

## COMMENTARY

### Radiation therapy patient education using VERT: combination of technology with human care

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#### Abstract

The Virtual Environment for Radiotherapy Training (VERT) system is a recently available tool for radiation therapy education. The majority of research regarding VERT-based education is focused on students, with a growing area of research being VERT's role in patient education. Because large differences in educational requirements exist between students and patients, focused resources and subsequent evaluations are necessary to provide solid justification for the unique benefits and challenges posed by VERT in a patient education context. This commentary article examines VERT's role in patient education, with a focus on salient visual features, VERT's ability to address some of the spatial challenges associated with RT patient education and how to combine technology with human care.

#### Introduction and Background

Patient education is known to be a vital element of providing high quality care in radiation therapy (RT).<sup>1</sup> Effective patient education has positive impacts on patient consent, collaboration during treatment, patients' empowerment and psychosocial well-being.<sup>1–3</sup> However, 'radiation' and the processes of RT are known to be difficult concepts for patients to understand, due to the complex nature of radiation as both a therapy and a danger, and a wide array of learner factors due to the diversity of cancer patient presentations, health literacy and competency in the local language.<sup>4–6</sup>

Over the years, patient education methods have seemingly evolved in line with available technology, from paper-based information, to video and online approaches in more recent years. The continuum of this trend is relevant to this day, as current advances in technology have led to the use of 'virtual reality' tools for patient education. The Virtual Environment for Radiotherapy Training (VERT) system is a hybrid virtual reality tool, which contains rich visual displays of the RT environment and patient with essential equipment. VERT provides a combination of graphics, sensory technology and a physical hand-held pendant which enables users to interact actively with the artificial, computer generated environment.<sup>7</sup> The introduction of VERT into patient

education offers clinical and academic educators an innovative way to demonstrate RT information.<sup>8–15</sup>

#### Current Evidence For Patient Education Using VERT

Current evidence demonstrates a range of VERT-based intervention methods. Learner groups and measures of outcomes have been developed within or for local cancer care centre resources and patient education needs. Studies delivered education to patients with a range of cancer diagnoses,<sup>8,9</sup> with some dedicated studies delivering education to prostate cancer patients<sup>10–12</sup> and breast cancer patients.<sup>13,14</sup> Researchers have taken advantage of the VERT system's features including display of computed tomography (CT) datasets which specifically matched their target learner group and education objectives. In one study,<sup>8</sup> VERT education sessions were conducted using each individual patient's RT treatment plan. All other studies employed a relevant, but generic patient CT data set.<sup>9–15</sup>

In terms of evaluation outcomes, patient knowledge and satisfaction were the most commonly explored outcomes.<sup>8–15</sup> Patients' satisfaction with the education intervention was often measured using non-validated, study-specific instruments or interviews, reducing the ability to compare results between different studies.<sup>8–15</sup>

Nonetheless, data from these studies report an increase in knowledge and/or satisfaction with the VERT-based education interventions. VERT was also found to be useful in providing patient positioning and bowel and bladder preparation information to pelvic cancer patients, which supports the use of VERT for specific-instructional education.<sup>10,12</sup>

Although general cancer-related patient education has been shown to have a positive effect on patients' psychological state, research on psychological advantages of VERT education compared to traditional RT methods are limited in the current literature. Marquess et al.<sup>11</sup> conducted a VERT-based patient education study involving prostate cancer patients, acquiring data from pre- and post-intervention surveys. Results demonstrated a statistically significant reduction in anxiety scores with the largest decrease in anxiety related to treatment precision, which concurs with literature on patient education needs.<sup>16</sup> Similarly, a qualitative study found that prostate cancer patients reported feeling less anxious about their treatment after being shown a prostate cancer treatment on the VERT system.<sup>12</sup>

In another study at an Australian cancer care centre,<sup>13</sup> longitudinal analysis compared mean anxiety in two groups of breast cancer patients, one who had participated in a VERT education session, and another who had not. Mean scores for both groups were highest at the time of consultation with radiation oncologists, but decreased thereafter. This trend was more pronounced for the VERT education group, which may suggest that perception of RT as a stressful event or a threat decreases over time, potentially due to factors such as increased knowledge and familiarity with the RT process and the RT department. Survey data from the same study demonstrated that the patient group who participated in VERT education had statistically higher agreement with a range of positively worded RT 'Experience' and 'Knowledge' questions compared to the nonintervention group, indicating that the VERT education intervention was empowering for patients. Qualitatively, the VERT group indicated that the three dimensional imagery allowed them to focus on the therapeutic aspects of RT rather than the risks associated with radiation.

