

Economic evaluation of a psychological intervention for high distress cancer patients and carers: costs and quality-adjusted life years

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Abstract

Objective: This study compared the cost-effectiveness of a psychologist-led, individualised cognitive behavioural intervention (PI) to a nurse-led, minimal contact self-management condition for highly distressed cancer patients and carers.

Methods: This was an economic evaluation conducted alongside a randomised trial of highly distressed adult cancer patients and carers calling cancer helplines. Services used by participants were measured using a resource use questionnaire, and quality-adjusted life years were measured using the assessment of quality of life – eight-dimension – instrument collected through a computer-assisted telephone interview. The base case analysis stratified participants based on the baseline score on the Brief Symptom Inventory. Incremental cost-effectiveness ratio confidence intervals were calculated with a nonparametric bootstrap to reflect sampling uncertainty. The results were subjected to sensitivity analysis by varying unit costs for resource use and the method for handling missing data.

Results: No significant differences were found in overall total costs or quality-adjusted life years (QALYs) between intervention groups. Bootstrapped data suggest the PI had a higher probability of lower cost and greater QALYs for both carers and patients with high distress at baseline. For patients with low levels of distress at baseline, the PI had a higher probability of greater QALYs but at additional cost. Sensitivity analysis showed the results were robust.

Conclusions: The PI may be cost-effective compared with the nurse-led, minimal contact self-management condition for highly distressed cancer patients and carers. More intensive psychological intervention for patients with greater levels of distress appears warranted.

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Introduction

The burden of cancer worldwide is significant accounting for 7.6% of total disability-adjusted life years. While the majority of the burden from cancer is attributable to the years of life lost (10.74% of global YLLs), years lived with disability (0.58% of global YLDs) contribute to the total burden [1]. A portion of this disability is contributed by psychological distress. Up to one third of people diagnosed with cancer experience clinically significant psychological distress [2,3], and carers and partners also report distress that may be greater than the person with cancer diagnosis [4].

Although a range of psychological interventions have evidence demonstrating effectiveness in reducing psychological distress for cancer patients [5], there are very few

economic evaluations of these interventions to assist in the allocation of resources for cancer care and support services [6].

This study reports the results from an economic evaluation conducted alongside a randomised controlled trial that assessed the effectiveness of two levels of psychological intervention for distressed cancer patients and carers [7]. In brief, the main clinical study enrolled adult patients with cancer and carers of people with cancer who called telephone-based cancer information and support lines and had elevated distress based on brief distress screening [8,9]. The trial showed that participants' outcomes (psychological distress, cancer-specific distress and positive adjustment) improved similarly over time in both arms, and the level of distress at baseline did not appear to impact the primary outcome of distress reduction [10].

The aims of the current study are as follows: first, to assess the costs associated with both interventions, including the costs of the interventions and other broader healthcare costs and second, to assess the secondary outcomes of health-related quality of life in order to determine whether any differences in quality-adjusted life year (QALY) gains were associated with the intervention. QALYs are important outcomes from a cost-effectiveness perspective because they allow comparisons across different diseases and interventions [11]. Although most clinical trials are rarely powered to detect differences in costs and health-related quality of life used to determine QALYs, it is important to assess such outcomes given that healthcare decision-makers still need to decide whether it is 'worth' financing such interventions [11,12].

The specific study questions for the economic component of the initial clinical trial were to determine whether the psychologist-led, individualised cognitive behavioural intervention (PI) was more 'cost-effective' compared with the nurse-led, minimal contact self-management condition (NI) for high distress participants, and whether the NI was more cost-effective than the PI for participants with low levels of distress, where \$50 000 per QALY was taken as the benchmark for cost-effectiveness in Australia [7,13]. Level of distress at baseline was considered an important predictor of outcome in the primary study hypotheses [7].

Methods

The economic evaluation was conducted alongside a randomised trial of psychological interventions for high distress cancer patients and carers, allowing resource use information to be collected at the same time as clinical effectiveness information. Details of the methods used in the randomised controlled trial and the main study results have been published [7,10]. To summarise, people were eligible for participation in the trial if they were adult cancer patients or carers who called cancer helplines in Queensland or New South Wales between September 2009 and October 2010. Inclusion criteria included having a score of 4 or more on the distress thermometer [8,9] and being able to read and speak English. People were excluded if they had a previous history of head injury, dementia or psychiatric illness or if presenting with current grief/bereavement. Ethical approval was obtained from the Griffith University Human Research Ethics Committee.

