea McNiven was appointed as the Director of the Medical Physics Residency Program at UTDRO, effective February 2016.

Barbara-Ann Millar and Ewa Szumacher assumed the roles of Faculty Development and Continuing Education & Professional Development Co-Directors at UTDRO starting December 2016.

Doug Moseley stepped down as the Director of Knowledge Translation at UTDRO after a successful 4-year leadership term (2012-2016).

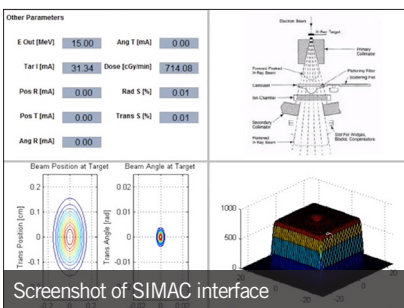
Highlights

RMP STAFF RECOGNIZED FOR CONTRIBUTIONS TO EDUCATION IN RADIATION MEDICINE

Jean-Pierre Bissonnette was the recipient of the Wightman-Berris Academy Award for Excellence in Educational Administration from the University of Toronto, in recognition for his immense contributions to the delivery of curriculum as the Director of the Medical Physics Residency Program at UTDRO (2007-2016). His leadership has enhanced teaching and learning for physics residents and has helped to establish the program as one with lasting global impact.

Marco Carlone, Nicole Harnett and Bern Norrlinger received the American Association of Physicists in Medicine (AAPM) Award for Excellence in Educational Innovation for their project entitled, "SIMAC: A Simulation Tool for Teaching Linear Accelerator Physics". Developed to address the limited availability of learning resources related to linacs, SIMAC (simulation linac) is a teaching tool that allows medical physicists and students to peek inside the linac to learn how the machine operates at the engineering level.

Kieng Tan and Lisa Di Prospero were the 2015-2016 recipients of the Colin Woolf Award for Long-Term Contributions to Continuing Education (CE) from the University of Toronto for their roles as Co-Chairs of RTI3, an innovative 2-day conference which provides the sole forum for disseminating research on all aspects of radiation therapy in Canada. Their steadfast commitment and contributions to CE and continuing professional development has led to the development of a high quality program with global impact.



STARS21 SPOTLIGHT: TRAINING FUTURE LEADERS OF CANADA'S SCIENTIFIC COMMUNITY

The Strategic Training in Transdisciplinary Radiation Science for the 21st Century (STARS21) Training Program, led by **Anne Koch** and **Marianne Koritzinsky**, is designed to provide clinicians, graduate students and post-doctoral fellows with the skills essential to conduct innovative research in radiation medicine, along with leadership, management, collaborative and communication proficiencies necessary to define them as the future leaders of Canada's scientific community (www.radonc.utoronto.ca/stars21). The program is built on the foundation and legacy of the former Excellence in Radiation Research for the 21st Century (EIRR21) Program, which was founded by **Fei-Fei Liu**.

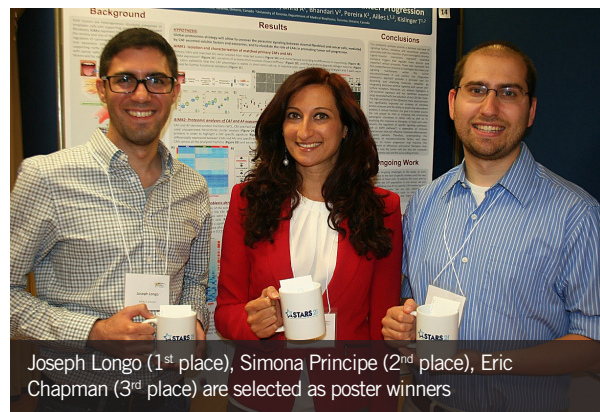
In 2016, there were a total of 27 scholars and 40 mentors from 10 Canadian research institutions in the STARS21 Program. The scholars were involved in a broad spectrum of research projects, ranging from molecular biology of DNA repair/damage response, novel therapeutic approaches, imaging physics, bioinformatics, molecular predictors of radiation response, technical improvements in radiation delivery,

and health delivery for cancer patients. The achievements of many of the STARS21 scholars continue to be attested by receipt of additional external competitive training awards, publications and promotions.

