

## ORIGINAL ARTICLE

# Meeting radiation therapy patients informational needs through educational videos augmented by 3D visualisation software

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## Abstract

**Introduction:** Misconceptions and uncertainties about radiotherapy compound the anxiety patients experience at the commencement of treatment. This project investigated the utility of locally produced treatment process videos in meeting patients' informational needs. **Methods:** In-house video production was conducted on a voluntary basis by staff and patients at a regional Australian radiotherapy centre. Videos included real footage and animated sections created with PEARL™ 3D visualisation software (Vertual Ltd, UK) to meet specific key content objectives. Quantitative cross sectional analysis was conducted. Patients attending for simulation watched a relevant video. After their first fraction of radiotherapy they were asked to complete an ethics-reviewed questionnaire about how well the video addressed their information needs. **Results:** The survey completion rate was 29% ( $n = 61/212$ ). Surveys were collected over 9 months from August 2014 to April 2015. Statistical analysis found 98% of patients reported that the video was useful in meeting one or more of the learning objectives. Forty-nine percent of patients also reported a reduction in fear and anxiety as a result of watching the video. Patients reported subsequent review of videos at home (39%), primarily to explain treatment processes to loved ones (46%). **Conclusion:** The combination of real footage and 3D visualisation software assisted in meeting learning objectives regarding the treatment process. Standardised videos provided consistency of information provision to patients and facilitated multiple viewings of the video if desired.

## Introduction

Misconceptions or a lack of knowledge about radiotherapy processes can compound the anxiety patients may experience at the commencement of treatment.<sup>1–3</sup> During the early phase of establishing a new regional radiotherapy service, patients identified that specific information needs were not being effectively met by the existing approach to patient education.

There is a considerable amount of Australian and international literature on the informational requirements of radiotherapy patients, ranging from little to no information preference<sup>4–6</sup> to a comprehensive description of side effects, procedural descriptions and follow-up information.<sup>7,8</sup> The literature reports figures ranging from 5% to 36% of patients not wanting information about their cancer or treatment.<sup>7</sup> Our experience is that

information videos can cater to these varied needs to some extent, for example patients may choose not to watch or to watch several times and use the content as a shared starting point for further discussion.

In addition, targeted patient educational materials have been shown to improve patient satisfaction with treatment, decrease anxiety and improve compliance.<sup>1–3,9</sup> However, it is most common for radiotherapy treatment education to be given verbally in face-to-face sessions and reinforced through paper handouts.<sup>9–11</sup> The evolution of technology has seen a move towards audio-visual materials and emerging multimedia tools to assist in describing processes that traditional techniques cannot.<sup>11–13</sup>

The informational requirements of patients at the centre were consistent with published literature, including the need to understand the treatment process and rationale.<sup>2,7,9</sup>

Many needs could be simply met through discussions, but describing the treatment environment, processes and rationale are far more challenging to explain verbally. The department had access to PEARL™ 3D Visualization Software.<sup>14</sup> PEARL is a desktop application intended for use in physician/patient discussions which displays a 2D representation of a three-dimensional interactive model of the radiotherapy treatment environment operating from a standard computer platform.<sup>14</sup>

Not all aspects of the needs identified by patients were able to be described using PEARL alone, such as explaining how the treatment staff interact and leave the room prior to irradiation. Patients also indicated a need for information to be accessible for later review at home and sharing with loved ones, as many patients travelled substantial distances for care. Literature indicated that educational videos have been popular and successful communication tools and the format also supports distribution and sharing with others.<sup>7,13,15</sup>

Standardised videos provide consistency of information and video editing allows for control of what is shown, making the demonstration clearer. A project was therefore initiated, aiming to produce patient education videos that used real footage and animations from PEARL to meet the information needs that patients identified (see key content below). Three videos were initially produced, including a general radiotherapy process video (URL: <http://vimeo.com/tamworthnwcc/rt>) and two disease-site specific (breast and prostate) videos. Appropriate information provision can be challenging for health care providers<sup>16</sup> so patient engagement was a key component throughout the development and evaluation process, as recommended by Carey *et al.*<sup>17</sup> Patients volunteered to have their treatments filmed and generously engaged in review activities. This included sessions where patients and carers watched a draft video, then provided feedback about what worked, and what needed improvement including an assessment of the length, language and tone. This paper describes the findings of the post-implementation evaluation.