Interventions

Participants were randomised to a psychologist-led, five-session, individualised cognitive behavioural intervention or a nurse-led, single-session self-management

intervention [10]. Randomisation was stratified by patient/carer status and state.

The NI group was provided as a single telephone support session with a nurse counsellor. The nurse counsellors were experienced oncology nurses with more than 5 years of experience in cancer support. The PI group was provided up to five weekly sessions of telephone-based counselling from a psychologist following principles of cognitive behavioural therapy. The psychologists had 2 to 5 years of experience in psycho-oncology. Both nurses and psychologists received regular supervision and session review by credentialed clinical psychology supervisory staff. Participants in both groups were mailed a self-management resource kit in advance of the sessions.

Costs

The economic perspective of the current study is the Australian health sector. The economic analysis included the costs for operating the programmes as well as costs associated with health-care resources used by cancer patients and carers including the out of pocket expenses borne by the individual such as co-payments for medical care or prescription medications.

Both groups received a mailed resource kit with educational materials on stress management, problem solving and wellness promotion. The cost of the resources was estimated at \$15, and an additional \$3 was needed for postage. The average call time (46.4 and 46.5 min for PI and NI, respectively) was used with the hourly wage rate to calculate a cost per session for each study group. These costs were then applied to participant data on the number of sessions actually attended to determine the intervention costs. The mean number of sessions for the PI group was 3.85. Intervention start-up costs (e.g. costs of developing the mailed resource kits) were excluded so that both interventions were evaluated and compared as if operating under steady-state conditions (i.e. fully implemented and operating).

Contacts with health and social services were collected from each participant via a brief resource use questionnaire administered via a computer-assisted telephone interview at baseline, 3, 6 and 12 months after randomisation. Participants reported the number of contacts with health services (i.e. medical and psychological) in the preceding month, and this was multiplied to reflect the number of months since the previous interview. The contacts were summed over 12 months to estimate the total visits for each service within the study period.

For psychiatrist, psychologist, social worker, general practitioner and nurse contacts, a weighted average of the cost paid by the government and out of pocket costs to the patient for services provided by these health professionals was applied [14]. The counsellor field was designed to capture visits where the participant may not

have been sure of the credentials of the mental health professional visited. To reflect the uncertainty of this category, the cost for the counsellor is a weighted average of the cost for psychologist and social worker visits (Table 1).

Some contacts (family friends, face to face, online or other support groups, community counselling and government or community organisations) were difficult to attribute a cost to. Many support groups are run by volunteers, and while there is an opportunity cost to the time involved, we did not have estimates of time required to run these groups or the amount of time that each study participant was involved in these groups. Similarly, community counselling, government and community organisations have employees with an average wage rate, but assumptions regarding the length of contact would be required. Therefore, due to the uncertainty and numerous assumptions, the mean number of contacts was tested between groups to assess if there were any substitution effects between services. If the differences between groups were not significant, the service was not costed in the final analysis because these costs would be unlikely to influence the choice of intervention in the cost utility analysis, because they cancel out [11].

The name and dosage for medications taken by the participant for anxiety and depression along with the start and stop dates were also collected with the computer-assisted telephone interview. Using information on the number of dosage units provided for each prescription from the Pharmaceutical Benefits Schedule website [15], the total number of prescriptions required was calculated. The health sector cost for each medication was calculated as a weighted average of the benefit paid by the Pharmaceutical Benefits Schedule (government) and the patient (out of pocket) for all similar medications (brand and generic are included where applicable).

All costs are represented as 2011/2012 Australian dollars. Because the costs and outcomes were collected over 1 year, discounting was not applied.

Outcomes

The primary study endpoints of psychological distress (Brief Symptom Index-18), cancer-specific distress (Impact of Events Scale) and positive adjustment (Post-

Traumatic Growth Inventory) were not significantly different between the intervention arms as reported in the primary study results [10].

To assess participants' health-related quality of life and utility, the assessment of quality of life – eight-dimension – (AQOL-8D) was completed at each assessment [16]. It contains 35 items and comprises eight separately scored dimensions, consisting of independent living, relationships, mental health, coping, pain, senses, self-worth and life satisfaction. The AQOL-8D is a multi-attribute utility instrument that means that there is a separate utility scoring algorithm allowing the calculation of utility values for each participant used in the calculation of QALYs. Utility values (or weights) are constrained between 0 and 1 where 0 refers to death and 1 refers to perfect health with values in between denoting less than perfect health states. The AQOL-8D has similar discriminant validity to other multi-attribute utility instruments such as the EQ-5D, SF-6D and HUI3 as well as the best correlation with other mental health symptom measures [17]. The utility algorithm used in the current study is derived from the Australian general population [18]. QALYs are calculated by multiplying the length of time spent in any health state by the utility value associated with that health state. The QALYs for the 12-month study period in the current study were estimated using the area under the curve method [12].

