

Clinical Investigation

A Research Agenda for Radiation Oncology: Results of the Radiation Oncology Institute's Comprehensive Research Needs Assessment

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Summary

We report on the Radiation Oncology Institute's comprehensive research needs assessment, which used rigorous qualitative and quantitative social scientific methods to identify priority areas for research to advance the field of radiation oncology. The top six areas identified are: communication, quality, survivorship, comparative effectiveness, value, and data registries.

Purpose: To promote the rational use of scarce research funding, scholars have developed methods for the systematic identification and prioritization of health research needs. The Radiation Oncology Institute commissioned an independent, comprehensive assessment of research needs for the advancement of radiation oncology care.

Methods and Materials: The research needs assessment used a mixed-method, qualitative and quantitative social scientific approach, including structured interviews with diverse stakeholders, focus groups, surveys of American Society for Radiation Oncology (ASTRO) members, and a prioritization exercise using a modified Delphi technique.

Results: Six co-equal priorities were identified: (1) Identify and develop communication strategies to help patients and others better understand radiation therapy; (2) Establish a set of quality indicators for major radiation oncology procedures and evaluate their use in radiation oncology delivery; (3) Identify best practices for the management of radiation toxicity and issues in cancer survivorship; (4) Conduct comparative effectiveness studies related to radiation therapy that consider clinical benefit, toxicity (including quality of life), and other outcomes; (5) Assess the value of radiation therapy; and (6) Develop a radiation oncology registry.

Conclusions: To our knowledge, this prioritization exercise is the only comprehensive and methodologically rigorous assessment of research needs in the field of radiation oncology. Broad

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Introduction

In recent years, scholars and policy makers alike have devoted increasing attention toward the identification and prioritization of health research needs. Rigorous methods have been developed at the national level by organizations such as the Institute of Medicine (IOM) (1, 2), which most recently obtained input from a wide variety of stakeholders to prioritize needs for comparative effectiveness research (3), as directed by the American Recovery and Reinvestment Act of 2009. A similar approach may be used for the definition of research agendas within particular disciplines.

The Radiation Oncology Institute (ROI) was developed in 2006 with a mission to “enhance and promote the critical role of radiation therapy in the treatment of cancer by supporting research and education about the life-saving and quality-of-life benefits of radiation therapy” (4). Fundraising commenced, and by 2009, the ROI was able to begin to conduct projects. As one of its first initiatives, the ROI’s Research Committee commissioned a comprehensive study to identify research priorities for the field of radiation oncology. We report here the methods and results of this comprehensive research needs assessment, which may be useful not only for directing the initiatives of ROI itself but also for other funding agencies that seek to support research of high significance with the potential to have an impact on practice.

Methods and Materials

In January 2010, the ROI issued a request for proposals to conduct a comprehensive assessment of research needs in radiation oncology. The ROI Board of Directors selected an independent healthcare consulting group affiliated with a major university (the Yale Center for Healthcare Solutions) to perform the assessment, after considerations of experience and the desire to engage an impartial group to conduct the endeavor. The Yale Center used a mixed-methods, qualitative and quantitative social scientific approach, including structured interviews with diverse stakeholders, focus groups, surveys of American Society for Radiation Oncology (ASTRO) members, and a prioritization exercise.

The Yale Center initially developed a structured guide for telephone interviews, moderators’ guide for in-person focus groups, and survey questionnaire for solicitation of views of other interested ASTRO members after focused literature review and strategic discussions with ROI and ASTRO leadership. In the fall of 2010, Yale Center researchers performed detailed (average

duration one hour) telephone interviews with 43 stakeholders, including private practitioners of radiation oncology, academic radiation oncologists, and representatives of government, industry, and payers. To allow for the additional insights that emerge from the dynamic interaction of stakeholders from different perspectives, they conducted seven in-person focus groups with an additional 40 individuals, including ASTRO leaders, radiation oncology trainees, nurses, researchers, and leaders in health policy. They also made available an online survey to ASTRO members to solicit input from any interested party. Results were annotated and organized using an Access database and the output was analyzed using SPSS v18 (SPSS Inc., Chicago, IL).

