**Abstract**

Introduction

Interprofessional learning (IPL) is a vital aspect of training in radiation oncology professions, yet is rarely delivered to those professionals who work most closely together in clinical practice. Scenario-based learning using simulation facilities provides a unique opportunity to facilitate this learning and this project aimed to determine the impact and value of this initiative.

Methods

Small groups comprising post-graduate diploma pre-registration therapeutic radiographers, medical physics trainees and radiation oncology registrars were challenged with 4 plausible and challenging radiotherapy scenarios within an academic simulation centre. Pre- and post-event completion of the “Readiness for Interprofessional Learning Scale” measured impact and a Likert-style survey gathered feedback from participants.

Results

The session increased participants’ teamwork and collaboration skills as well as strengthening professional identities. Participants reported high levels of enjoyment related to collaborative working, communication and observing other professionals deploying their technical skills and specialist knowledge.

Conclusion

Although beneficial, simulated scenarios offering equal opportunities for engagement across the professions are challenging to plan and timetabling issues between the 3 groups present significant difficulties. The safe environment and unique opportunity for these groups to learn together was particularly well received and future oncology-specific simulated scenario sessions are planned with larger cohorts.

Implications for Practice

Simulated scenario training can be used to improve team working across the radiotherapy interprofessional team and may have wider use in other specialist interdisciplinary team development.

**Introduction**

Interprofessional learning (IPL) has formed an essential aspect of most health education curricula over many years.[1,2] It has been used for healthcare disciplines, such as student nurses, dental students, medical students and physician associate trainees.[3-10] A key aspect of IPL is group work that draws on individual professional knowledge to develop enhanced understanding of others’ roles and responsibilities.[5,6,11-13] Directed and organised appropriately, it should enable students to learn about other key roles within their sphere of healthcare and the responsibilities of all concerned, whilst still maintaining their own distinctiveness and having an appreciation for the inter-dependability of staff needed for complete healthcare provision; all with the ultimate aim of improving patient care.[3,5,6,8,14]

Experience shows, however, that creating such programmes present challenges in terms of timing, curricula, managing expectations and leadership tensions.[7] Studies have emphasised a need for organisation, structure and design as opposed to merely providing a shared, common learning space[4] as well as designing activities with an understanding of the baseline abilities and learning of the student disciplines involved.[10] Commonly agreed recommendations[1,14] highlight the important role that carefully designed IPL can play in improving collaboration and thereby patient care, through education with, from and about each other’s disciplines and work.[15] A key recommendation is that IPL be embedded in pre-registration stages, making interprofessional teamwork central to students’ learning.[14] Evidence from students within these programmes highlights how improved understanding and appreciation of different roles improves the functioning of teams, thereby driving up standards of clinical practice and professionalism.[3,8]

Within most pre-registration clinical programmes, IPL comprises group learning across a range of health professions. In many cases these can represent plausible future working teams; such as doctors, nurses, physiotherapists, radiographers and operating department practitioners.[16] This is rarely achieved in radiotherapy, however, due to the range of specialised disciplines and roles, most of which are unique to the field. Unsurprisingly, student feedback relating to IPL sessions with therapeutic radiography students placed within these convenience groups commonly include issues with relevance.[17] This is a concerning finding since the rapidly evolving technological and professional boundaries within radiotherapy demand effective cross-discipline team working. It is only through deep understanding of roles and improved skills mix that efficient and safe clinical delivery can be maintained to ensure high quality and innovative practice.[18]

It is surprising, therefore, that few robust studies have been performed into oncology-specific IPL initiatives. Short simulations featuring radiation oncologists, therapeutic radiographers and medical physicists[19] reported improvement across a range of outcomes, but transferability and repeatability was limited by the use of a clinical facility. A recent workshop using VR Radiotherapy software with therapeutic radiographers and medical physicists[9] failed to identify impact; possibly due to a lack of simulated patient involvement.

This pilot project, accordingly, aimed to develop and evaluate an innovative inter-professional simulation experience based in the field of radiotherapy and building on existing experience with the use of simulation, small working group practices and authentic scenario-based work-packages.[20-22] This project was planned and implemented by a multi-stakeholder group[14] and aimed to determine whether a simulated radiotherapy placement could improve mutual understanding of key roles among radiotherapy professionals and whether participants found it to be useful.

**Methods and Materials**

**Participants**

Recruitment emails were sent to Year 2 PgDip pre-registration therapeutic radiography students at the lead institution as well as clinical and medical oncology trainees and trainee medical physicists at a regional clinical department. Participants were provided with written information about the study and provided their consent prior to participation. Approval for the project was provided by the Health and Life Sciences Research Ethics Committee at the University.