Statistical analysis

Analyses were conducted using Excel 2013 and STATA 13 (Stata Corp. LP, College Station, TX, USA). Results were analysed separately for patient and caregiver participant groups because the participants with cancer were independent from the caregivers enrolled in the study. Results were further stratified by baseline Brief Symptom Inventory score (>63 or <63) because the level of distress was hypothesised to be an important predictor of outcome. Intention to treat analysis was undertaken. All enrolled participants who completed a baseline assessment were included in the analysis (total $n=690$; carers $n=354$; patients $n=336$); however, 27% of participants did not complete all follow-up assessments. To account for missing cost and utility data, we used the multivariate imputation using chained equations technique in STATA 13 without predictor variables in the model because none were found to be strongly associated with the pattern of missing data. Two variables, total cost and total QALYs were imputed 10 times and analysed using the mi estimate commands that adjust coefficients and standard errors for the variability between imputations according to the rules by Rubin [19].

We calculated the incremental cost-effectiveness ratios (ICERs) as the difference in average cost between the NI and PI arms divided by the difference in average QALYs.

Table 1. Unit costs for support service utilisation

Service provider	Government cost	Out of pocket
Psychiatrist	\$140.66	\$22.69
Psychologist	\$101.82	\$17.35
Occupational therapist	\$83.73	\$13.02
Social worker	\$78.09	\$13.21
Counsellor	\$100.60	\$17.14
General practitioner	\$80.65	\$0.00
Nurse	\$13.33	\$0.52

Confidence intervals for the ICERs were calculated using a nonparametric bootstrap procedure for each of the 10 imputed datasets with 5000 iterations to reflect sampling uncertainty. The 5000 iterations from each of the 10 bootstrapping procedures were combined to calculate the mean ICER and confidence intervals [20]. The bootstrapped ICERs were graphically represented on cost-effectiveness planes to show the sampling uncertainty around the point estimate of the cost-effectiveness ratio by identifying the proportions of the 50 000 iterations falling in four different quadrants. Bootstrapped costs and QALYs were also used to generate cost-effectiveness acceptability curves, another method for evaluating sampling uncertainty. The curves were generated by calculating the probability that the estimated cost-effectiveness ratio falls below a specific willingness to pay.

Net monetary benefit (NMB) was calculated for each individual as the willingness to pay (\$50 000/QALY) multiplied by total QALYs minus the total cost. NMB is advantageous because it is a continuous variable and analysed with standard statistical tests. Because NMB was derived from the imputed total costs and total QALYs, it was analysed using the *mi estimate* commands in STATA 13.

Parameter uncertainty was evaluated by varying all of the unit costs for resource use by 20% in one-way sensitivity analyses. Imputation uncertainty was evaluated by comparison of results using multiple imputation to a last observation carried forward approach and to the analysis of participants with complete data.

Results

The costs of the two interventions were significantly different as shown in Table 2, with the mean difference between the PI and NI ranging from \$99 to \$142. There were no significant differences between the NI and PI

groups for the percentage accessing and the mean number of contacts with any of the categories of support service: family friends, support groups (face to face, online or other), community counselling and government or community organisations over the 12-month follow-up period. We therefore did not apply a cost to these services because utilisation was similar across groups and would be unlikely to influence the choice of alternative in the incremental analysis.

Over the 12 months of the trial, there were no significant differences between intervention groups in total costs as shown in Table 2, or for units of resource use or costs for specific categories (psychiatrist, psychologist etc.). However, there was a trend towards fewer numbers of visits (and cost) with nurses among carers with high distress at baseline in the PI group versus the NI group. A trend towards lower medication costs for both the carers and patients with high distress in the PI group versus the NI group was also evident.

With respect to utility outcomes, both carers and patients who had low levels of psychological distress at baseline also had significantly higher levels of utility compared with patients and carers with high baseline distress. By the 12-month follow-up, utility levels for most groups had increased significantly, but there were no significant differences between the NI and PI groups for either patients or carers (Table 2).