### **Disadvantages of VERT in patient education**

There may be a number of disadvantages associated with VERT for patient education. Due to the paucity of studies, and the recent availability of VERT, it is not yet known how to optimise VERT for patient education, and whether or not VERT-based education is suitable to all RT cancer patients. The images on the VERT system are very detailed and are likely to be unfamiliar to patients. A

recent study found that a minority of breast cancer patients found some VERT images, such as the internal anatomy displayed within a transparent body, 'distressing', and hence further evaluation is required to determine how to make use of VERT imagery without evoking negative feelings or worry for patients.<sup>14</sup>

One of the main ongoing challenges of VERT for patient education will be to provide evidence for cost-effectiveness of this new system, including purchasing licensing and RT staff education and availability to facilitate VERT education programs.

From the currently available studies, it is proposed that VERT enhances patient care quality through optimised educational approaches, however, this is yet to be established on a wider scale. We pose three interrelated factors to explain VERT's early success in patient education, including challenges associated with RT patient education, VERT's visual and interactive features and the combination of technology with human care.

## **Challenges Associated With RT Patient Education**

Understanding the factors which challenge education in RT is an important step in developing educational interventions which may support patients.

### **Nature of radiation therapy and perception of radiation danger**

RT is a highly technical modality which uses complex and specialised equipment. This raises two key challenges. The first is the conversion of complex and unfamiliar descriptions to lay terminology. Secondly, time and staff restrictions exist for education within a clinical environment, where equipment and resources are often prioritised for clinical patient use.<sup>17</sup> Radiation is imperceptible, which means that the public's ability to conceptualise radiation is compromised and often leads to a lack of understanding. Shnur et al.,<sup>4</sup> identified that the 'mysterious' aspect of radiation, led to patients worrying about RT as a cancer therapy. There is often a culture of fear about the damaging effects of radiation, and it is difficult to reconcile radiation as a therapy and radiation as a danger for most patients and their families.<sup>4,5,18</sup>

### **Varying information needs and health literacy amongst individuals**

Differences in the quantity and breath of RT information required by patients are wide ranging, and evidence suggests a 'one-size-fits all' education model does not

exist.<sup>19–21</sup> In addition, studies have shown that there is a challenge to meet the increased demand for knowledge, including younger patients and patients with higher level of education or health literacy.<sup>21,22</sup> When using most current health care services and health assessment tools, patients are required to have an ability to understand written, numerical and oral information. Generally, patients must understand information, if they are to follow instructions and understand the role of RT for their specific disease. Therefore, culturally and linguistically diverse (CALD) populations whose competence of the local language is not high may experience communication barriers when dealing with health professionals.<sup>6</sup> In addition, there is evidence to suggest that cancer patients experience anxiety through the course of their RT, and that information overload and cognitive limitations are common in the cancer patient population.<sup>23</sup> This raises equity issues for the development of patient education which is effective for RT patients with a wide range of health literacy, diverse language backgrounds and psycho-social needs.

## Support For Visual Aids in Patient Education

The general population is reported to have a low understanding of radiation and RT specifically, and often simple concepts taken for granted by the Medical Radiation Science practice community, such as shielding or planning tumour volume targeting, are difficult to comprehend by the lay person. Consequently, a newly diagnosed cancer patient will require a comprehensive explanation of the role of RT and its role for their disease management.

Visually rich methods are explored within the recent literature (peer-reviewed and grey literature) and have been reported to reinforce information provided during patient education sessions.<sup>22,24,25</sup> The innovative education opportunities offered by VERT include the wide range of visual displays of the RT environment, dynamic views and an interactive environment.<sup>7</sup> Viewing the virtual linear accelerator, treatment bed and room, and listening to the sounds of the RT equipment prior to entering the treatment room demystifies the RT experience for patients. Similarly, showing patients how a radiation beam interacts with a virtual patient's body on VERT can clarify how the treatment is capable of reaching the target volumes, whilst minimising dose to surrounding organs. In this context, VERT was found to be useful in providing bowel and bladder preparation information in prostate cancer patients, due to its rich visual display.<sup>12</sup> In a group of breast cancer patients, it was found that patients were aware that radiation would

be targeting the breast, but they were further comforted by knowing that *“it's not just random radiation everywhere”* (Jimenez Y, unpublished data, 2018). In addition, VERT's display of the room lasers and isocentre location provides an illustrative example for the justification of patient positioning, which may support patients' acceptance of the uncomfortable treatment positioning (Jimenez Y, unpublished data, 2018).

