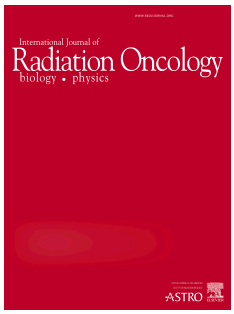


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# The Impact of an Introductory Radiation Oncology Curriculum (IROC) for Radiation Oncology Trainees Across the US and Canada

Evaluating IROC in the US and Canada

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Evaluating IROC in the US and Canada

**Abstract**

*Background:* Despite interest from both radiation oncology residents and program directors, many residency training programs lack a formalized introductory curriculum to orient incoming radiation oncology residents to the specialty.

*Methods:* Using the 6-step model for medical education curriculum development, a structured introductory radiation oncology curriculum (IROC) was created for incoming PGY-2 radiation oncology residents to address foundational concepts including patient simulation, contouring, and plan evaluation. The curriculum was distributed to 55 training programs across the US and Canada at the start of the 2018-2019 and 2019-2020 academic years. Feasibility of curriculum dissemination was assessed via a survey of participating program directors. Curriculum effectiveness was assessed using an anonymous survey of participating residents administered pre-and post-curriculum and consisting of both subjective and objective knowledge-based questions.

*Results:* A total of 236 residents participated in IROC at the start of the 2018-2019 and 2019-2020 academic years. Of those, 228/236 (97%) completed both the pre- and post- curriculum surveys. Of participating residents, the median residency program size was 10 (range 2-28) and the median number of residents in each program per year were 3 (range 1-7). At baseline, most PGY-2s (142/228, 62%) reported being “not at all” or “slightly” prepared to function in the radiation oncology clinic and after IROC most (188/228, 82%) felt “moderately,” “quite,” or “extremely” prepared. Objective knowledge improved pre- to post-curriculum on a multiple-choice test from 70% to 81% ($p < 0.0001$) correct with improvements observed across all question items. Program directors also reported that the curriculum was easier to use and more effective than prior orientation materials.

*Conclusions:* The implementation of an international introductory curriculum for PGY-2 radiation oncology residents is both feasible and effective. Similar strategies should be employed to enhance and standardize radiation oncology educational initiatives across training programs.

## Introduction

Among medical students who intend to pursue a career in radiation oncology, having received a formal radiation oncology curriculum during an elective rotation is considered valuable for understanding the field and for instilling confidence in their ability to function as a radiation oncology resident.[1-5] Yet, additional instruction may still be warranted, particularly as radiation oncology residents enter training after a general medical/surgical internship or transitional year during which they receive little additional exposure to the field of radiation oncology. At present, many residency training programs lack a formalized curriculum to assist with this transition from internship to radiation oncology. A recent survey of radiation oncology residents found that only 50% of residents reported participating in a formal introductory curriculum to residency.[6] However, among the residents surveyed, a dedicated introductory curriculum was deemed valuable and specific topics including the management of radiation emergencies, patient simulation, contouring, and treatment planning were cited as particularly important. In contrast, program directors who reported providing a formal introductory curriculum often did not include didactics on these topics.[6]

Other medical specialties, including neurosurgery and general surgery have adopted national boot camps during the first year of specialty training to provide a standardized curriculum for all incoming residents entering their specialties. These standardized curriculums have been shown to improve trainee objective knowledge and both resident and faculty satisfaction.[7-8] Therefore, in response to this relative gap in radiation oncology resident education, a structured introductory training curriculum for incoming PGY-2 radiation oncology residents, the Introductory Radiation Oncology Curriculum (IROC), was developed as a collaborative effort through the Radiation Oncology Education Collaborative Study Group (ROECSG).

IROC was piloted at 4 institutions in 2017-2018 and all 15 participating residents reported an improvement in overall preparedness for clinical training.[6] IROC was subsequently made available to all residency programs across the United States and Canada at the beginning of the 2018-2019 and 2019-2020 academic years. The goal of this study was to evaluate: 1) the feasibility of implementing a dedicated, standardized curriculum on a large scale across North American institutions and 2) the effectiveness of IROC as assessed by both radiation oncology resident and program director satisfaction and via improvement in resident confidence and objective knowledge.