“ I think this program offers an important and very interesting 360 degree overview of cancer treatment, focusing on radiation science... The opportunity to learn about transdisciplinary research and work with scientists from a wide variety of fields was invaluable. ”

STARS21 scholar

Highlights this year included the hugely successful Annual STARS21 Research Day, which took place in June 2016. New to the event was the well-received Inaugural Alumni Keynote Address, which was presented by STARS21 graduates, David Tulumello (Associate Scientist



Joseph Longo (1st place), Simona Principe (2nd place), Eric Chapman (3rd place) are selected as poster winners

at Sanofi Pasteur) and RMP's **Kathy Han**. Both alumni spoke about their current research and provided insights on how the STARS21 Program has had an impact on their careers. The “STARS21 Cup” was awarded to the team that created the best “How It’s Made” or “How It Works” video, with a focus on personalized radiation medicine. As always, a diverse array of research topics was showcased at this year’s scholar poster competition.

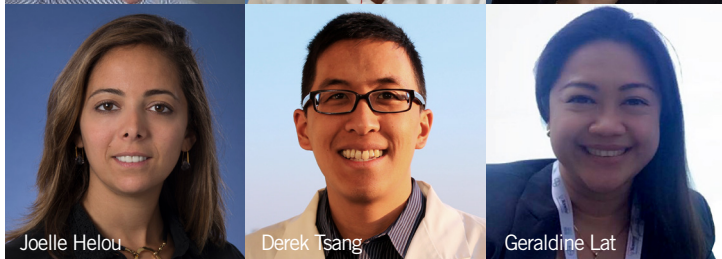
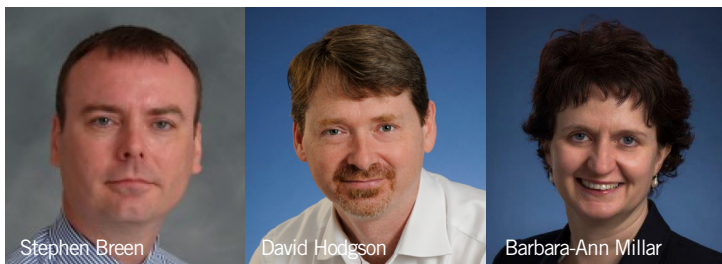
Programmatic assessments from the past year indicated that the STARS21 curriculum enhanced the scholars’ perceived proficiency in areas such as interprofessional collaboration, transdisciplinary radiation medicine and cancer research, scientific communication and research commercialization. Trainees also strongly acknowledged the value of learning together with an interdisciplinary group. Due to its success, the STARS21 Program is now offered as a module in the Institute of Medical Science’s graduate program, and is being piloted in the Department of Medical Biophysics. To date, there have been a total of 110 STARS21 graduates who have completed the program.



Anne Koch, Brennan Wadsworth, Pooneh Kalhorzadeh, Anna Pan, Mattea Welch, Marianne Koritzinsky; Anne and Marianne with the winners of the STARS21 Cup

PEOPLE

With a team of over 350 radiation specialists, the Radiation Medicine Program is fortunate to have a diverse pool of talent to increase RMP's capacity to deliver on its vision to achieve "Precision Radiation Medicine. Personalized Care. Global Impact." In 2016, RMP continued to exhibit excellence, innovation and leadership in patient-centred care, research and education, exemplified by the high level of productivity and achievements of our staff.



NOTABLE LEADERSHIP APPOINTMENTS

Stephen Breen joined Cancer Care Ontario's Provincial Radiation Treatment Program as the Physics Clinical Quality Lead, effective September 2016.

David Hodgson was appointed as the Medical Director of the Pediatric Oncology Group of Ontario (POGO), effective November 2016. With this appointment, he also holds the Endowed Chair in Childhood Cancer Control at the University of Toronto.

Barbara-Ann Millar now serves as the Chair-Elect for the Radiation Oncology Specialty Committee with the Royal College of Physicians and Surgeons of Canada.