**Intervention**

This pilot project utilised the simulation facilities of an academic Radiotherapy Simulation Centre comprising a wide range of virtual reality and genuine clinical equipment. A multidisciplinary steering group collaborated to devise several scenarios based around common radiotherapy pathways. Table 1 summarises the scenarios used on the day along with an indication of expected learning outcomes. Participants were assigned to small groups comprising therapeutic radiographers, physicists and oncologists before circulating between the scenarios. Figure 1 highlights the various roles within the groups for one of the scenarios. Academic and clinical staff provided direction and facilitation while actors provided patients for the groups to work with.

**Table 1: Simulated Scenarios**

|  |  |
| --- | --- |
| **Scenario** | **Learning Outcomes and Skills** |
| The group worked together to create an immobilisation shell for a patient receiving radiotherapy to the larynx. The patient exhibited confusion and memory loss arising from a recent diagnosis of vascular dementia.  | Patient communication Adapting communication skills Consenting patients lacking capacity to consentCreating an immobilisation shellInterdisciplinary communicationPatient care  |
| The group worked together to set up a skin apposition breast scar boost field on a patient using the virtual reality treatment machine. Beam energy was determined and monitor unit calculations were performed. | Team workingCommunicationRadiotherapy “skin apposition” setupGroup decision making and error checking |
| Each group was presented with two radiotherapy plans for a radical head and neck patient who had lost weight. They discussed the impact of the weight loss on coverage of CTV and OAR doses, then made a decision on whether to replan and the optimal timing for this. | Plan evaluation skillsCommunication Group decision makingClinical reasoning Applying correct process for reportingCalculating adjustment to dose and fractionation to compensate |
| Participants formed a multi-disciplinary team to discuss the management and interventions required for a cervix patient at various points in her radiotherapy and chemotherapy pathway.  | Understanding of cancer managementClinical reasoningGroup decision makingInterdisciplinary workingResponding to side effectsHolistic care approach |

**Figure 1: Example scenario for the skin apposition planning scenario**



**Outcomes**

Evaluation of the simulation day was harvested using a survey method. The impact of the intervention on interprofessional learning was measured using the well-validated “Readiness for Interprofessional Learning Scale” (RIPLS).[23,24] This comprises 19 Likert-style questions within the domains of: teamwork and collaboration, negative professional identity, positive professional identity, and roles and responsibilities. Deployment of this tool before and after the intervention enabled the impact on these domains to be identified. In addition, a post-event questionnaire was used to gather feedback from participants relating to their experience of the IPL simulation. Likert-style questions related to satisfaction and perceived learning and value while open questions allowed free text responses related to future implementation. Anonymity of responses was preserved through use of a participant-determined code-phrase written on each questionnaire return.

**Analysis**

RIPLS scores were tested for normality using the Shapiro-Wilks test ahead of comparison of means testing with paired t-test (following demonstration of normality) or Wilcoxon (for skewed data). The textual responses from the open questions were subjected to thematic analysis.

**Results**

There were 26 participants comprising 13 PgDip radiotherapy students, 7 oncology registrars and 6 medical physics trainees.

RIPLS Results are shown in Table 2 and indicate statistically significant improvement across all four domains with the professional identity domains exhibiting the most improvement. Domain two tests the prevalence of negative perceptions and is scored negatively when combining to generate an overall score.

**Table 2: RIPLS scores before and after the IPL study day**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Pre-test mean** | **Post-test mean** | **p-value** |
| Domain 1: Teamwork and collaboration | 39.15 | 40.73 | 0.0187 |
| Domain 2: Negative professional identity | 6.85 | 6 | 0.0022 |
| Domain 3: Positive professional identity | 16 | 17.38 | 0.0006 |
| Domain 4: Roles and responsibilities. | 8.65 | 8.46 | #N/A |
| **Overall** | **74.96** | **78.58** | **0.0025** |

Although small numbers make interpretation of profession-specific data challenging it was clear that there was a difference in response between the different groups as seen in Table 3.

**Table 3: RIPLS mean scores by professional group**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Questionnaire 1 Mean** | **Questionnaire 2 Mean** | **Delta** |
| Medical Physicist | 69.3 | 72.3 | 3 |
| Therapeutic Radiographer | 72.6 | 73 | 0.4 |
| Medical Registrar | 68.1 | 72 | 3.9 |

The results concerning participant satisfaction and perceived learning were very positive, as seen in Table 4, with 23 (88%) of the participants enjoying the day, recommending future use and reporting improved skills and understanding of other roles.

