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Title: Assessing the Cost-Effectiveness of RT Prepare: A radiation therapist-delivered intervention for reducing psychological distress prior to radiotherapy

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Abstract

Objective

Determine the cost-effectiveness of RT Prepare in reducing breast cancer patients' **psychological** distress before treatment, compared to usual care.

Methods

RT Prepare, an intervention involving patient education and support consultations with a Radiation Therapist (RT), was implemented at three Australian sites (Australian New Zealand Clinical Trials Registration: ACTRN12611001000998). The primary outcome was change in psychological distress using the Hospital Anxiety and Depression Scale (HADS); secondary outcomes were changes in quality of life (QoL) and additional health service use. Costs (2015 \$AU) included consultation time and training delivery. Between-group comparisons of HADS and QoL used generalised linear mixed models, and comparisons of health service use used negative binomial regression. Incremental cost-effectiveness ratios (ICERs) indicated mean costs per one-point decrease in HADS score. Sensitivity analyses explored variation in facility size and uncertainty in intervention effectiveness.

Results

Among 218 controls and 189 intervention participants, the intervention significantly lowered HADS scores at treatment commencement (adjusted mean difference 1.06 points). There was no significant effect on QoL or additional service use. Mean intervention costs were AU\$171 per participant (US\$130, €119) mostly related to RT training (~AU\$142 (US\$108, €99)). An

ICER of \$158 (US\$120, €110) was estimated. Cost-effectiveness improved in a sensitivity analysis representing a large facility with higher patient numbers.

Conclusion

This study provides new data on the cost-effectiveness of a RT-delivered intervention to reduce psychological distress prior to treatment, which will be useful to inform delivery of similar services. As most costs were upfront, cost-effectiveness would likely improve if implemented as standard care.

Keywords: anxiety; breast cancer; cost effectiveness; distress; radiation therapy

Background

Although radiotherapy is commonly used in the management of cancer, patients often present with high information needs,¹⁻³ and heightened anxiety and distress prior to radiotherapy.³⁻⁵ Previous studies have noted that information provision is inconsistent and often late,⁶ and pre-treatment anxiety is rarely considered.⁷ Patients who are inadequately prepared for radiotherapy and anxious may decline or not adhere to treatment and take longer to treat on a daily basis.^{8, 9} Untreated comorbid psychological conditions can be detrimental to patients emotionally and physically¹⁰ and also lead to higher medical costs and longer hospital stays.¹¹ Appropriate and timely information and support prior to treatment commencement may reduce distress and increase patient satisfaction.¹²

This team developed RT Prepare, an educational intervention consisting of two one-on-one patient education sessions with a Radiation Therapist (RT) prior to radiotherapy planning and treatment commencement. The intervention was based on Level I evidence on preparing patients for threatening medical procedures which indicates that sensory and procedural information, and techniques for addressing anxiety, are effective.¹³⁻¹⁵ Prior to delivering the intervention, RTs participated in communication skills training focusing on preparing patients for radiotherapy and eliciting and responding to emotional cues.¹⁶ A pilot randomised controlled trial, conducted at one site with 122 participants, found that the intervention was clinically feasible and acceptable to health professionals and patients.¹⁷ Furthermore, the pilot study showed a trend towards lower anxiety and concerns about radiotherapy, and higher knowledge.¹⁸ Results of our large multi-site study demonstrated that compared to usual care, intervention participants reported lower psychological distress at treatment commencement

($p=0.01$); lower concerns about radiotherapy ($p<0.01$); higher knowledge ($p<0.001$); higher preparedness for procedural concerns ($p<0.001$); and higher preparedness for sensory-psychological concerns at treatment planning ($p<0.001$).¹⁹