## Materials and Methods

### *Curriculum Design and Overview*

The design of IROC followed the six-step model for medical education curriculum development including: 1) Problem identification and general needs assessment, 2) Targeted needs assessment, 3) Goals and objectives, 4) Education strategies, 5) Implementation, and 6) Evaluation and feedback.[9] As detailed above, a targeted needs assessment was previously performed among both radiation oncology residents and program directors to characterize the perspective of each group. Based on the responses, a working group was formed to evaluate the data and establish the basis for a formal introductory pilot curriculum, which was then created to address each of the identified learning needs.[6]

The resulting curriculum, which is publicly available at https://voices.uchicago.edu/roecsg/iroc/, consisted of 7 didactic sessions, ranging from 30 minutes to 2 hours in length for a total of approximately 8 hours of instruction: 1) Overview of Radiation Oncology including treatment workflow and frequently used radiation oncology abbreviations (30 minutes), 2) Patient simulation, including immobilization tools (2 hours), 3) Contouring (2 hours), 4) Plan Evaluation

(2 hours)[10], 5) Quality Assurance (30 minutes), 6) Treatment Delivery, including the composition of a linear accelerator, patient positioning, port films, and cone beam CT (60 minutes), and 7) Management of radiation oncology emergencies (45 minutes). Specific objectives were identified and reviewed prior to each session (Figure 1). All sessions incorporated a slides-based lecture component to ensure consistency of content and a hands-on interactive component to assist with engagement and retention. For example, the second session on Patient Simulation included a brief, image-rich lecture to define the steps taken during a simulation and a discussion of some of the common immobilization devices. After the lecture, the residents participated in an interactive session in the simulation room where they were guided through the steps of simulation and asked to identify and try out different immobilization devices and tools, e.g. lay on a belly board, have a face mask made, taste oral contrast. All sessions were designed to be delivered by a faculty member, senior resident, physicist, or dosimetrist as appropriate with an open format to encourage interaction. Speaking notes and a teaching guide were also provided for all sessions to maximize uniformity across institutions and instructors. Following initial development, implementation, and refinement of the pilot introductory curriculum in 2017-2018 [6], all accredited US radiation oncology residency programs were then contacted by email using the ACGME directory and extended an invitation to participate in IROC prior to the beginning of the 2018-2019 and 2019-2020 academic years. The curriculum was additionally promoted via the Radiation Oncology Education Collaborative Study Group (ROECSG) and the Association of Radiation Oncology Program Coordinator (AROPC) listservs. To ensure consistency of the curriculum across institutions, each participating institution was asked to deliver all 7 sessions without supplementary educational lectures and in a period limited to the first month of the academic year. Video conferences were also held with representatives

from interested programs in advance of the curriculum rollout each year to demonstrate the curriculum content, discuss the approach to teaching, and enhance consistency across programs. Otherwise, program specific training during this period was left to the discretion of each individual residency program.

*Data Collection and Evaluation*

All participating residents were contacted to complete an anonymous REDCap-based survey before and after completion of IROC consisting of both subjective and objective questions, using asingle group pre-test/post-test approach. The survey contained a total of 30 questions, a subjective portion of the survey consisting of 10 items to ascertain the size of the resident's training program, assess the resident's preferred learning style, and determine his/her comfort with components of radiation oncology (Table 1), and an objective portion of the survey consisting of 20 multiple choice questions about foundational concepts in radiation oncology (Supplement), consistent with the Kirkpatrick model of learning evaluation. Subjective questions consisted of both free text and Likert-type responses (1 = not at all, 2 = somewhat, 3 = moderately, 4 = quite, and 5 = extremely). Free text responses regarding the residents' impression of the curriculum were independently reviewed by two authors (R.B.J. and E.C.F.) and compared, with themes summarized in the "Resident Qualitative Feedback" section below. Objective questions, half of which had previously been validated in radiation oncology trainees, covered subject matter contained in IROC.[11] The remaining questions were developed to test additional information taught in IROC, but were not previously validated. These questions were reviewed and revised as appropriate, for content, clarity, and meaning by several of the study authors, all of whom were radiation oncologists. These new questions were then shown to two

teaching faculty, uninvolved with IROC, and additionally refined when uncertainty about clarity existed.[12]