## Combination of Technology With Human Care

Patient education in RT is considered to be a part of role of the multidisciplinary team, including radiation oncologists, cancer care nurses and radiation therapists. Commonly, radiation oncologists are the first health professionals to provide dedicated RT information to patients. Radiation therapists are then responsible for pretreatment education in the subsequent time period prior to and during treatment.<sup>26</sup> Thus, radiation therapists are in the ideal position to deliver detailed education and psychosocial support to patients as they are in direct contact with patients at CT-simulation and treatment.<sup>2</sup>

VERT provides the flexibility of multimedia education, using verbal, audio, visual, and interactive delivery. If delivered by a radiation therapist then it also offers human support to navigate the complexities of RT. Delivering one-on-one education has benefits for the patient-radiation therapist interaction, which has previously been identified as an important aspect of patients' receiving and recalling a positive RT experience.<sup>2</sup> Bolderston<sup>27</sup> states a quote from a RT patient: *“I always presumed competence, but it was your kindness and humanity which set you apart”*. Within this context, the influencing factor in patient's positive reception of VERT-based education is the connection between patient care and technology. VERT can support an existing framework of patient education, further enriched by an early development of rapport with RT staff. The provision of time for the radiation therapist educator to talk to and listen to patients, whilst simultaneously having a highly visual display of the RT information, may provide a better model of patient education.<sup>28</sup>

## The Transformation of Patient Education in RT

The need for patient education is both topical and evolving. New health care frameworks identify necessary changes in patients' roles within the medical sphere and there is a growing emphasis of patients' complex psychological needs.<sup>28</sup> Evidence suggests it may no longer

be sufficient to provide cancer patients with basic information about RT, and enhanced education will be necessary to provide integrated and comprehensive RT education for the growing patient population requiring RT.<sup>3,21,28</sup>

The transformation of patient education in RT relies on the values placed on patient centred care.<sup>28</sup> Current technology used for RT education is largely dependent on available technology such as the internet. Hence, the implementation of VERT for patient education is a new approach, which requires financial resources for initial purchase and ongoing costs. It is likely that evidence of VERT education outcomes will be necessary to influence the funding bodies.

Education using VERT-based approaches should be provided inclusive of cultural or linguistic background, geographic location, age or gender. Barriers to patient access to education should be evaluated and removed and it has been reported<sup>13</sup> that CALD RT patients are not been catered for in VERT-based education, despite the potential for VERT's visual displays to act as a universal language.

Education should be an ongoing process occurring at appropriate time-points across the patient journey. Patients report that RT was not as scary as they initially expected,<sup>29</sup> hence the time period where RT is considered to be a threatening entity is the widow of opportunity to make maximum gains in knowledge transfer. In addition, work is required to identify continuing patient information needs. This process would benefit from a coordinated and systematic approach which is in-built to patients' overall cancer management.

## Conclusion

The VERT system can be used to provide comprehensive information, beyond what is possible with isolated verbal delivery, in a more engaging and tailored manner, compared to traditional methods. VERT expands on the traditional methods of education by offering an interactive learning experience that may have the ability to translate well across different CALD patient groups. VERT education delivered by a radiation therapist can double as a supportive counselling effect to enhance patients' experience.

## Conflicts of Interest

The authors have no conflicts of interest to declare.

## References

1. Smith SK, Nathan D, Taylor J, et al. Patients' experience of decision-making and receiving information during

- radiation therapy: Strategies to meet patient needs. *Eur J Oncol Nurs* 2017; **30**: 97–106.
2. Elsner K, Naehrig D, Halkett GKB, Dhillon HM. Reduced patient anxiety as a result of radiation therapist-led psychosocial support: A systematic review. *J Med Radiat Sci* 2017; **64**: 220–31.
3. Bibault JE, Pernet A, Mollo V, Gourdon L, Martin O, Giraud P. Empowering patients for radiation therapy safety: Results of the EMPATHY study. *Cancer Radiother* 2016; **20**: 790–3.
4. Schnur JB, Ouellette SC, Bovbjerg DH, Montgomery GH. Breast cancer patients' experience of external-beam radiotherapy. *Qual Health Res* 2009; **19**: 668–76.
5. Gillan C, Abrams D, Harnett N, Wiljer D, Catton P. Fears and misperceptions of radiation therapy: Sources and impact on decision-making and anxiety. *J Cancer Educ* 2014; **29**: 289–95.
6. Murray SB, Skull SA. Hurdles to health: Immigrant and refugee health care in Australia. *Aust Health Rev* 2005; **29**: 25–9.
7. Bridge P, Appleyard RM, Ward JW, Philips R, Beavis AW. The development and evaluation of a virtual radiotherapy treatment machine using an immersive visualisation environment. *Comput Educ* 2007; **49**: 481–94.
8. Sule-Suso J, Finney S, Bisson J, et al. Pilot study on virtual imaging for patient information on radiotherapy planning and delivery. *Radiography* 2015; **21**: 273–7.
9. Stewart-Lord A, Brown M, Noor S, Cook J, Jallow O. The utilisation of virtual images in patient information giving sessions for prostate cancer patients prior to radiotherapy. *Radiography* 2016; **22**: 269–73.
10. Hansen H, Nielsen BK, Boejen A, Vestergaard A. Teaching cancer patients the value of correct positioning during radiotherapy using visual aids and practical exercises. *J Cancer Educ* 2016; <https://doi.org/10.1007/s13187-016-1122-2>.
11. Marquess M, Johnston SP, Williams NL, et al. A pilot study to determine if the use of a virtual reality education module reduced anxiety and increases comprehension in patients receiving radiation therapy. *J Radiat Oncol* 2017; **6**: 317–22.
12. Flockton AJ. Men's experience of virtual simulation to aid patient education for radiation treatment to the prostate (Thesis, Bachelor of Radiation Therapy with Honours). University of Otago. Available at: [https://protect-au.mimecast.com/s/\\_y3hCANZvPiBnN6QC9l69s?domain=ourarchive.otago.ac.nz](https://protect-au.mimecast.com/s/_y3hCANZvPiBnN6QC9l69s?domain=ourarchive.otago.ac.nz) (Accessed: 07/04/2018).
13. Jimenez YA, Cumming S, Wang W, Stuart K, Thwaites DI, Lewis S. Patient education using virtual reality increases knowledge and positive experience for breast cancer patients undergoing radiation therapy. *Support Care Cancer* 2018; <https://doi.org/10.1007/s00520-018-4114-4>.