For carers and patients with high distress at baseline, the PI delivered slightly more QALYs (mean differences of 0.035 and 0.037) at a lower total cost as shown in Table 2. For low distress carers and patients, the total costs were higher, and the difference in QALYs was small. NMB was also higher for the PI versus the NI in the high distress carers and patients as well as the low distress patients. However, given that the confidence intervals include 0, these differences were not significant.

The cost-effectiveness planes in Figure 1 show that there is a great deal of sampling uncertainty around the

Table 2. Intervention costs, multiply-imputed total costs (\$AUD, 2011/2012) QALYs and net monetary benefit over 12 months by baseline BSI score

	High distress BSI > 63				Low distress BSI < 63			
	NI	PI	Mean difference	95% CI	NI	PI	Mean difference	95% CI
Carers	<i>n</i> = 44	<i>n</i> = 45			<i>n</i> = 125	<i>n</i> = 122		
Intervention costs	\$60	\$193	-\$133	-\$159 – \$107	\$60	\$159	-\$99	-\$116 – \$83
Total costs	\$5485	\$4070	-\$1415	-\$4305 – \$1474	\$2362	\$2971	\$610	-\$774 – \$1993
QALYs	0.640	0.674	0.035	-0.057 – 0.126	0.756	0.728	-0.028	-0.078 – 0.021
Net monetary benefit	\$26 939	\$29 986	\$3047	-\$2526 – \$8620	\$35 189	\$33 520	-\$1669	-\$4316 – \$978
Patients	<i>n</i> = 53	<i>n</i> = 56			<i>n</i> = 123	<i>n</i> = 122		
Intervention costs	\$60	\$202	-\$142	-\$161 – \$122	\$60	\$181	-\$121	-\$136 – \$107
Total costs	\$4095	\$3773	-\$322	-\$2609 – \$1964	\$2394	\$2729	\$335	-\$904 – \$1574
QALYs	0.577	0.614	0.037	-0.045 – 0.118	0.744	0.760	0.016	-0.027 – 0.060
Net monetary benefit	\$24 219	\$27 190	\$2970	-\$2610 – \$8551	\$34 781	\$35 607	\$827	-\$2183 – \$3836

AUD, Australian dollars; QALYs, quality-adjusted life years; BSI, Brief Symptom Inventory; NI, nurse-led, minimal contact self-management condition; PI, psychologist-led, individualised cognitive behavioural intervention; CI, confidence interval.

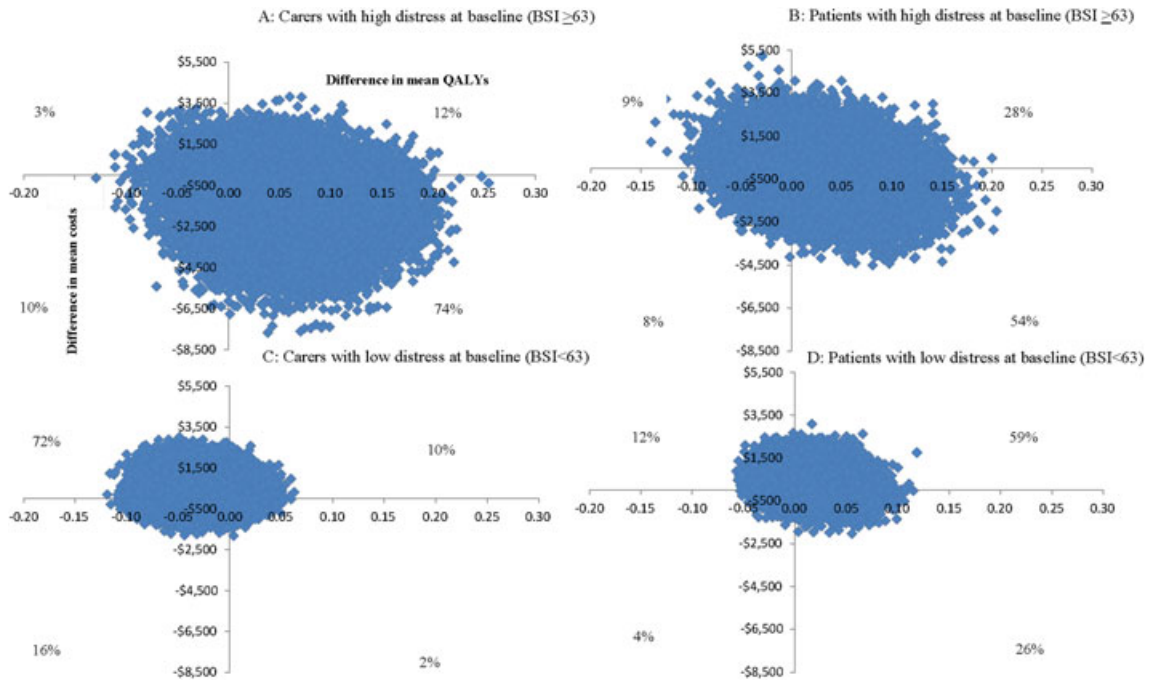


Figure 1. Cost-effectiveness planes. BSI, Brief Symptom Inventory; QALYs, quality-adjusted life years