In order to introduce psychosocial interventions successfully into clinical practice both efficacy and cost effectiveness need consideration. Service managers and policy makers can use this information to decide whether a new intervention should be implemented into clinical practice. No previous studies have assessed the cost effectiveness of psychosocial interventions introduced prior to radiotherapy to increase patient preparation and reduce anxiety prior to commencing treatment. A recent systematic review found eight studies which had assessed the cost effectiveness of psychosocial interventions aiming to improve psychological adjustment among people with cancer.²⁰ Six of the interventions were found to be cost effective; three were cognitive behavior therapy based interventions, one was nurse delivered follow-up and education (including on psychological and social consequences of breast cancer²¹), one was group based exercise and psychosocial intervention, and one was a series of 10 individual support sessions with a nurse. A second review, which focused on reviewing cost-effectiveness and cost-utility of psychosocial care in cancer patients, found 11 studies which included the following interventions: collaborative care (4 studies), group interventions (4 studies), individual psychological support (2 studies) and individual psycho-education (1 study).²² Seven studies assessed cost-utility, three investigated cost effectiveness and one did both.²² A third review, focusing on patient education interventions in healthcare, concluded that patient education interventions are effective tools in reducing costs.²³ Studies in this review demonstrated the interventions decreased hospitalisations and

visits to emergency departments or general practitioners (GPs), increased quality-adjusted life years (QALYs), and reduced productivity losses.²³ All three reviews concluded that psychosocial and education interventions can be cost-effective approaches in healthcare. However, additional robust economic studies are needed to determine which interventions are most cost-effective.^{20, 23}

The aim of this study was to determine cost-effectiveness of RT Prepare in reducing breast cancer patients' psychological distress before treatment, as compared to usual care.

Methods

Reporting follows the Consolidated Health Evaluation Reporting Standards (CHEERS) statement.²⁴ Trial methods have been published previously and are summarised below.^{19, 25}

Target population

Eligible participants were diagnosed with early breast cancer; referred for curative radiotherapy (≥ 50 Gy equivalent); had not commenced radiotherapy planning or treatment; had planning scheduled at least 2 days after recruitment; had no cognitive impairments or psychiatric illnesses; and could communicate in English. The trial was conducted at three sites, in Perth, Melbourne and Adelaide, Australia. All participants provided written informed consent prior to participating in the study.

Intervention

The educational intervention consisted of two face-to-face consultations with an RT: prior to treatment planning and prior to the first day of treatment. RTs provided sensory and procedural information, assessed the psychosocial needs of patients and provided coaching in

anxiety reduction methods. RTs were trained through two communication skills workshops on eliciting and responding to emotional cues; and a radiotherapy specific workshop on sensory and preparatory information. RTs were also provided with a detailed study manual which included the following sections: workshop materials, communication and consultation skills to use in radiotherapy planning and treatment, checklists to use for each consultation and copies of previous articles by the team.

Usual Care

Usual care patients received standard care provided in each department which consisted of patients being provided with information by their radiation oncologist, radiation oncology nurse and RTs at their initial radiation oncologist appointment, treatment planning and on the first day of treatment (see supplementary material of previous manuscript).¹⁹

Study design

A multiple baseline method was used. Data were collected at each site first from usual care participants, then from intervention participants immediately following the implementation of the intervention. RT training was provided after 12 months at site 2, 18 months at site 1 and 24 months at site 3¹⁹. Baseline surveys were conducted between seeing the radiation oncologist and the treatment planning session. Follow-ups were immediately prior to the treatment planning appointment (F1), within 24-48 hours of the first treatment (F2), and within a week of treatment completion (F3). F1 and F2 time points were selected because our focus was on reducing patient psychological distress prior to treatment commencement. F3 was measured at treatment completion to determine levels of psychological distress at

treatment completion. Time between each follow-up are reported in the supplementary material.

Outcomes

The primary outcome was psychological distress measured using the total score for the Hospital Anxiety and Depression Scale (HADS) at F2, as defined in a previous protocol paper.²⁵ Anxiety and depression scores are added together to provide a score for psychological distress, a higher score indicates higher distress levels.^{26, 27} This is commonly used to measure emotional distress in patients with cancer.²⁶ Secondary outcomes were quality of life, measured using the Assessment of Quality of Life Survey (AQoL-6D),²⁸ and use of additional health services, using the Patient Health System Usage and Cost Questionnaire (PHSUCQ).²⁵

The PHSUCQ asks patients to report on the use and costs of additional health services relating to their cancer diagnosis or treatment. Participants reported a wide range of services and it was often unclear whether the services reported described cancer treatment itself, additional services in relation to their cancer or completely unrelated services. Services which appeared to describe the cancer treatment itself were excluded from analysis and all other services retained. This approach may impact on the total number of services analysed but it is unlikely that the impact of this would differ between the intervention and control groups. The PHSUCQ also collected information on the use of medicines. Participants were asked to report if they had needed any medicines to assist with nervousness, anxiety, depression or similar feelings; the type of, and reason for, the medicine; and costs.