A total of 1150 coded comments were identified from this work. These were subjected to standard techniques of thematic analysis and organized into 10 broad categories. In January 2011, a total of 107 proposed research topics distilled from this initial qualitative phase of research were then presented to a panel of 21 national leaders in the field of radiation oncology. The panel used a systematic, iterative approach, based upon the Delphi method pioneered by the RAND Corporation, to reach prioritized consensus (5).

The Delphi panel performed two anonymous, web-based reviews to refine the list of priority topics to 30. Panelists evaluated each topic based on two criteria: (1) impact on patients, and (2) ability to fill critical gaps within the specialty of radiation oncology. In the first round, panelists rated the 107 topics and were asked to provide free-text comments regarding each. In the second round, panelists reviewed the top 53 topics from the first round and considered de-identified free-text comments of the other panelists before re-rating the topics. The 30 topics selected through the first two rounds of the Delphi process were then evaluated through a survey of 1500 ASTRO members, selected to reflect the distribution within the full membership by professional activity, region, and gender. Responses received from 241 of the surveyed ASTRO members were used to inform the third round in-person meeting of the Delphi panel. The third round Delphi panel was also informed by the results of a town hall-style meeting with patients and their supporters, held in Virginia in April 2011, attended by 31 cancer survivors, family, and friends. In the third round, the Delphi panel considered all data collected by the Yale Center, along with criteria articulated by the ROI board (patient and public needs, strategic “fit” with ROI, and implementation feasibility) and sensitivity to a variety of different “game-changing” scenarios (*e.g.*, a shortage of cancer physicians creates barriers to access; useful radiation sensitizers are discovered; radiation fears increase as a result of public disaster). After the Delphi panel concluded, the priority topic areas it identified were assigned to ROI Research Committee members, who recruited experts in each area to help define in greater detail

the gaps in knowledge and potential approaches for addressing each.

Results

Ultimately, the Delphi panel identified seven consensus priority topics. One of these topics—namely, studies to advance the scientific understanding of cancer and radiation biology—was deemed to be outside the scope of what the ROI could currently feasibly support, and within the scope of other institutions, foundations, and agencies that provide existing support mechanisms. The other six topic areas of greatest importance were ultimately considered to be “first among equals” and unranked in terms of importance.

Below, we provide detailed elaboration of these priority areas.

Communication

“Identify and develop communication strategies to help patients and others better understand radiotherapy.”

The increasing complexity of cancer care generally, and radiation therapy specifically, preclude ready understanding—both by patients and by their non-radiation oncologist physicians—of the therapeutic balance between toxicity and tumor control for many radiation-eligible patients. Clear communication of expected outcomes is often emotionally charged and physician dependent. In scenarios where radiation therapy provides equivalent oncologic outcomes with competing interventions (*e.g.*, surgery, chemotherapy), relatively complex toxicity profile data must be carefully explained in an unbiased, yet understandable, way. Furthermore, specific patient cohorts (*e.g.*, socioeconomically disadvantaged patients, subsets of certain ethnic minority, and/or elderly patient cohorts) may have identifiable barriers to understanding the potential benefits of radiation therapy. Finally, a shared decision-making (SDM) process now often occurs in the framework of a multidisciplinary care model, with an opportunity to educate medical professionals and to improve decision-making processes regarding radiation therapy indications and outcomes.

At present, minimal high-quality, prospective data exist regarding optimal SDM processes or information needs with respect to radiation therapy. Furthermore, although novel risk communication tools have been developed to assist in SDM processes for radiation therapy (*e.g.*, risk nomograms, risk calculators), verification of the impact of these instruments in terms of improving patient or physician understanding or satisfaction is limited. Consequently, a high-priority area in the comprehensive research needs assessment was to “identify and develop communication strategies to help patients’ and others’ understanding of RT.”

Coherent communication of the utility of radiation therapy is essential to ensure high-quality health-related decision making. In an increasingly SDM-based model, treatment selection may often be relegated to decision makers whose capacity for risk assessment may be overestimated by radiation oncologists. At the macro level, inability to effectively communicate to stakeholders leads to potential underuse by patients (*e.g.*, selection of mastectomy vs. breast conservation across sub-populations), under-referral/under-implementation by physician colleagues, and potential displacement from federal prioritization by legislative bodies. Inability to clearly communicate complex

risk–benefit profiles may be magnified when rare, unfortunate events receive prominent media attention. At the micro level, communication strategies between radiation oncologists and either patients or providers are often informal and thus exceedingly operator dependent and variable. Consequently, efforts that identify specific identifiable communication needs for the aforementioned stakeholders, which can then be systematically addressed through prospective interventions, are timely and appropriate (6).