14. Jimenez YA, Wang W, Stuart K, Cumming S, Thwaites DI, Lewis S. Breast cancer patients' perceptions of a virtual learning environment for pre-treatment education. *J Cancer Educ* 2017; <https://doi.org/10.1007/s13187-017-1183-x>.
15. Williams K, Blencowe J, Ind M, Willis D. Meeting radiation therapy patients informational needs through educational videos augmented by 3D visualisation software. *J Med Radiat Sci* 2017; **64**: 35–40.
16. Halkett GK, Kristjanson LJ, Lobb E, et al. Information needs and preferences of women as they proceed through radiotherapy for breast cancer. *Patient Educ Couns* 2012; **86**: 396–404.
17. Merchant S, O'Connor M, Halkett G. Time, space and technology in radiotherapy departments: How do these factors impact on patients' experiences of radiotherapy? *Eur J Cancer Care* 2017; **26**: e12354.
18. Lewis S. Finding my own voice through the breast cancer journey: Humour, sadness and smurfs. *J Med Radiat Sci* 2015; **62**: 82–5.
19. Zeguers M, Haes H, Zandbelt LC, et al. The information needs of new radiotherapy patients: How to measure? Do they want to know everything? And if not, why? *Int J Radiat Oncol Biol Phys* 2012; **82**: 418–24.
20. Sutherland J. Patient information in radiation therapy: Strategies to meet patient needs. *J Radiat Oncol* 2014; **3**: 223–8.
21. Douma KFL, Koning CCE, Zandbelt LC, de Hae HCJM, Smets EMA. Do patients' information needs decrease over the course of radiotherapy? *Support Care Cancer* 2012; **20**: 2167–76.
22. Matsuyama RK, Lyckholm LJ, Molisani A, Moghanaki D. The value of an educational video before consultation with a radiation oncologist. *J Cancer Educ* 2013; **28**: 306–13.
23. Andreotti C, Root JC, Ahles TA, McEwen BS, Compas BE. Cancer, coping and cognition: A model for the role of stress reactivity in cancer related cognitive decline. *Psychooncology* 2014; **24**: 617–23.
24. Waljee JF, Rogers MA, Alderman AK. Decision aids and breast cancer: Do they influence the choice for surgery and knowledge of treatment options? *J Clin Oncol* 2007; **25**: 1067–73.
25. Friedman AJ, Cosby R, Boyko S, Hatton-Bauer J, Turnbull G. Effective teaching strategies and methods of delivery for patient education: A systematic review and practice guideline recommendations. *J Cancer Educ* 2011; **26**: 12–21.
26. Halkett GKB, Short M, Kristjanson LJ. How do radiation oncology health professionals inform breast cancer patients about the medical and technical aspects of their treatment? *Radiother Oncol* 2009; **90**: 153–9.
27. Bolderston A, Robins S. The radiation therapist and the patient: Epiphanies, stories, and social media. *J Med Imaging Radiat Sci* 2018; **49**: 11–15.
28. Zucca A, Sanson-Fisher R, Waller A, Carey M. Patient-centred care: Making cancer treatment centres accountable. *Support Care Cancer* 2014; **22**: 1989–97.
29. Shaverdian N, Wang X, Hedge JV, Aledia C, Steinberg ML, McCloskey SA. The patient's perspective on breast radiation therapy: Initial fears and expectations versus reality. *Int J Radiat Oncol Biol Phys* 2017; **99**: S39–40.