Estimating resources and cost

Intervention costs were estimated based on: (1) RT time delivering the two intervention consultations based on hourly RT rates (including on costs) and the time spent on each consultation; (2) RT time attending training workshops based on hourly rates multiplied by the workshop and follow-up session durations; (3) workshop costs including facilitator time to prepare and run the workshops plus actor hire; and (4) estimated costs of rooms both for intervention consultations and workshops. Workshop costs were divided equally between all intervention patients. Full details are included in the supplementary material. No cost was applied to the usual care group as the intervention was applied in addition to usual care. Although the primary outcome was HADS score at F2, we considered that relevant services or medications reported at F2 could have continued beyond that point in time (e.g. a follow-up appointment to discuss anxiety or depression symptoms or medications), hence included the costs of services and medications reported through to F3.

As cost-effectiveness is reported from the health system perspective the costs of service provision to the Government were estimated. Where the service reported by a participant was a service available through Medicare (Australia's universal public insurance scheme), it was assumed to have been accessed via Medicare and the costs to the Government of providing that service ascertained from the Medicare Benefits Schedule²⁹ for the relevant year.

Costs (to Government) of medicines prescribed were estimated based on the dispensing price for each medication as reported in the Schedule of Pharmaceutical Benefits³⁰ for the relevant year. The cost to Government was estimated as the portion of each medication's dispensing price in excess of the patient contribution (i.e. the portion subsidised by the Government).

Patients over 65 and certain other groups in Australia are “concessional beneficiaries” who pay a lower patient contribution for each medicine. Participants over 65 were assumed to be concessional beneficiaries and those below 65 as standard beneficiaries.

Analysis

Results were reported on an intention-to-treat basis. Patients were included in the analysis if they had completed data collection at baseline and F2. Where loss to follow-up occurred, differences on baseline demographics between completers and non-completers were assessed using Chi-square and independent samples t-tests. Between-group comparisons of psychological distress at each follow-up were estimated using a generalised linear mixed model (GLMM). The GLMM included baseline HADS total scores, group, site and time as fixed effects, participant as a random effect, and interactions among these variables. Quality of life assessment followed the same procedure.

As a secondary analysis, changes on the HADS were assessed in terms of a ‘minimum clinically important difference’ (MCID). We were unable to identify any published MCID for the HADS scale in a similar population so have defined a MCID as a change in score in excess of half of a standard deviation on the baseline measure³¹, which in this case is a change of 3.4 points on the HADS scale. This was assessed as a binary outcome with people categorised as experiencing an increase in HADS score (corresponding to a worsening of anxiety or depression symptoms) or no change/improvement (as the intervention was mainly concerned with preventing worsening of anxiety/depression symptoms). Intervention effects were assessed using a generalised estimating equation model with a binomial family, logit link and exchangeable correlation structure, including the same covariates and interactions as

in the GLMM described above. Stata's postestimation –margins- command provided adjusted probabilities of clinically important worsening in HADS score to F2 for each branch which were used as inputs in cost-effectiveness analysis.

Use of medicines and additional services were analysed as count outcomes using negative binomial models, chosen for the over-representation of 'zero' values. Combined costs of services and medicines were analysed using a generalised linear model with a gamma distribution and log link. Covariates in each of these models included site, branch and a site*branch interaction and baseline HADS score (as the intervention was hypothesised to affect service use through reducing psychosocial distress).

Cost-effectiveness analyses

The outcome measure used in cost-effectiveness analysis was score on the HADS scale at F2.²⁵ Decision trees were constructed using TreeAge Pro (Williamstown, Massachusetts, United States), comparing RT Prepare (intervention) to usual care (control).³²

Results were reported as an incremental cost-effectiveness ratio (ICER) expressing the mean intervention cost required for an additional 1-point improvement in HADS score. Costs were reported from the health system perspective in 2015 Australian Dollars. As the time horizon was short, no discounting was applied.

A base case analysis was performed in which the mean adjusted HADS scores and mean intervention costs were applied.