The pre-curriculum survey was circulated, and all responses were collected prior to the first lecture. The post-curriculum survey responses were collected within 4 weeks of the start of the curriculum to minimize recall bias and reduce the impact of independent studying on objective survey performance. Of note, respondents were not made aware that they would receive the same survey pre- and post-IROC to minimize any practice effects on performance in the objective portion of the survey. Direct email reminders and communication with individual training programs was used to enhance response rates, however all survey data was anonymous, de-identified, and none of the site directors at participating institutions had access to the content of resident responses. Any responses received outside of the window described were excluded from analysis. In addition, all participating program directors were surveyed after completion of IROC, using a REDCap-based electronic survey, to assess their satisfaction with the content and ease of use of the curriculum using a 10-item questionnaire. Yes/no, free text and Likert-type responses were similarly utilized for this survey. This study was reviewed and approved by the institutional review board at xxx which provided oversight for the other participating sites.

*Statistical Analysis*

Descriptive statistics were used for all qualitative responses and categorized to identify common themes. Paired pre-curriculum and post-curriculum subjective Likert-type data were compared with the Wilcoxon signed ranks test. Paired pre-curriculum and post-curriculum objective data were compared with the McNemar's test of paired proportions. All statistical analysis was performed using SAS version 9.4 (SAS Institute, Cary, NC), with a 2-sided p-value at the 0.05 significance level.

## Results

The introductory curriculum was subsequently given at 40 academic training programs at the beginning of the 2018-2019 academic year and at 55 academic training programs at the beginning of the 2019-2020 academic year. The participating programs included both US and select Canadian programs who solicited the opportunity to participate.

At the beginning of the 2018-2019 and 2019-2020 academic year, a total of 236 PGY-2 radiation oncology residents participated in IROC. Almost all residents, 228/236 (97%), completed pre and post curriculum surveys and were included in the analysis. Of those participating, the median size of the residency program was 10 (range 2-28) and the median number of residents in each program per year were 3 (range 1-7). When asked about their preferred method of learning, respondents endorsed a visual (*n* = 104/228, 46%) or "hands-on" (*n* = 119/228, 52%) approach as their most preferred learning style. By resident report, faculty and senior residents were most likely to lead at least one of the IROC sessions, at 70% (*n* = 159) and 82% (*n* = 186), respectively. Dosimetrists, physicists, junior residents, and others made up 118 (52%), 151 (62%), 98 (43%), and 10 (4%) of all IROC instructors, respectively.

*Subjective Knowledge*

At baseline, most PGY-2s (*n* = 142/228, 62%) felt that they were either "not at all" or "slightly" prepared to function in the radiation oncology clinic and only (*n* = 8/228, 4%) felt "quite" or "extremely" prepared. Specifically, half of respondents (*n* = 114/228, 50%) felt they only "moderately" understood the responsibilities of a radiation oncologist prior to IROC. Most felt "not at all" or "slightly" prepared to attend a patient simulation (76%) or contour a case (73%). Almost all participants (*n* = 215/228, 94%) felt unprepared to evaluate a treatment plan. The vast majority of respondents, 89% (*n* = 202/228), felt "not at all" or "slightly" prepared to evaluate a

port film and 87% (*n* = 199/228) felt "not at all" or "slightly" unprepared to handle an emergency on-call situation.