**Table 4: Participant feedback concerning the IPL study day**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Strongly Agree** | **Agree** | **Neither** | **Disagree** | **Strongly Disagree** |
| I enjoyed today’s interprofessional simulation session | 13 | 10 | 3 | 0 | 0 |
| I learned some useful skills during the interprofessional simulation | 11 | 12 | 2 | 1 | 0 |
| I understand the roles of the other two professions better after working with them in the simulation session | 10 | 13 | 1 | 2 | 0 |
| I would recommend any future interprofessional simulation sessions to others | 12 | 11 | 3 | 0 | 0 |

Thematic analysis of the textual responses to open questions led to a range of common themes being identified as seen in Table 5.

**Table 5: Student feedback main themes (over 2 responses)**

|  |  |  |
| --- | --- | --- |
| **Question** | **Theme**  | **Count** |
| Please tell us what you enjoyed most about today | Understanding other professions | 9 |
| Learning activities | 6 |
| Working with other professions | 5 |
| What could we do to improve today? | Nothing | 5 |
| More time per scenario | 5 |
| More scenarios | 3 |
| Separate rooms | 3 |
| What other scenarios might you have found useful? | Technical: Physics (2)Treatment (2)Planning (1)Pre-Treatment (1) | 6 |
| What were the key SKILLS you learned? | Communication:General (2)Patient (3)Team (3) | 8 |
| Technical | 6 |
| How did this differ from other IPL? | More relevant | 8 |
| What were the key things you learned about the roles of the other two professions? | Technical: Setup (3)Consent (5)Planning (5)Patient care (1)  | 14 |
| Diversity of roles | 5 |
| Patient Communication | 3 |

**Discussion**

**Sharing Professional Identities**

In their journey towards qualification, trainees in the health care sector develop a range of beliefs and attitudes about the professions for which they are preparing themselves, generally referred to as their “professional identity”. As they develop an understanding about the boundaries of their profession, and the ways in which they may interact with others as part of a multi-professional healthcare team they themselves formulate their own identity within the context of their own profession.[25,26] An important result from this project relates to how the different participants enjoyed exploring each other’s professional identities. While the evidence base demonstrates the impact of IPL on preparing students for future collaboration,[27] this generally relates to activities involving a “convenience” range of allied health students who may have limited opportunity to work together in clinical practice. This project was specifically targeted at a group of professionals who are destined to work closely together in a time-pressured environment. The different training pathways for these 3 groups means that there is currently little opportunity for them to learn together or collaborate before undertaking clinical work. It is clear from the open-question responses that participants enjoyed being able to learn together and gain valuable experience of each other’s’ skills and roles. Participants especially enjoyed being able to work together to solve problems.

The improvement in RIPLS scores suggests that the simulation session increased participants’ receptivity to IPL to some extent. When triangulated with the qualitative data, however, it is clear that the participants relished the opportunity to engage with other oncology professionals outside the confines of the clinical workplace. The strongest theme within the open question responses related to their enjoyment of the day and indicated that this multi-professional learning in a safe environment was the largest factor supporting this.

“Seeing other working professionals in a ‘fake’ environment”

“Learning about the roles/skills of other professions”

“Working with other healthcare professionals”

“Good to see different skillsets of different professions”

While engaging with the tasks and learning skills contributed to participants’ enjoyment, it was clear that they valued experiencing the expertise of the other professionals directly and discussing issues with them:

“Seeing the other professional views/expertise”

“Discussion with other professionals”

“Interaction with other professionals, especially physicists”

“Listening to what other professionals had to say”

Despite working together to support the patient radiotherapy journey, these professionals tend to meet frequently but for relatively short periods of pressurised time and have little opportunity to observe practice or to debrief afterwards. The simulated scenarios allowed participants to explore each other’s’ roles in an unpressured environment and to reflect on their shared experiences.

**Skills Gain**

Participants were asked what skills they had learned. While this depended to some extent on the activities within the scenarios, a strong theme emerged relating to participants learning technical skills from each other. While this is not intended as a training exercise, this will lead to increased understanding of processes, expertise and some of the challenges associated with different tasks. This can only be achieved through careful selection and planning of scenarios that allow each professional group to contribute and showcase their skills as equally as possible. While several of the participants reported technical skill gain, the strongest theme in the data related to communication and teamworking skills:

“Communicating with patients (from the oncologists getting consent from patients)”

“Ability to talk to professionals or other specialists”

This finding echoes previous work[21] identifying a more significant increase in “soft skills” gain through simulation compared to technical skills.