Sensitivity analyses

Deterministic sensitivity analyses were then performed in which:

- (1) The consultation time was the shortest (29 minutes) or longest (41 minutes) mean time among the study sites
- (2) RTs were paid at the site 2 rates (the lowest RT rates) or the site 3 rates (the highest RT rates)
- (3) The intervention was assumed to be implemented at a small facility with a single linear accelerator (LINAC) machine or a large facility with six LINAC machines
- (4) The outcome was a deterioration in HADS score in excess of the MCID from baseline to F2, rather than a one-point change in HADS

Full details of cost calculations and assumptions are included in the supplementary material. RT and patient numbers at the small and large facilities are derived from a radiotherapy staffing model described in Smith et al.³³ and figures on radiotherapy in Australia for 2017.³⁴ Finally, probabilistic sensitivity analysis was conducted using simulation methods to assess the effect of uncertainty in intervention effectiveness. HADS scores in the intervention and control groups varied, based on drawing repeated samples from a population where the distribution in these scores reflected the trial sample. Cost effectiveness was assessed against a range of willingness to pay (WTP) values (i.e. the maximum value that a funder is willing to pay for an outcome³⁵, in this case a one-point decrease in HADS).

Results

Participant characteristics

Briefly, of 218 controls and 190 intervention participants recruited, the mean ages were 55.9 and 57.9, the proportions in a relationship were 68.3% and 65.3%, English was spoken at

home by 94.5% and 95.8%, chemotherapy had been received or was being received by 49.1% and 53.7%, 58.3% and 54.7% were employed or studying, and other health conditions were reported by 51.6% and 54.7%, respectively.³⁶

Three-hundred and fifty-seven participants (86.7%) completed the HADS assessment at F2. Completion was slightly higher among controls (89.9%) than intervention participants (84.7%) though this difference was not significant ($p=0.115$). Baseline HADS scores were slightly lower (i.e. distress was lower) among completers than non-completers (mean of 9.3 compared to 11.3) though again this was not significant ($p=0.072$). There were no significant differences between completers and non-completers on any baseline demographic variables.

Participant outcomes

There were no significant differences between groups at baseline on any demographic variables.¹⁹ Baseline HADS scores were 9.15 (95% CI 8.25, 10.05) in the intervention and 9.76 (95% CI 8.79, 10.74) in the control group.

Figure 1a shows that the intervention group reported significantly lower total HADs scores at F2. This was primarily driven by reductions in anxiety, with no significant difference in depression between groups.¹⁹ At F2 the HADs total score in the intervention group was 7.79 (95% CI 7.12, 8.45) compared to 8.85 (95% CI 8.32, 9.39) in the control group, an improvement of 1.06 points ($p=0.01$). At the other follow-up points there were no significant difference in HADS scores between groups. The adjusted probability of an increase in HADS score (worsening of symptoms) from baseline to F2 in excess of the MCID was significantly

lower for intervention participants (probability of 0.049, 95% CI 0.015 to 0.084) than controls (probability of 0.143, 95% CI 0.095 to 0.193).

There were no significant differences in AQoL-6D scores between groups at any follow-up point (Figure 1b); at F2 adjusted mean scores in the control group were 0.815 (95% CI 0.804 to 0.827) and in the intervention group were 0.822 (95% CI 0.809 to 0.835). Individual domains of the AQoL-6D were also analysed as reduced anxiety may be more likely to influence certain domains than others. These analyses did not show a significant impact of RT Prepare in any domain (see supplementary material). Therefore, no cost-utility analysis was undertaken.

Across the three follow-ups, 54% of participants reported the use of an additional health service and 32% reported the use of medicine. A mean of 2.7 (SD 5.1) additional services were accessed with the most common being general practice (37% of participants) and psychology (7%).

Table 1 displays results of logit models assessing the impact of RT Prepare on use of additional health services and medications. The intervention did not significantly impact on the use of additional services or medicines (additional services incidence rate ratio (IRR) =1.17, 95%CI 0.52, 2.65 and medicines IRR=0.84, 95%CI 0.36, 1.98). Notably, a higher baseline HADs score was associated with a significant increase in the use of additional services (IRR 1.05, 95%CI 1.02, 1.09) and medicines (IRR=1.08, 95%CI 1.05, 1.11). Combined costs of services and medicines did not differ between branches; adjusted costs in the intervention group were \$102 (95% CI \$62 to \$144; US\$78, €71) compared to \$106 in the control group (95% CI \$68 to \$145; US\$81, €74).