Following completion of the curriculum, the majority of PGY-2's (*n* =148/228, 65%) reported being "moderately" prepared to function in the radiation oncology clinic while a minority (n = 40/228, 18%) felt "quite" or "extremely" prepared. The majority of respondents (*n* = 119/228, 52%) felt "moderately" prepared to attend a patient simulation and a sizable minority (*n* = 55/228, 24%) felt "quite" or "extremely" prepared. A similar proportion felt "moderately" (*n* = 128/228 56%), "quite or "extremely" prepared to contour a case (*n* = 48/228, 21%). In addition, after IROC fewer than half (*n* = 111/228, 49%) felt underprepared to evaluate a treatment plan, evaluate a port film (*n* = 107/228, 47%) or felt "not at all" or "slightly" prepared to handle a radiation emergency (*n* = 113/228, 49%) (Table 1, Figure 2). Across each domain above, residents demonstrated a statistically significant improvement in their preparedness after completion of IROC (Table 1, all $p < 0.0001$). Overall, following completion of IROC, PGY-2 residents rated the usefulness of the curriculum as a median of '4' out of '5' on the Likert scale.

*Objective Knowledge*

The overall rate of percent correct items assessing objective radiation oncology knowledge at baseline was 70%, Following completion of IROC, the overall percent correct items was 81% ($p<0.0001$) and the percent of respondents who answered each question correctly before and after the curriculum increased for each of the individual 20 items (Table 2). According to a McNemar's test, the percent correct for each individual question improved significantly from prior to after completion of IROC except for questions 6: "Which tumor type causing superior vena cava syndrome is likely to respond quickly to systemic chemotherapy?", 14: "What are port films?", 16: "What does ITV stand for?", and 17: "What is the clinical target volume (CTV)?".

*Resident Qualitative Feedback*

Following completion of IROC, PGY-2 residents were asked to provide free text responses to the following question: "If you could improve or change anything about your orientation curriculum what would it be?" (Table 3) Of 228 participants, 71/228 (31%) provided comments. Overall, commenting residents reported a high level of satisfaction with the curriculum, with occasional feedback reporting that it was either too basic or too overwhelming. A number of respondents requested even more time with contouring and plan evaluation and a frequent request was for IROC to provide written materials or copies of the slides for residents to review once they entered the clinic. Some residents requested more institution specific information including instructions for particular software applications or simulation orders. This was beyond the scope of IROC but this feedback may assist program directors in further refining their institutional orientations to include additional practical information for their trainees.

*Program Director Feedback*

In 2018, 83% ($n$ = 33/40) of the program directors whose programs participated in the curriculum completed a post-curriculum survey. Most program directors (73%) reported participating in IROC by teaching at least one session themselves. For those who did provide direct instruction, they rated a 10 (range 0-26) out of a scale of 0 (easy) to 100 (difficult) for the ease of use of the curriculum materials. Comparing IROC to prior orientations, this curriculum was rated much more effective at a mean score of 81 (range 4-100) on a scale of 0 to 100 at orienting residents. Almost all responding program directors 97% ($n$ = 32/33) believed that IROC covered key concepts and was clear and comprehensive and 94% ($n$ = 31/33) believed that IROC was hands-on and engaging for residents. All program directors reported they would be willing to participate in the curriculum again, with 85% ($n$ = 28/33) willing to pay a small fee

(up to $100) per program to participate and support maintenance of, and assistance with, presentation materials.

In 2019, 82% (*n* = 45/55) of program directors whose programs participated in the curriculum completed a post-curriculum survey. Again, the majority (69%) participated directly by teaching at least one session. For those who did give lectures, they rated a mean score of 3 (range 0-50) out of a scale of 0 (easy) to 100 (difficult) for the ease of use of the curriculum materials. Comparing IROC to prior orientations at their institutions, this curriculum was rated much more effective at orienting residents with a mean score of 90 (range 14-100) on a scale of 0 (ineffective) to 100 (effective) at orienting residents. All of the program directors believed that IROC covered key concepts. 98% (*n* = 44/45) reported that IROC was clear and comprehensive. 41/45 (91%) believed that IROC was hands-on and engaging for the residents. All program directors reported they would be willing to participate in the curriculum again, with 82% (*n* = 37/45) willing to pay a small fee (up to $100).