NEW TALENT

RADIATION ONCOLOGY Joelle Helou, Derek Tsang

RADIATION THERAPY Bruce Chan, Stephen Genier, Diana Lee, Nathaniel So

ADMINISTRATION Geraldine Lat, Tara D. Spence

Welcome to all new hires!

LONG SERVICE RECOGNITION

Congratulations and thank you to our dedicated RMP members who reached their ≥ 25 year service milestone in 2016.

25 YEARS Andrea Bezjak, James Brierley, Frederick Cheung, Wilfred Levin, Sin Ping Li-Cheung, Andrea Shessel

30 YEARS Eleni Sachinidis, Pdraig Warde

35 YEARS Debbie Davison, Shenaz Ladak

Emma Pavlov, Debbie Davison, Marnie Escaf, Shenaz Ladak at the Long Service Recognition Ceremony

NOTABLE AWARDS AND DISTINCTIONS

Charles Catton received a Best of ASCO Award for his paper entitled, “Randomized Trial of a Hypofractionated Radiation Regimen for the Treatment of Localized Prostate Cancer^{ix}”

Laura Dawson was elected as an ASTRO Fellow (FASTRO)

Meredith Giuliani received the Canadian Medical Association (CMA) Award for Young Leaders

Mary Gospodarowicz was the recipient of the 2016 Canadian Cancer Trials Group Cosbie Lectureship Award

Kathy Han was appointed as a Clinician Scientist by the Ontario Association of Radiation Oncologists, effective January 2016

Nicole Harnett received the Canadian Association of Medical Radiation Technologists Life Member Award

Joelle Helou won the Best Abstract in Supportive Care Award at the 2016 CARO Conference for her project entitled, “Acute Quality of Life Changes After Stereotactic Ablative Radiotherapy for Liver Metastasis: A Prospective Cohort Analysis”

Ali Hosni received the Conquer Cancer Foundation Merit Award of the American Society of Clinical Oncology

Sophie Huang received an Associate Member Award at the 2016 CARO Conference for her project entitled, “Prognostic Value of Pretreatment Serum Lactate Dehydrogenase in HPV-Related and HPV-Unrelated Oropharyngeal Cancer”

David Jaffray was elected as a Fellow of the American Association of Physicists in Medicine

Marianne Koritzinsky was awarded the Radiation Research Society Michael Fry Award

Fei-Fei Liu was selected as the Ted Phillips Distinguished Speaker at the University of California San Francisco

Brian O’Sullivan delivered the Inaugural Stiefel Lecture in Head and Neck Cancer at the MD Anderson Cancer Centre

Radiation Medicine Program received the 2016 Emmanuel van der Schueren Award from the European Society of Radiotherapy and Oncology (ESTRO)

PRINCESS MARGARET AWARD WINNERS

Sameera Ahmed and **Tamara Garnes** were winners of the Princess Margaret Cancer Centre Employee Engagement Team Award in the Leadership Category

Robert Bristow received the Best Clinical Paper Award for 2015 by the Princess Margaret Cancer Research Institute for his *Nature Genetics* publication entitled, “Spatial Genomic Heterogeneity within Localized, Multifocal Prostate Cancer^x”

Jennifer Deering was awarded the Princess Margaret Cancer Centre Education Award – Outstanding Contribution to Cancer Education

Amanda Lamb received the Princess Margaret Cancer Centre Marlene Abate Award

Joanna McCusker received the Princess Margaret Cancer Centre Matthew’s Scholarship

Team 4 Planners were selected as winners of the Princess Margaret Cancer Centre Employee Engagement Team Award in the Impact Category

Patricia Toolsie was the winner of the Princess Margaret Cancer Centre Employee Engagement Individual Award in the Impact Category