Cost-effectiveness

Intervention costs are displayed in detail in the supplementary material. Although an estimate of intervention costs was provided in a previous paper,¹⁹ this did not include the room costs which have been included in the current analysis, hence the costs reported here are slightly higher. Intervention costs were estimated at \$171 (US\$130, €119) per participant. The treatment planning and treatment consultations were relatively brief; the combined durations had mean values of 29, 36 and 41 minutes across the three sites. Mean costs directly attributable to these were \$30 (US\$23, €21) per participant; while RT training workshops accounted for \$142 (US\$108, €99) per intervention participant.

Table 2 displays incremental costs, effectiveness and the ICER for the intervention branch as compared to controls at F2. An ICER of \$158 (US\$120, €110) was estimated, i.e. on average, \$158 of expenditure was required for a mean one-point decrease in HADS score at F2.

Outcomes of the deterministic sensitivity analyses are reported in Table 2. Changes to consultation durations had relatively little effect on cost-effectiveness; increasing consultation duration from 29 minutes to 41 minutes, resulted in a \$10 (US\$8, €7) increase in mean cost per participant and similar increase in ICER. Changing the RT hourly rate from that of the site with the lowest rates that of the highest resulted in a modest change in ICER from \$155 (US\$118, €108) to \$163 (US\$124, €114). Estimates derived for hypothetical small and large facilities, covering cost-effectiveness over a one year period following implementation of the intervention, differed more substantially. For a small facility (with a single LINAC) an ICER of \$153 (US\$116, €107) was estimated, whereas for a large facility (six LINACs) an ICER of \$88 (US\$67, €61) was estimated. When the effectiveness measure

was prevention of an increase in HADS score in excess of the MCID (rather than mean change) the ICER increased to \$1,674 (US\$1,274, €1,168). This can be interpreted as the incremental cost of avoiding one MCID increase in HADS.

Figure 2 shows that at a WTP of \$100 (US\$76, €70) the intervention was cost-effective in only 12% of samples, and at a WTP of \$350 (US\$266, €244) the intervention was cost-effective in 90% of samples (Figure 2). These values all correspond to the base case ICER.

Discussion

RT Prepare reduced anxiety symptoms among patients undergoing radiotherapy for breast cancer and was low cost. Most intervention costs related to RT training rather than intervention delivery, suggesting that mean costs would reduce and cost-effectiveness improve over a longer time horizon. No effect on quality of life or health service use was observed over the short study duration.

While this is the first study to assess the cost-effectiveness of specific RT-delivered education sessions prior to commencing radiotherapy for breast cancer, two recent reviews have described the cost-effectiveness of similar interventions.^{20, 22} Many interventions, such as those delivering cognitive behavioural therapy,^{37, 38} treatment for depression in the context of cancer,³⁹ or mindfulness⁴⁰ are not comparable to RT Prepare. Arving et al.³⁷ reported on an intervention in Sweden providing nurse or psychologist-delivered psychosocial support for people with breast cancer. They found benefits in quality adjusted life-years and reduced health service costs. Their intervention was more extensive than RT Prepare, involving a cognitive behavioural therapy approach. It was also more costly, with costs of €60 per

person (~AU\$906 at time of writing) for the nurse-delivered, and €653 (~AU\$1,057) per person for the psychologist-delivered intervention over two years.

There could be several explanations for the lack of effect of RT Prepare on quality of life and health service use. The AQoL-6D is made up of six domains and on some of these (e.g. mental health) changes in anxiety and depression may be more likely to impact than others (e.g. senses). Domains where RT Prepare is less likely to impact represent additional variation in AQoL-6D scores, making statistically significant changes in quality of life more difficult to detect given the trial was powered for HADS score as the primary outcome. Though generic measures such as the AQoL-6D can lack sensitivity in assessing individual conditions, they are an important component of economic evaluations as these measures aid decision making by allowing the comparison of outcomes across different patient groups or intervention types.³⁵ Additionally, reporting this information provides data that could inform power calculations for future cost-effectiveness trials; this information is included in the supplementary material for the benefit of readers planning future work in this area.