mean cost-effectiveness ratios. In Figure 2, the cost-effectiveness acceptability curves show that for carers with high distress at baseline, 89% of bootstrapped

iterations were below the \$50 000/QALY threshold. This was in contrast to the carers with low distress where only 21% of iterations fell below our willingness to pay

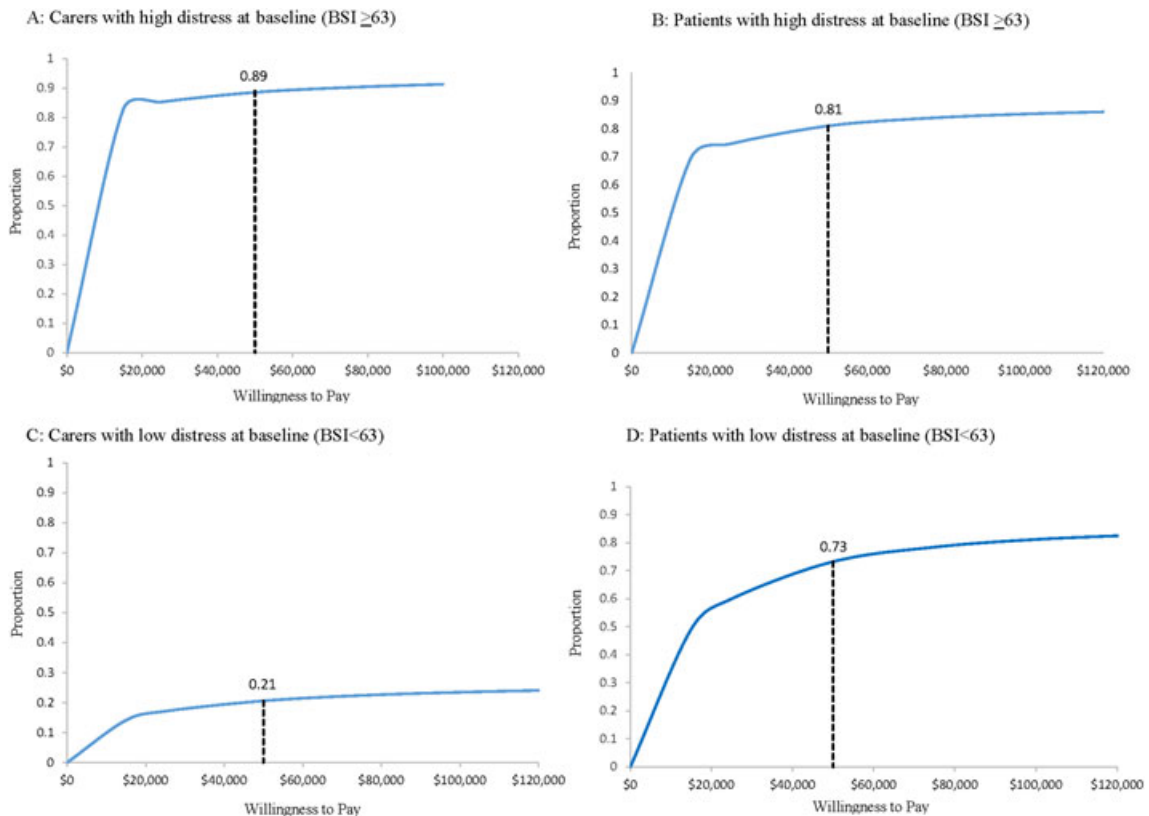


Figure 2. Cost-effectiveness acceptability curves. BSI, Brief Symptom Inventory

threshold. This representation of the results also demonstrates the lack of statistical significance. The height of the curve would need to be above 97.5% to be confident that the PI is a good value compared with the NI.