**Discussion**

With 55 programs and nearly 250 residents participating in the 2 years since dissemination, IROC is a successful example of large-scale educational resource sharing in radiation oncology residency training programs. To our knowledge, it also represents the first international education curriculum effort for residents in radiation oncology. Collaboration among radiation oncology programs is particularly important as the median number of residents per US program is only 7, and with just 1-2 incoming PGY-2 residents each year, many smaller programs lack the resources to develop comprehensive educational curricula like IROC. The shared curriculum model has many advantages. It is financially sustainable, saves time and resources, and provides educational consistency across diverse training institutions, placing us on par with initiatives

utilized by other specialties including neurosurgery and general surgery. Equally important, it creates a culture of sharing and promotes collaboration across training programs.

Using this shared curriculum model, we have demonstrated that IROC improved both resident subjective preparation for radiation oncology clinic as well as objective knowledge of radiation oncology concepts. Program directors rated the curriculum as more effective than prior orientation programs at their individual institutions while simultaneously endorsing that the curriculum was easy to use, engaging, and covered concepts central to practice.

Radiation oncology is a specialty where interprofessional collaboration is part of daily practice. While it was not specified who should give each of the 7 IROC training sessions, a diverse mix of faculty, residents, physicists, dosimetrists and therapists presented the orientation material. Recently, it has been shown that interprofessional education initiatives are largely lacking in radiation oncology, [12] so to introduce these relationships early on in orientation is important and may facilitate future collaboration, professionalism, and collegiality across role groups. Prior initiatives in radiation oncology medical student education, via ROECSG, have highlighted the benefits of an interprofessional teaching model between students and residents and underscored the feasibility of implementing shared curricula in the field.[13-14]

There are some limitations to the broad delivery and testing of a curriculum such as IROC. These include variable delivery of the lectures, variable timing of the sessions, and the fact that residents come into residency programs with differing baseline knowledge. To try to control for some of these variables, a teaching guide was created with detailed notes for each session. To prevent knowledge contamination from clinical experience, programs were requested to complete all 7 sessions within the first 4 weeks of the residents' orientation, and the overwhelming majority of programs complied. However, it was clear from resident feedback

that there were a minority of incoming residents who already felt the curriculum was too basic, while others felt the sessions were useful and requested additional training prior to entering clinic. Given the diversity of clinical cultures as well as software applications in radiation oncology, IROC cannot entirely replace a given training program's orientation structure, and institution-specific teaching is still encouraged to promote trainee readiness for clinical practice. We also acknowledge the inherent limitations of a single group pre-test/post-test survey design, including the role of the testing effect as well as by maturation, wherein, any knowledge learned from independent reading and practice in the clinic during the orientation period could have influenced performance on the post-IROC survey. It is possible then, that these gains in objective performance may be more enhanced than what might be demonstrated in the long-term, however as this study was intended only to provide orientation with which to build on formal teaching and not to provide mastery, we believe that the observed improvement in survey performance pre- and post-IROC remains valuable. Lastly, the conclusions from this study are limited to the first two levels of the Kirkpatrick evaluation framework – reaction and learning. The data do not evaluate levels three and four – behavior and results. Further evaluation of the longitudinal impact of this curriculum is needed to evaluate these higher levels of program impact.

Despite its limitations, this study lends support to the suitability and usefulness of IROC and the IROC curriculum will be made available to all residency training programs who wish to utilize this resource at https://voices.uchicago.edu/roecsg/iroc/. Feedback will continue to be solicited from participating programs to enhance the content and structure of the curriculum to evolve for the needs of future trainees. In addition, with the success of IROC, a consolidative curriculum to improve the readiness of senior residents as they transition from supervision to independent

practice is now under development as a subsequent ROECSG initiative. This curriculum will also be shared broadly and made available as a resource to interested training programs.