Similarly, the use of additional services and medicines depends on factors aside from anxiety and depression, for example differences in health or financial status between people. This combined with high inter-individual variation made changes more difficult to detect in a study not powered specifically for this outcome. When estimating the effect of the intervention on the use of additional services and medications, 95% CIs suggested that the intervention effect may range from approximately a 50% reduction to a 100% increase on each outcome, i.e. this lack of power led to very imprecise estimates. A higher baseline HADS score was associated with increased use of additional services and medications. This

supports the hypothesis that reducing distress could reduce health service usage, and that the lack of effect on these outcomes could reflect insufficient power. Alternatively, RT Prepare may have encouraged participants to recognise where additional services were required to manage distress and hence could have increased service use for some patients.

Clinical implications

Although HADS is commonly used for assessing anxiety, depression and distress in cancer patients,^{39, 41} it has not been used previously for cost effectiveness analyses. Lemieux et al.⁴² used the profile of moods states (POMS) to assess cost-effectiveness of a group therapy intervention for women with metastatic breast cancer. An incremental cost of \$5,550 was reported for a 0.5 point improvement on the POMS scale (2002/3 Canadian dollars, ~AU\$8,520 in 2015 terms). Similar to the current study, these authors were unable to specify WTP as generally accepted thresholds relate to measures such as QALYs gained.⁴³ As there is no WTP threshold available for a decrease in HADS score, our probabilistic sensitivity analysis specified the likelihood of RT Prepare being cost-effective across a range of WTP values. This provides a starting point for policy makers to consider what they may pay to reduce psychosocial distress among patients undergoing radiotherapy.

Another consideration is the distribution of benefit from the intervention. ICERs presented in this study relate to mean changes in HADS scores and do not consider whether benefits were evenly distributed across intervention participants. There may have been subgroups where the intervention was more or less effective. Cost-effectiveness may improve if the intervention could be targeted towards those at highest risk of anxiety or depression while undergoing radiotherapy. The sub-analysis for cost-effectiveness based on avoiding a MCID increase in

total HADS score showed that by this measure the intervention is more expensive, though there is no WTP threshold to inform an assessment of whether this is acceptable or not. This additional measure was chosen to contextualise the findings in terms of their likely clinical importance, and provide further information to health managers. The main ICER value in terms of cost per mean one-point decrease in HADS score has been reported in the literature for other interventions^{44, 45}.

The vast majority of costs were incurred through workshops to train the RTs in delivering the intervention. Cost-effectiveness improved markedly in a scenario where staff at a large facility were trained in RT prepare and delivered the intervention over a one-year period. In this case the upfront workshop costs were spread across a larger number of patients for a large department compared to a small department treating fewer patients, i.e. there was a benefit in terms of economies of scale. Changes in RT wages had a modest impact on cost-effectiveness. This, combined with the trial being conducted in three different hospital systems suggests it is reasonable to generalise findings across Australia. The role and provision of RTs varies between countries,⁴⁶⁻⁴⁸ and thus application of these study results outside of Australia needs to account for any disparities in the location specific-role and salary requirements of radiotherapists, differing breast cancer epidemiology, and RT Prepare components pre-existing within 'usual care'.³¹⁻³³

Strengths and limitations

This study used data collected from a well-designed multiple baseline study conducted over three trial sites,¹⁹ with attention paid to trial design and to collection of relevant clinical data (HADS score) as well as data relevant to health-related quality of life (AQoL-6D) and health

resource use. Costs have been considered from a payer (health system) perspective and these have included consideration of health resource use. Facility costs were also accounted for; while these costs were not charged for this trial, these may need to be considered if other groups implemented this intervention. The robustness of results has been tested through extensive sensitivity analyses, as well as presenting alternate scenarios to aid planners and practitioners in adapting findings to differing settings. This study had some limitations. The nature of this intervention being newly implemented meant the majority of costs were associated with training. As such, the ability to comment on cost-effectiveness over the longer term is somewhat diminished through uncertainty over the need for and regularity of ongoing training following implementation in practice. Assessment of costs and outcomes was over a short time horizon compared to other health interventions; though this was appropriate to the RT Prepare intervention this time horizon should be weighed when assessing these results. The trial may have been underpowered to detect changes in AQoL-6D and health resource use, as the primary outcome was change in total HADS score.¹⁹ While it is possible to calculate an ICER in terms of cost per quality-adjusted life year gained, standard for many cost-utility analyses informing health technology assessment, the high crossover of 95% CIs and short time-horizon for this analysis have combined to inform the decision not to report this value based on point estimates. Some loss to follow-up occurred in this study and may have had some impact on the findings reported. The potential for this introducing bias is minimised by including baseline HADS score as a covariate, as this differed between non-completers and completers ($p = 0.072$) and that there were no demographic differences between non-completers and completers.