Tamara Garnes, Sameera Ahmed, Marnie Escaf at the Princess Margaret Staff BBQ



Marianne Koritzinsky

Jennifer Deering

RMP AWARD WINNERS

Research Awards

Research Productivity – Radiation Oncology: **Jolie Ringash**

Research Productivity – Medical Physics: **David Jaffray**

Research Productivity – Radiation Therapy: **Michael Velec**

Most Influential Research Publication: **Sophie Huang, Brian O'Sullivan**

Exceptional Research Support: **Stephen Chung, Tony Lam, Pat Merante, Bernhard Norrlinger, Ana Sanchez**

Research Leadership Award: **Tom Purdie**

Top Clinical Trial Accrual Investigator Award: **Meredith Giuliani**

Education Awards

Chief's Choice RMP Rounds: **Jean-Pierre Bissonnette, Timothy Craig, Vickie Kong** for “Dose Accumulation and Adaptive Radiotherapy Vignettes”

Chief's Choice RMP Rounds: **Bernadeth Lao, Sonca Lengoc, Ana Sanchez, Kawalpreet Singh** for “Clinical Research Program: A Re-Introduction”

Best RMP Rounds: **Kathy Han** for “Personalizing Cervix Cancer Treatment: Seeing is Believing”

Trainee Excellence in Education: **Jonathan So**

Excellence in Education Support: **Kathleen Conway**

Distinction in Teaching: **Anne Di Tomasso**

Distinction in Professional Mentorship: **David Jaffray**

Robert V. Brady Resident Award: **Ezra Hahn**

Accelerated Education Program Awards

Highest Overall Teaching Effectiveness Score: **Laura Dawson**

Putting Innovation to Work Award: **Robert DeSimone**



Pat Merante, Michael Milosevic, Ana Sanchez at the RMP Awards Ceremony



Meredith Giuliani at the CMA Award Ceremony



Deb Murley and Nicole Harnett



Michael Milosevic and Michael Velec



Rebecca Wong and Kathleen Conway



Laura Dawson



BRIAN O'SULLIVAN: HONOURING THE CAREER AND LEGACY OF A LEADER IN ONCOLOGY

Over the past 32 years, **Brian O'Sullivan** has been an invaluable member of the Radiation Medicine Program, and the multi-disciplinary management teams of sarcoma and head & neck cancer. He is an internationally-renowned leader and expert in the management of these diseases, and his achievements span across multiple arenas, including education, cancer staging, clinical trials, outcomes assessments and global cancer control. As a Clinician Scientist, Brian has led a number of practice-changing clinical trials and

research studies, both in sarcoma and head & neck cancer. He has published well over 350 peer-reviewed publications during his distinguished career; he is a highly sought-after speaker, and advisor on many scientific boards and agencies. Fittingly, he has received innumerable awards and honours, including the most recent 2017 European Society for Radiotherapy and Oncology Honorary Member Award, in recognition for his outstanding scientific contributions to the field of radiation oncology, as well as the

2017 Canadian Cancer Society O. Harold Warwick Prize for his immense contributions to cancer control.

Despite his retirement, Brian will continue his important academic work on behalf of RMP, as well as the University of Toronto's Department of Radiation Oncology. A celebration event was held in April 2017, with a Tribute Symposium focusing on the themes of his expertise and achievements over the years.



LOOKING AHEAD

2016 saw our **Strategic Roadmap to 2020** come to life. Focusing on our four strategic pillars, we have made strides in advancing cancer care on a global scale through research, pushed the boundaries in innovation, and contributed to enhancing practice through our award-winning education programs. Our achievements and successes are a reflection of the hard work and deep commitment of our talented, multi-professional team of staff.

In the year ahead, we will build upon these achievements and work collectively towards implementing our Year-2 priority initiatives, bringing us one step closer to achieving our mission to **“advance exemplary radiation medicine through patient care, research and education in partnership with our patients and community.”** UHN’s new Purpose, Values and Principles will also continue to guide us on our path of sustained excellence in patient-centred care, and our approach towards realizing our vision. By remaining true to our core values of innovation, integrity, excellence, collaboration and accountability, we will shape our program into one that delivers **“Precision Medicine. Personalized Care. Global Impact.”**



PRECISION MEDICINE. PERSONALIZED CARE. GLOBAL IMPACT.

RADIATION MEDICINE PROGRAM
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