## Materials and Method

### Design and setting

A cross-sectional study design was conducted at an Australian regional radiotherapy centre. Human Research Ethics Committee review resulted in a waiver for low-risk research being issued. Patients were shown the educational video during their pre-simulation education session. After the first treatment patients were given the option of a brief, anonymous questionnaire to complete and return on a subsequent visit. The questionnaire contained

self-evaluations of the content and appropriateness of the video in terms of its impact on their knowledge and understanding of treatment processes. The survey also asked patients to self-assess the movie's impact on their level of anxiety at the first treatment appointment.

### Key content of educational videos

The educational videos were produced with the following content and objectives.

- Provide a clear overview of the relevant treatment process
- Introduce basic operation of the machine
- Explain the need for a specific computed tomography scan for planning
- Explain the importance of remaining still
- Describe the rationale for machine movements
- Explain the purpose of the lasers

The video production team determined whether these objectives would be best met with real footage, animations from PEARL or a combination of both.

### Video content summary

All videos used voice-overs to describe the footage being shown, with closed captions also available for hearing impaired patients. Each video starts with a common introduction to external beam radiotherapy, which lasts around 1 min. This includes a mix of real and PEARL footage showing the treatment unit and computed tomography (CT) scanner with a sample patient. PEARL footage shows a virtual patient fading to transparent, revealing internal CT anatomy, with 3D contours of normal organs and a tumour volume appearing as the CT image scrolls. Example beam angles are then shown, along with 3D representations of high- and low-dose volumes. The videos then transition to real footage of patient alignment processes with the voiceover explaining how precise positioning and keeping still is required to achieve the plan objectives. This section aimed to address the majority of the key content, prior to branching into site-specific areas to address other aspects of the relevant treatment process. Real footage was used for the majority of the remaining process, but PEARL sections were also used when real footage did not permit ready explanations, for example how tangential fields typically clip a small section of the ipsilateral lung and the need for bladder and rectal consistency in prostate treatments. At the end of each video, reassurance was provided that staff can assist in answering further questions at any time.

## Inclusion criteria

All patients who received greater than or equal to five fractions of radiotherapy for a confirmed cancer diagnosis at the North West Cancer Centre, who are over the age of 18 years and who were able to read and write English were eligible to participate in the study. Participation was voluntary, and return of the completed survey was deemed as consent to participate.

## Exclusion criteria

Patients who were unable to watch or who declined to watch the video or who had a cognitive impairment which would hinder their understanding of the study were excluded from the study. Patients prescribed with less than five fractions of radiotherapy. These patients are typically of palliative treatment intent with the aim of simulation and treatment in a short timeframe. Thus, these patients were excluded to avoid unduly burdening them.

## Survey

Demographics and patient variables: age, gender, previous radiotherapy status and version of the video viewed (breast, prostate or general) were recorded.

Information sources: six closed ended questions were used to assess the patient's information sources. One open-ended question allowed for the patient to specify any sources that were not already listed.

Pre-treatment anxiety: Pre-treatment anxiety was self-assessed by the patient as either present or not present.

Accessibility of the video: four questions targeted the accessibility of the video from home, how many times it was viewed, whether it was viewed alone or with family and friends.

Video satisfaction and quality: eight questions were designed to assess the patient's perceived increase in knowledge after watching the video, and specifically where this knowledge was gained. Patients were also asked to rate how effectively the treatment process was demonstrated, the usefulness of the animations and the appropriateness of mixed animation and real footage.

Satisfaction with the information: two open-ended free text questions assessed whether there were any parts of the process that were not explained in the video.

## Study procedure

Patients were standardly shown the educational video during their pre-simulation education session. The three videos produced covered the main anatomical treatment sites that are encountered at the centre, breast and

prostate, and a general process video. Patients were given a card with the URL to a password protected online version, or a copy on DVD if they did not have Internet access. Patients had unlimited access to the online version, were able to watch it with family and friends, or could share the log in details with others.

During a subsequent pre-treatment education session patients were given the evaluation survey by the radiation therapists to complete at a later stage. The voluntary and anonymous nature of the survey was reiterated and the purpose for the data collection was explained. Patients placed their completed surveys into a box at the reception desk if they elected to participate so that their responses remained unidentifiable. Reminder posters were positioned in patient waiting areas, on digital media and in the refreshments area.