Conclusion

This study provides valuable new data on the cost-effectiveness of a RT-delivered intervention to reduce psychological distress among breast cancer patients undergoing radiotherapy as part of their treatment. The ICER was \$158 (US\$120, €110) for a 1-point reduction in HADS score. The majority of costs were for training, cost-effectiveness would improve over the medium to long-term if implemented within a department as standard care. Though the lack of clear WTP threshold limits the ability to provide a firm conclusion on cost-effectiveness, extensive reporting and the sensitivity analyses provided will assist health service managers and practitioners in assessing the likely resource requirements and clinical yield likely through implementation of a similar initiative.

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Conflict of interest statement

None to declare.

Ethics

Ethics approval was gained from Curtin University (HR123/2011), Peter MacCallum Cancer Centre (11/93), Royal Adelaide Hospital (110907a), Sir Charles Gairdner Hospital (2011-130). The study was performed in accordance with the Declaration of Helsinki. All participants were provided written information sheets and informed consent was gained prior to participating in the study.

Clinical trial registration

Australian New Zealand Clinical Trials Registration: ACTRN12611001000998

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Tables

Table 1: Impact of RT-Prepare on self-reported use of (a) additional health services (b) medicines across all follow-ups and (c) combined costs of medications and services across all follow-ups. Incidence rate ratios represent the effect of each variable on numbers of additional health services or medications used.

Table 2: Incremental cost-effectiveness of RT-Prepare. Results are presented for (a) the base case and deterministic sensitivity analyses in which: (b) all visit durations were equal to site

1; (c) all visit durations were equal to site 3; (d) all RT rates were equivalent to site 2; (e) all RT rates were equivalent to site 3 (f) intervention was implemented at a small facility with a single LINAC; (g) intervention was implemented at a large facility with six LINACs; and (h) the outcome was prevention of an increase in HADS score in excess of the MCID rather than a one-point change.

Figure legends

Figure 1: Comparison of control and intervention group scores on the Hospital Anxiety and Depression Scale (A) and the Assessment Quality of Life – 6 Dimension index (B). Mean scores presented at follow-ups 1, 2 and 3 derived from generalised linear mixed models adjusted for baseline score on the relevant scale, group, site, time, participant and interactions among these variables. Mean scores presented at Baseline are the overall means on each scale for all participants.

Figure 1: Comparison of control and intervention group scores on the Hospital Anxiety and Depression Scale (A) and the Assessment of Quality of Life – 6 Dimension index (B). Mean scores presented at follow-ups 1, 2 and 3 derived from generalised linear mixed models adjusted for baseline score on the relevant scale, group, site, time, participant and interactions among these variables. Mean scores presented at Baseline are the overall means on each scale for all participants.

Figure 2: Results of probabilistic sensitivity analysis displaying acceptability of RT Prepare at different values of willingness-to-pay. Outcome is a one point improvement on the Hospital Anxiety and Depression Scale (HADS) at the second follow-up. Probabilistic sensitivity analysis run with 1,000 samples in which group mean HADS scores at the pre-treatment follow-up and the use of complementary services and medications in each group varied according to parameters observed in the trial.

Figure 2: Acceptability of RT Prepare at different values of willingness-to-pay. Outcome is a one-point score decrease on the Hospital Anxiety and Depression Scale (HADS). Derived from Probabilistic Sensitivity Analysis with 10,000 samples in which group mean HADS scores at the pre-treatment follow-up varied.

Figure 1: Comparison of control and intervention group scores on the Hospital Anxiety and Depression Scale (A) and the Assessment Quality of Life – 6 Dimension index (B). Mean scores presented at follow-ups 1, 2 and 3 derived from generalised linear mixed models adjusted for baseline score on the relevant scale, group, site, time, participant and interactions among these variables. Mean scores presented at Baseline are the overall means on each scale for all participants.

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