Sensitivity analyses

The sensitivity analyses around assumptions for missing data showed that results were very robust to the technique used. Furthermore, variations around the assumptions of unit costs did not change study conclusions.

Discussion

This is the first economic appraisal of two interventions designed to target both patients and carers with varying levels of distress. The analyses provide some limited support to the hypothesis that the PI may be more 'cost-effective' compared with the NI for high-distress participants. Even though the results showed that both interventions were equally effective in improving distress and health-related quality of life over time, there is a greater likelihood that the PI may lead to greater health-sector cost-savings. The conclusions for low-distress carers in particular are reversed, with the NI intervention having a greater likelihood of being the preferred intervention. However, these findings need to be interpreted with great caution because the differences in costs and NMB did not reach statistical significance, and the trial was likely under-powered to detect such differences. It is for this reason that a probabilistic approach to economic analyses alongside trials is undertaken rather than blanket reliance upon significance levels [11]. From a decision-making perspective, it may be concluded that there is a greater probability that the PI for both patients and carers with high distress is more cost-effective, and the less-intensive self-management intervention for patients/carers with lower levels of distress is more cost-effective. However, further appropriately powered research is required to verify this finding.

This analysis also found that the AQOL-8D appears to have good construct validity in terms of differentiating the impacts of quality of life of varying distress levels. The population utility norm of the AQOL-8D is 0.86 [21]. Both patients and carers, regardless of distress levels, had utility levels that were lower than the population norms, and those with baseline high distress had much lower levels of utility. Both groups had improvements in utility scores over time, although not to the type of levels seen in the same age/sex generic population norms. It is uncertain whether these improvements were due to the interventions without a treatment as usual control group.

Limitations

While the conclusions from the current study are in the direction of what was initially expected, there are some important limitations. First, the analysis was conducted from a health sector perspective and only included the costs for Medicare-eligible services and excluded the costs for support services such as family, friends and support groups. However, from a funder perspective, this more limited perspective may be closer to the decision-making context of most government decision-makers. In this regard, it has been suggested that one of the barriers to psychosocial care implementation is that the cost-savings may only be evident downstream from acute care or in this case in a different sector from the service provider [22]. On this basis, our study results are important in demonstrating this effect and bringing this issue to the table. However, our approach, in only considering costs that are likely to differ, limits the ability to assess the broader budget impact outside the health sector.

Second, the time horizon of the current analyses is only 12 months. It is unclear whether the potential cost-savings observed in the current study or impacts in health-related quality of life are maintained, improved or deteriorated over a longer-term horizon. Third, the generalisability of the results may be limited because the study population was drawn from people calling a cancer helpline in two Australian states. The study population contained more women (82.5% of patients and 87.8% of carers) [23] that was much higher than the reported prevalence of cancer in women of 45% [24]. However, there is no reason to suggest that the types of patients and carers who use such services in New South Wales or Queensland would differ substantially to patients/carers in other states.

Fourth, the main clinical trial upon which the current study was based did not include a treatment as usual arm. Hence, we are unable to test differences between these two interventions and current approaches to psychosocial care that may be delivered by a range of professional groups including nurses, social workers, psychologists, counsellors or chaplains and so are likely heterogeneous both in terms of cost and impact. However, other researchers have applied decision analytic approaches to suggest that systematic identification or screening for distress followed by stepped and integrated treatment in depressed cancer patients is likely cost-effective and this is consistent with the present results [25].

Finally, given that two different interventions are potentially appropriate according to different levels of distress, a simple and effective way of differentiating such distress levels in routine practice is required. In this regard, international standards for psychosocial care in cancer advise that quality cancer care must integrate the psychosocial domain into routine care and that distress should be

measured as the sixth vital sign after temperature, blood pressure, pulse, respiratory rate and pain [8,26]. The distress thermometer has been validated across settings and cultures as a valid screening tool [27,28], and various groups have proposed tiered or stepped models of care as a service framework to guide use of resources [29].

Conclusion

This analysis supported the conclusion that the PI is likely to be cost-effective compared with the NI for highly distressed cancer patients and carers. Overall, it appeared that the conclusions for low-distress patients/carers support the use of the nurse-led self-management intervention. These results provide support for the direction and targeting of more intensive psychological intervention to those cancer patients who are more highly distressed. Further research is needed across both community and

acute care settings to more clearly establish how much intervention is needed to reduce the psychosocial burden of cancer for both patients and carers and to whom this more in-depth care may be most usefully directed.

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Conflict of interest

There are no conflicts of interest to disclose that would bias this research.

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