**Conclusion**

The implementation of a nationwide introductory curriculum for PGY-2 radiation oncology residents is both feasible and effective. Similar strategies should be considered to enhance and standardize radiation oncology educational initiatives across residency training programs.

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Figure 1: (A) Learning objectives for Simulation session. (B) Image from lecture component (C) Interactive session

Figure 2: IROC Resident Subjective Self-Assessment Pre- and Post-Curriculum

Table 1: IROC Pre- and Post-Curriculum Subjective Survey and Results

| Subjective Survey Questions: | Pre-Curriculum Median (IQR) | Post-Curriculum Median (IQR) | P-value |
|---|---|---|---|
| *How many total residents are in your training program? | | | |
| *How many residents are in your year of training? | | | |
| *How do you learn best? (select as many choices as apply in order of ranked preference)<br>Answer choices:<br>a. Visual/Spatial b. Hands-on c. Auditory d. Book/reading e. Writing f. Talking g. Other | | | |
| How prepared are you to function in the radiation oncology clinic?<br>Likert scale (1= not at all, to 5=extremely) | 2 (2-3) | 3 (3) | <0.0001 |
| How well do you understand the responsibilities of a radiation oncologist?<br>Likert scale (1= not at all, to 5=extremely) | 3 (2-3) | 4 (3-4) | <0.0001 |
| How prepared are you to attend a patient simulation?<br>Likert scale (1= not at all, to 5=extremely) | 2 (1.75-2) | 3 (3-3) | <0.0001 |
| How prepared are you to contour?<br>Likert scale (1= not at all, to 5=extremely) | 2 (2-3) | 3 (3-3) | <0.0001 |
| How prepared are you to evaluate a treatment plan?<br>Likert scale (1= not at all, to 5=extremely) | 1 (1-3) | 3 (2-3) | <0.0001 |
| How prepared are you to evaluate a port film?<br>Likert scale (1= not at all, to 5=extremely) | 1 (1-2) | 3 (2-3) | <0.0001 |
| How prepared do you feel to handle an emergency on-call situation?<br>Likert scale (1= not at all, to 5=extremely) | 1 (1-2) | 3 (2-3) | <0.0001 |

* Questions with asterisks were asked only in the pre-curriculum survey

Table 2: IROC Objective Knowledge Assessment Pre- and Post-IROC

Knowledge questions:

| Question Number | Pre-IROC % Correct | Post-IROC % Correct | P-value |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1. What is an “isocenter” | 77 | 89 | <0.0001 |
| 2. When treating a whole brain radiation field, what is an appropriate inferior border? | 54 | 76 | <0.0001 |
| 3. In a treatment planning system, what does "BEV" stand for? | 63 | 84 | <0.0001 |
| 4. An "isodose line" is defined as:? | 77 | 89 | 0.0001 |
| 5. What critical structure can be spared radiation dose by using a prone belly board? | 56 | 73 | <0.0001 |
| 6. Which tumor type causing superior vena cava syndrome is likely to respond quickly to systemic chemotherapy? | 78 | 83 | 0.1011 |
| 7. What isodose line falls at the block edge of a photon beam? | 52 | 68 | <0.0001 |
| 8. Which of the following is specified on a radiation simulation order? | 80 | 96 | <0.0001 |
| 9. Image-guided radiotherapy (IGRT) is used for what purpose? | 85 | 91 | 0.0196 |
| 10. 1 Gray (Gy) is defined as what? | 61 | 77 | <0.0001 |
| 11. Which of the following is considered ionizing radiation? | 97 | 99 | 0.014 |
| 12. What percent of oncology patients receive radiation therapy as part of their care? | 50 | 62 | 0.001 |
| 13. What is the appropriate order of steps to initiate a patient on radiation therapy? | 93 | 99 | 0.003 |
| 14. What are port films? | 58 | 59 | 1.000 |
| 15. What is an example of interfraction motion? | 73 | 85 | <0.0001 |
| 16. What does ITV stand for? | 88 | 92 | 0.1172 |
| 17. What is the clinical target volume (CTV)? | 70 | 71 | 0.8111 |
| 18. When evaluating skin dose on a patient undergoing radiation, which of the following is the most appropriate dosimeter to utilize? | 27 | 39 | 0.0018 |