Quality and safety

“Conduct research to establish a set of quality indicators for major radiation oncology procedures and evaluate their use in radiation oncology delivery.”

The strategic importance of quality assurance and safety received renewed impetus recently with a series of *New York Times* articles detailing radiation accidents in both therapy and diagnostic procedures (7). Those events, along with recent data showing that facilities failed the Radiation Therapy Oncology Group (RTOG) quality assurance intensity-modulated radiation therapy (IMRT) test phantom irradiation test at a discouraging rate (28% for the head-and-neck cohort), have created a sense of urgency to improving current quality assurance efforts and implementing quality improvement efforts that guard against similar problems.

Safety in radiation oncology is not a new issue. However, recent changes have made ensuring safety more difficult. In particular, the implementation of IMRT has made the verification of correct delivery more difficult, while at the same time making online, pretreatment checks of patient setup less likely to detect any errors, because IMRT fields can no longer be defined and checked by a straightforward “port-film” (8). Among other factors, the move to hypofractionation means that mistakes cannot be adjusted for in later fractions and can lead to injury even if made on a single fraction. Moreover, technical changes in both software and hardware of treatment machines, while potentially providing new opportunities, also introduce new system elements that may, at least theoretically, fail. Understanding IMRT delivery accuracy is therefore a high priority.

It has long been recognized that the effort to improve quality in health care should depend on lessons learned in the effort to improve quality in other fields, such as manufacturing, aviation, and nuclear power. Such techniques include six-sigma; lean techniques; and Plan-Do-Study-Act (9). Pawlicki and Mundt have reviewed quality improvement techniques as they apply to the field of radiation oncology (10). Of particular importance are three agreed-upon principles: (1) A quality process is understood statistically to have low variance that is acceptable (11); (2) Processes should be analyzed to understand potential fail modes, as well as to understand root causes of important errors; and (3) There should be added focus on errors that have the potential to harm the patient (12).

Although there is a rich resource of established procedures to ensure the delivery of safe radiation therapy urgent work remains to be done to improve quality in radiation therapy (12, 13). We currently lack quality metrics that capture the quality of the planning and delivery process for individual patients. To that end, studies that focus on new metrics of quality care relating to variability in contouring, IMRT treatment planning, and geometric setup accuracy may be particularly important.

Survivorship and toxicity management

“Identify best practices for the management of radiation toxicity and issues in cancer survivorship.”

As of January 2008, 11.9 million individuals, or 4% of the United States population, are cancer survivors (14). Furthermore, the number of survivors is expected to grow rapidly over the next decade because of the aging of the population and the higher incidence of common cancers among older adults. Survivors of cancer face unique physical, psychological and social challenges that require strategies to minimize negative impact on the quantity and quality of their lives. There remains a significant knowledge gap regarding the specific impact of radiation therapy on long term cancer survivorship.

The role of radiation oncologists in the ongoing follow-up and management of cancer survivors needs to be more clearly defined. Radiation oncologists have a unique opportunity to establish a long-term relationship with their patients and to support their lifelong health objectives. The treating radiation oncologist, as part of a multidisciplinary team that includes the patient's primary care provider and other oncologists, can help to identify risks of late effects and secondary malignant neoplasms and to minimize their negative impact.

It may be particularly worthwhile to compile and categorize both late and acute radiation symptom management strategies and to prioritize them by effectiveness and the levels of evidence that support them. After all, more than half of the 1.4 million Americans diagnosed each year with cancer undergo radiation therapy and many of them experience side effects from this therapy. The management of treatment related symptoms often involves the empiric administration of medications or therapies with limited evidence about their relative effectiveness. Because there is growing concern that the severity of acute radiation side effects may have a substantial impact on a patient's recovery and risk of late effects of therapy, improving practice for management of both acute and late toxicities is important.

Comparative effectiveness

“Conduct comparative effectiveness studies related to radiotherapy that consider clinical benefit, toxicity (including quality of life), and other outcomes.”

Various study designs can compare the benefits and harm of competing approaches to cancer treatment, including randomized clinical trials, pragmatic clinical trials, and prospective or retrospective observational research studies. The essence of radiation therapy effectiveness research is to understand what health interventions work, for which patients, and under what conditions.