## Statistical evaluation

The statistical analysis was conducted using SAS v9.4 software by the Clinical Research Design, IT and Statistical Support team at the Hunter Medical Research Institute (HMRI), Australia. Simple descriptive statistics were deemed sufficient for this work. Survey results were entered and independently checked by the radiotherapy team to ensure input accuracy.

## Results

### Cohort demographics and usefulness of the educational video

The survey completion rate was 29% ( $n = 61/212$ ). Surveys were collected for a period of 9 months from August 2014 to April 2015. Of the 61 returned surveys, all were completed at a satisfactory level for data analysis. The cohort demographics can be seen in Table 1.

### Reduction in anxiety as a result of the video

In total, 50% of patients reported a reduction in fear and anxiety as a result of watching the video. When looking specifically at the 25 patients who reported being anxious prior to viewing the video, the proportion that benefited was 75%.

**Table 1.** Demographics of the 61 participants.

	Frequency $n = 61$
Age (years)	Mean = 65, SD = 12, Range 42–94
Gender (female)	40 (66%)
No previous radiotherapy	59 (97%)

**Table 2.** The number of participants in agreement with successful delivery of the key content and objectives.

	Frequency <i>n</i> = 61
Clear overview of the relevant treatment process	
Yes	82 (50%)
Mostly yes	16 (10%)
No	2 (1%)
Introduction to basic operation of the machine	34 (56%)
The need for a specific CT scan for planning	44 (72%)
The importance of remaining still	49 (80%)
The rationale for machine movement	49 (80%)
The purpose of the lasers	31 (51%)
Patients indicating that no key content objectives were met	2 (1%)

### Subsequent review of the video

Of the 61 patients surveyed, 24 (39%) viewed the video at home with 33% of this cohort opting for the DVD version and 67% viewing online. The viewing times varied from once to greater than four times, with 18% of respondents indicating that they viewed the video multiple times. Viewing was almost always done with family and/or friends, with survey responses indicating this was to increase their understanding of radiotherapy.

### Meeting key content objectives

Analysis of the survey results found 98% of patients checked boxes to indicate that the video was useful for one or more of the listed purposes. Only one patient checked the box to indicate that the video had not addressed any of the key content objectives. The results can be seen in Table 2. Learning goals regarding understanding machine operations and the purpose of the lasers were only met in around half the respondents.

### Unmet informational needs

Responses to open-ended questions provided no indication of unmet informational needs. Instead 19 (31%) patients chose to use those questions to provide further statements expressing their satisfaction with the video and how well the process was explained.

## Discussion

Conversations with patients during semi-formal feedback sessions and review of the literature suggested that targeted information on radiotherapy is paramount for most patients<sup>9,10</sup> and must be directed at a level for the community to understand.<sup>9</sup> Research indicates that radiotherapy patient anxiety levels peak prior to the first

fraction of radiotherapy,<sup>18</sup> which aided in the time point decision of when to show the video. A Cochrane Review of the literature on patients and their orientation to cancer facilities suggests that patients benefit from an orientation of the department.<sup>19</sup> These benefits extend to a reduction in stress, trait anxiety and depressive symptoms.<sup>19</sup> Real footage of the radiotherapy centre treatment facility was used to address this information requirement within the video. However, to date little research is available on the effects of multimedia patient education, in particular interactive treatment models in radiotherapy.<sup>20</sup>

A review of recent literature on educational video production in an oncology setting found that patient engagement and evidence based content were among the most important principles of patient information provision.<sup>17</sup> The favourable survey outcomes are consistent with these findings as they are attributable to meaningful patient engagement throughout the video production process. Video production is a resource intensive undertaking and patient engagement required an additional investment of time, but provided a degree of confidence that the resulting videos would address actual patient needs.

The survey relied on patients to self-assess their anxiety levels, and categorised anxiety as either present or not present. A validated tool such as the State Trait Anxiety Inventory Scoring system, a self-scoring anxiety measure, or equivalent with varying levels may have yielded more information on the less dominant ends of the anxiety spectrum. However, a study conducted by Arroll *et al.*<sup>21</sup> demonstrated that mental health issues such as depression and anxiety can be screened in patients using one to two questions with high (97%) sensitivity and reasonable specificity (67%). When the authors compared these results from one or two simple questions to a comprehensive 27 question interview reporting a sensitivity of 96% and specificity of 57%, the simpler approach yielded statistically equivalent results. Furthermore, a review of 41 studies in the United States of America yielded similar average likelihood ratios for accurate diagnosis as the one to two question study.<sup>22</sup> As the primary aim of the informational videos analysis was not to ascertain and measure associated reductions in anxiety, the use of a more detailed anxiety questionnaire was considered as overly burdensome for patients. An analysis of the strengths and weaknesses of common anxiety testing methodologies, including self-reported anxiety, is covered in detail by Julian.<sup>23</sup> There is the potential for a follow-up study with a greater patient cohort to confirm the effectiveness of the videos.