**Professional mix**

One of the aims of this project was to identify the specific value of an oncology-specific IPL session and participants were asked how the session had differed from previous experience of IPL. With no prompting, it was evident that they perceived the session to be highly relevant:

“More relevant to clinical day to day practice”

“More relevant to our day to day careers”

“More relevant people that we would meet day to day on practice”

While wider IPL with the full range of health professionals is useful for learning generic healthcare concepts and gaining understanding of a range of roles, these findings strongly suggest that for these groups the opportunity to learn alongside fellow oncology professionals is particularly valuable.

**Impact**

Although statistically significant improvements were demonstrated, it is clear that the extent of these improved scores is limited. There are several possible explanations for this. Most likely is the prior impact of the training and experience of the participants on their perceptions of each other’s roles as proposed by Hood.[28] While textual responses indicated that the event had highlighted aspects of each other’s roles that they were unaware of, this specific knowledge was not tested within RILS. Rather it is likely that each group had existing professional mutual respect. Repeating this exercise with less experienced health profession trainees as in other published papers[28,29] might yield a higher impact. It must also be acknowledged that the intervention ran within a short timescale and that more extended collaborative simulation might increase overall impact.

**Professional Differences**

There was a perceptible (although statistically insignificant) difference in the impact of the session on each profession. The medical physicist and oncology registrars experienced the greatest improvement in their RIPLS scores around ten times that of the therapeutic radiographers. Although all 3 groups presented roughly equal “post-test” scores the therapeutic radiographers had a higher pre-test with the intervention making little impact on their scores; this may reflect the existing and recent IPL experienced by these students. Similar findings were found in a 2011 paper[30] which noted increased scores among nursing students compared to medical students. Further work with a larger cohort is needed to establish the significance of this and to identify why these differences exist.

**Limitations**

Participant feedback indicated a desire for more time with the scenarios and a longer, more in-depth simulation session could perhaps have made a stronger impact on the participants. A factor which did impact on this was the challenge of coordinating timetables across 3 different professional groups and training schedules. Similar challenges have been reported in the literature.[24] More extensive simulation sessions are planned for future iterations to ensure that participants have plenty of opportunity for learning and debriefing.

While the RIPLS is a well validated measure, there are some reported limitations. In particular, relevant to this study, some evidence suggests a reduced measurement precision when used with participants with high scores. Furthermore, although mean scores improved it was clear that some individuals scored lower on the post-test questionnaire. It is not clear what factors influenced this and future qualitative work will seek to explore this issue in more depth.

The final limitation relates to the voluntary nature of this exercise with participants self-selecting for the event. This may suggest that these individuals were more enthusiastic about simulated scenarios and therefore more likely to report benefit.

**Future Implementation**

It is important that the healthcare professionals driving the Radiotherapy Vision in the future,[18] learn within an environment which in itself is innovative and a preparation for the challenges of modern radiotherapy. With the increasing complexity of cancer patient pathways, it is more important than ever that radiation oncology professionals work effectively together to deliver patient-focussed care.[31] In particular, it is increasingly important that a multi-disciplinary approach to response to error management and reporting is adopted and the findings from this project suggest that training via simulated scenarios could be a useful and safe means of achieving this. Future iterations will, therefore, seek to introduce more error-detection and response scenarios, while long-term evaluation will identify any impact of this training on working practices.

While engagement with a wide range of professionals during training is desirable, it is clear from the student feedback that mutual learning between these three groups is especially relevant to their future professional working. These findings support more widespread use of radiotherapy-specific IPL and ongoing work is now seeking to implement regular simulated scenario IPL sessions to foster more fruitful professional relationships between the oncology professionals.

**Conclusions**

An interprofessional learning activity comprising a series of simulated scenarios was well received by trainee therapeutic radiographers, medical physicists and oncologists. The session increased participants’ teamwork and collaboration skills as well as strengthening professional identities. Participants reported high levels of enjoyment related to collaborative working, communication and observing other professionals deploying their technical skills and specialist knowledge. Although beneficial, simulated scenarios offering equal opportunities for engagement across the professions are challenging to plan and timetabling issues between the 3 groups present significant difficulties. The safe environment and unique opportunity for these groups to learn together was particularly well received and future oncology-specific simulated scenario sessions are planned with larger cohorts.

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