| | | | |
|---|---|---|---|
| 19. What is a monitor unit (MU)? | 64 | 90 | <0.0001 |
| 20. Which of the following is true regarding a dose volume histogram (DVH)? | 95 | 98 | 0.0522 |

Table 3: Example Resident Feedback and Suggestions for Improvement

| Example General Feedback: | |
|---|---|
| "I feel like a lot of the concepts are coming up on their own each day, which feels like enough reinforcement for me." | "I think everything will start to click and make sense with repetition but I'm glad the curriculum provided me with a foundation for learning. It's hard to learn without the basics, which I now feel like I understand." |
| "We felt that this was very insightful for us, given our temporal lag in radiation medicine experience through internship (aka we forgot everything useful)." | "It's a completely different skill set from intern year and a reminder that residency/the career is significantly different from what you see on a medical student rotation (similar to other fields)." |
| "Very helpful having this training at the beginning. I could not imagine starting without it!" | "The curriculum corresponds well with clinical duties, so it seems that simply performing clinical tasks on a daily basis provides good reinforcement." |
| Example Suggestions for Improvement: | |
| "The course was very helpful as a general introduction to become familiar with the terminology and workflow. Would continue to expand to include even more. A big part of transitioning is learning…the new tools/machines/systems. Copies of the [powerpoint slides] would also be helpful to keep handy." | "Information presented was very helpful but also overwhelming. I think this course may be even better if done over more days with more time for contouring practice, etc." |
| "More hands-on time with contouring and treatment planning systems." | "Perhaps a refresher course or more advanced curriculum a few months into the start of the year?" |
| "The hands-on computer-based sessions such | "Our program only used the IROC slides… |

| | |
|---|---|
| as contouring were excellent. Going through more systems like this would be beneficial.” | perhaps encouraging programs to add an additional lecture/customization if needed, for example, having a few slides on resident responsibilities would have been nice….” |