### Application to patient education sessions

While PEARL allows for individualised patient education using the patient's own CT data set, the department elected

to standardise the education sessions in the form of patient education videos as this format has been presented positively in the literature.<sup>10,12,13,17</sup> Additionally, the standard education session occurs prior to the acquisition of the planning CT, meaning that the patient's own data are not yet available. The pre-CT time-point was selected in order to address uncertainties that may exist prior to simulation. Providing the copy for later review at this time also gave patients an opportunity to review the information prior to starting treatment. The department maintains the capability to use PEARL to explain individual treatments on an as needed basis, but this has not yet been necessary.

### Less frequently met key content objectives

The lower rate of patient reported learning regarding machine operations and the purpose of the lasers suggest areas for improvement. Despite this, the overall satisfaction with the videos was not adversely impacted, suggesting that these key content objectives were given a lower significance by patients in the studied cohort.

### Deployment for later review

Information needs research typically focuses on the content of the studied resources.<sup>1,2,5,11</sup> Some describe the logistics of how the information is made available, for example a DVD viewed at home.<sup>15</sup> The prevalence of subsequent review of resources at home, demonstrates that ready accessibility of information is also a need. Patients' use of resources to explain treatment processes to loved ones at home demonstrates a need in adult patients that has previously been described in paediatric radiotherapy patients.<sup>24</sup>

### Future directions

Future directions for further study include the introduction of more anatomical site-specific videos, including head and neck and electron sites. The videos explaining bladder and bowel preparation, chest wall and nodal region irradiation have been implemented clinically with a good response. Other institutions have elected to integrate the educational videos into their patient orientation procedures. The general treatment process video has also been incorporated into the Targeting Cancer public awareness campaign ([www.targetingcancer.com.au](http://www.targetingcancer.com.au)).

### Study limitations

The study would have had more robust scientific validity if the design included a control group, for example a randomised controlled trial. However, as the videos

contained more information than existing education methods, the equipoise necessary to justify a control group design was not present. The sample size was small, with only 61 respondents, but the responses were highly consistent so additional data collection is unlikely to have altered the findings significantly.

Surveys were paper based and therefore had no inbuilt validation for completeness or consistency. Moreover, the surveys were returned on a voluntary basis. This leads to the potential that the responses were predominately patients who felt strongly (positively or negatively) about the video they had seen.

### Conclusion

Patients who are about to undergo radiotherapy have diverse information needs. Concepts in radiotherapy pertaining to the technical aspects of planning and treatment can be difficult to explain to patients in a way that avoids jargon and unfamiliar terminology. The mix of real footage and 3D visualisation software assisted in explaining the need for the planning scan, dosimetry technicalities and treatment delivery in a range of patients. Standardised videos delivered consistent information and facilitated subsequent review and sharing of information as desired. The videos were considered successful as 98% of patients described them as useful for one or more of the intended key content objectives. A side benefit was that 50% of the cohort reported a reduction in their self-assessed anxiety levels. Further research is needed to evaluate the broader applicability and utility of this approach in providing pre-treatment information to radiotherapy patients.

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### Awards Received

- Winner: Ko Awatea International Excellence in Health Improvement Award – Citizens at the Centre of Service Re-Design and Delivery – 2016
- Winner: Hunter New England Area Health Service Quality Awards – 2015

- Winner: Tamworth Hospital Quality Awards – 2015
- Finalist: Northern Inland Innovation Award – 2015
- Winner: Clinical Innovation Scholarship – 2015
- Winner: Rural Innovation Award – NSW Agency for Clinical Innovation – 2015

## Conflict of interest

The authors have no conflict of interest to declare.

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## Supporting Information

Additional Supporting Information may be found in the online version of this article:

**Video S1.** An example of an educational video for patients on the radiation therapy treatment process.