Comparative effectiveness research (CER) is important to field of radiation oncology (15). As summarized by the 2009 consensus report by the Institute of Medicine, “the purpose of CER is to assist consumers, clinicians, purchasers, and policy makers to make informed decisions that will improve health care at both the individual and population levels.” Given the large pool of possible CER questions, the ROI supports CER evidence generation to identify treatments that consistently improve health outcomes compared with alternatives, and patient subpopulations that consistently benefit from treatments (16).

The ROI encourages effectiveness research that examines survival (defined as overall survival and disease-specific survival)

and quality of life (defined as disease-specific and overall quality of life). As local-regional cancer control with maximal normal tissue preservation is a defining role for radiation therapy the ROI particularly encourages research that examines the impact of local-regional cancer control on survival, toxicity/side effects, and quality of life. Other intermediate outcomes, such as the following (and others) are also important: surrogate disease response outcomes; second malignancies; patient-reported outcomes; and disease-specific quality of life.

The ROI has identified *four main topic areas* as CER priorities for radiation oncology: (1) outcomes of invasive vs. noninvasive approaches to definitive treatment; (2) outcomes of competing radiation therapy modalities; (3) outcomes of alternative approaches to management of oligometastatic disease; and (4) outcomes of hypofractionation for prevalent disease.

Value

“Assess the value of radiation therapy.”

As a percentage of gross domestic product (GDP), health care spending growth is projected to outpace Social Security and Defense programs over the next 20 years. Radiation oncology accounts for a small portion of oncology spending but has seen substantial cost growth secondary to technology innovation. CER, as defined above, and cost-effectiveness analysis are related but distinct approaches to evaluating the benefits and harms of medical interventions. Cost-effectiveness analysis is a method designed to examine the comparative effects of spending on different health interventions. The incremental cost-effectiveness ratio is a measure of relative value: the difference in costs between an intervention and its alternative divided by the difference in their health outcomes.

The ROI supports studies that examine the comparative value of radiation therapy because such studies have the potential to generate the evidence needed to improve cancer outcomes while slowing the growth of health care spending (17). To examine the comparative value of radiation therapy three main topic areas are proposed. First, because new and expensive radiation therapy technologies have been introduced without evidence indicating incremental benefits compared with alternatives, studies should evaluate the cost-effectiveness of alternative radiation therapy modalities. Second, because locoregional control and function preservation are defining goals of radiation therapy, studies are necessary to establish health-related quality of life and utilities (*e.g.*, preferences for health states) for locoregional control and function preservation across prevalent disease sites. Third, studies should examine productivity loss associated with alternative approaches to definitive cancer care, as the cost of lost productivity may be considerably greater than direct medical costs and may be minimized by advances in radiation therapy technique and delivery (18).

Registry

“Develop a radiation oncology registry.”

A robust source of large-scale observational data regarding the diagnoses, treatments, and outcomes of radiation oncology patients would facilitate much of the research described above (19). Although large, population-based databases exist (such as the Surveillance, Epidemiology, and End-Results registry), there is a need for a radiation oncology-specific registry that captures the

details of radiation techniques used, including dose data, and comprehensive treatment outcomes, including details regarding recurrence and quality of life from the patient's own perspective (patient-reported outcomes). A National Radiation Oncology Registry project is currently underway to that end, with ROI support, as detailed by Palta *et al.* (20). Of particular importance is the development of a comprehensive taxonomy and data dictionary for the collection of physician, patient, tumor, treatment, and outcomes data, as well as the requisite information technology infrastructure.

Discussion

The systematic process used by the ROI to identify and prioritize research needs for the field of radiation oncology has yielded multiple promising directions for future research. The priority areas identified here will now be used by the ROI's Research Committee and Board of Directors to define Requests for Proposals for specific projects, after consideration of strategic fit and feasibility.

We provide this report because, to our knowledge, this prioritization exercise is the only comprehensive and methodologically rigorous assessment of research needs in the field of radiation oncology, and therefore its findings may be useful to the broader community. In particular, because grant funding decisions are often made by committees on which highly specialized disciplines such as radiation oncology are under-represented, significant projects with substantial potential for impact may not be recognized. By disseminating the results of this research needs assessment, those applying for other source of funding to explore these areas may use these findings to support the significance of their applications.

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