Figure 1A: Goals and Objectives for Simulation Session

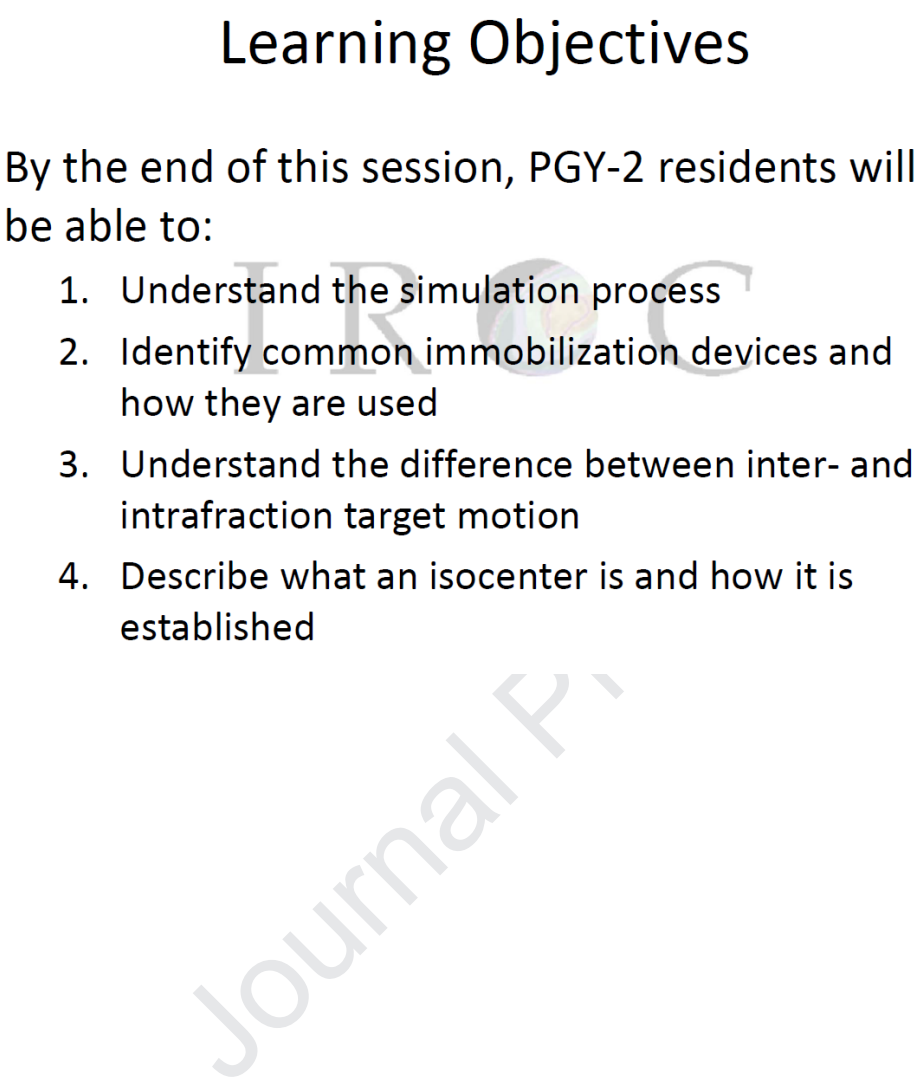

Figure 1B: Image from Lecture Component of Curriculum

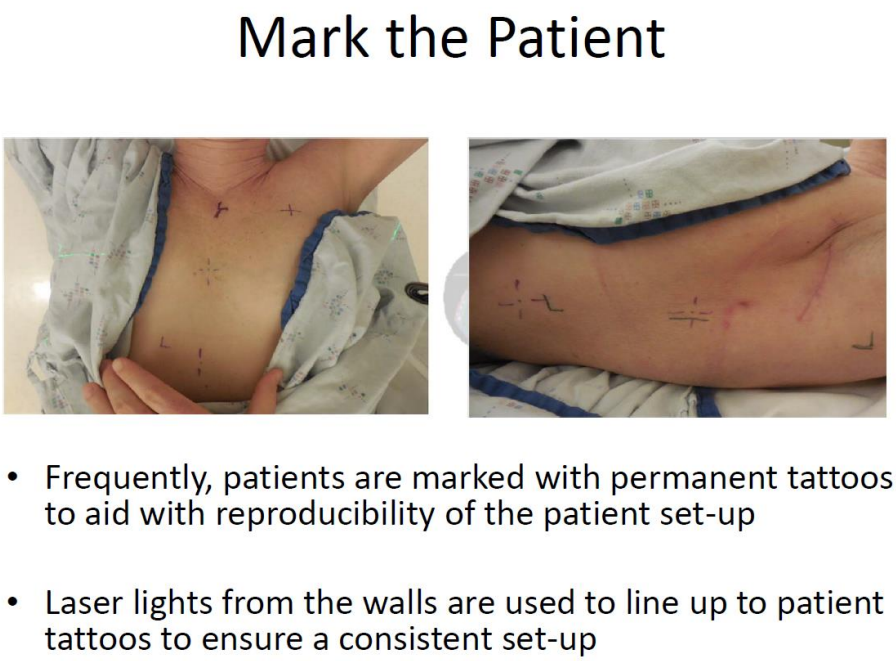

Figure 1C: Photos from Interactive Session of Curriculum

C. Interactive Session


Residents demonstrate the use of active breathing control and undergo a mask fitting.

Figure 2: IROC Resident Subjective Self-Assessment Pre- and Post-Curriculum